A.ALIKHANYAN
National Laboratory

ANNUAL REPORT

A. Alikhanyan National Lab (AANL)

2016

CONTENT

Annual Report, Artem Alikhanyan National Lab (AANL) 2016

2016 STATUS REPORT

A. Alikhanyan National Laboratory (AANL)
(Yerevan Physics Institute, YerPhI)

1. INTRODUCTION

Vision: *A. Alikhanyan national lab has distinctive expertise and insights relating to high-energy physics and astrophysics, nuclear physics, scientific instrumentations and multivariate data analyses, as well as in education. National lab should serve for the positive influence and impact to national values through research, education and innovation programs. National lab provides opportunities for intellectual, personal and professional growth. Learning and working at national lab will foster high professionalism, quick, well-rounded minds, well equipped to succeed in our fast-changing world.*

Mission*: Perform world-class research in Armenia, participate in world-biggest scientific collaborations, and offer scientific instruments and services for Armenian nuclear medicine, industries and cultural studies. Establish high standards of education in master and PhD courses; demonstrate that science and education can really provide development of Armenia.*

2016 was last year of my director's term (2012-2017) and 2017 bring new challenges to national lab. Among them most serious are aging problem, scarcity of students, decline in quality of physical education in Armenia and planned by Armenian government cut of the 2018 scientific budget and posing an age limit for the administrative scientific positions. Therefore, national lab should be ready for the needed, may be not popular, changes to meet these serious challenges.

All institute departments in 2016 continued research according to recommendations of the international scientific council (Attachment 1), strategic plan of national lab (Attachment 2), decisions of the board of trustees (see Attachment 3) and AANL director's orders.

Among most important matters of 2016 were: election of the institute scientific council and its governing body (see Attachment 4); attestation of scientific and engineering personnel (see Attachment 5) and competition of the best scientific papers (see Attachment 6).

In 2016 the AANL strengthened its scientific activity in traditional scientific directions and increased activity in the high-energy atmospheric physics. In 2016 AANL director visited CERN and met experiments spokespersons (see his opinion on AANL participation in Attachment 7). After negotiations with CERN ATLAS experiment spokesperson institutional agreement was updated, now including participation in 4 working packages (see Attachment 7). A new agreement with CERN officials on collaboration with beam department was signed (see Attachment 7). After finishing data analysis from HERMES and Olympus experiments DESY officials requested new topic of collaboration. Therefore, a new agreement was prepared and signed with DESY for participation in BELLE and CMS experiments (see Attachment 8). Thus, support of DESY for high-energy physics will continue. A new long-lasting collaboration program with German Federal Ministry of Education and Research (BMDF) is under preparation (see Attachment 9); possible schemes of the collaboration are under investigation.

Physicists from experimental physics division were involved in experiments on Large Hadron collider (LHC) and in Jefferson lab (Virginia, US). The situation with Jlab collaboration improved, several YerPhI employees visited Jefferson lab and participate in experiments. Institutional agreement will be signed in end of June (see Attachment 21).

An agreement was signed with Joint institute of Nuclear Research (JINR) for calibration of CsI spectrometers on ARUS injector. In 2017 planned 2 series CsI crystal calibration to be used

in the experiment Mu2e (FNAL, USA). New precise equipment was purchased and experimental division engineers are preparing calibration setup.

Theory Division consists of several small groups, working on different problems of modern theoretical physics. The activities of the members cover a large area from mathematical and theoretical high-energy physics to the condensed matter theory, statistical physics, quantum mechanics and thermodynamics. The main directions of investigations in 2016 were: Theoretical high-energy physics: phenomenology, quantum field theory and integrable models. Department physicists studied a model for an adaptive heat engine, where due to feedback from the functional part-the engine's structure adapts to given thermal baths. Hence, no on-line control and no external fitting are needed. The engine can employ unknown resources; it can also adapt to results of its own functioning that make the bath temperatures closer. The resources of adaptation and relate them to the prior information available about the environment was determined. The calculations were performed on the nonlinear susceptibility and the resonant Raman cross section for the paramagnetic phase of the ferromagnetic quantum Ising model in one dimension. Using AGT correspondence was expressed the simplest fully degenerate primary fields of Toda field theory in terms of an analogue of Baxter's Q-operator naturally emerging on the N = 2 gauge theory side. The study of the short-range nucleon correlations has been continued within the Data Mining program. The previously achieved results on the O(N) Bethe Ansatz were applied to construct a general form factor formula for the O(N) Gross-Neveu model. Lattice models were used for understanding behaviors of interacting complex many-body systems. The lattice dimer model has been proposed to study the adsorption of diatomic on a substrate. The properties of the generalized spin-1 Ising-Heisenberg model on a diamond chain was studied. Magnetization and quadrupole moment plateaus are observed at one- and two-thirds of the saturation value.

Cosmic Ray division continuing research of the Thunderstorm Ground Enhancements, now correlated with atmospheric discharges on millisecond time scale; based on multiple observations in 2016 CRD physicists propose lightning initiation model for the first time reliably connected particle fluxes with lightning initiation. 4 reports (including invited one) were presented on International Cosmic Ray conference in Dubna *and - invited talk at* International Conference "Frontiers of Nonlinear Physics". Numerous talks were presented during traditional symposia TEPA-2016 in Nor Amberd. The electrostatic field measurements from Aragats enter now the Global network of Atmospheric Electricity Measurements (Reading univ., see Attachment 10). It is another network in addition of the Neutron monitors (NMBD), SEVAN – East European particle detector network managed by CRD and World Wide Lightning Location network (WWLLN) connected CRD with international research in solar physics, atmospheric physics and space weather.

A new project to be implemented on mt. Aragats was funded by the Russian science foundation, the project title is: “Comprehensive research of high-energy particles sources and powerful VHF radiation in electrically active atmosphere based on ground-based measurements and satellite observations”. Physicists from YerPhI, Moscow Space Research institute, Nijnij Novgorod Applied Physics institute will develop and commission on Aragats precise interferometer for the lightning flash precise location and registration of lightning current. A new applied project was funded by RA in 2016, namely, “The Armenian Geophysical Network”; development of Armenian network already started! The project on high-energy physics in atmosphere submitted to Swiss based International Space Science Institute (ISSI) foundation (High-energy particles sources and powerful VHF radiations in electrically active atmosphere) was considered to be of high scientific value and relevance and was approved for implementation

in 2017-2018. In 2016 CRD physicists were invited to join EU COST ACTION CA15211AT: "Atmospheric electricity network: coupling with the earth system, climate and biological systems". Experiments on Mt. Aragats are continuing involving new scientific groups and new experimental techniques. Research on Aragats is a good example how the country with very limited recourses can reach leadership in the important scientific discipline. Students from Armenian universities may be involved in experiments on Aragats and in data analysis.

Isotope physics department is still waiting 18 MeV proton beam for obtaining Te isotope. Unfortunately operation of accelerator is delayed, however the preparatory jobs were continued to obtain medicine intended radioactive isotopes using proton beam from C18 cyclotron. The new technology of molybdenum target cryogenic cooling has been developed. Department personnel participate in preparation of particle detectors and fast electronics for the experiments on Aragats. The neutron scintillation counter with 0.5 x 0.5 sq. m. sizes has been studied and installed on Aragats station; now the 1-sec time series from detector are continuously monitored.

Applied physics department continues research of silicon crystals and develops new methods of the accelerator beam diagnostics. New experiment was performed on the 5-MeV accelerator of CANDLE institute. The influence of high-energy electrons (3-50 MeV) on the silicon crystals conductivity with different resistivity was investigated. It was shown that radiation defects formation depends on irradiation energy, intensity, dose and specific resistivity of silicon sample, moreover, clusters occurred in samples with higher specific resistivity at lower irradiation dose). The developed wire scanner, called resonant target vibrating wire scanner, is applied to photon beam profiling, in which the photons reflected on the wire are measured by a fast photodiode.

New established IT department provides computing and networking services for YerPhI departments by installing new servers, new networking equipment and updating operating software. Unfortunately after moving the IT networking group from institute and making it private company (WEB) the personnel problem is not solved till now. Despite 2 competitions in 2017 we hire only one IT expert.

Advanced Scientific instrumentation is one of key qualities of the technologically developed nation. Some of these projects will not only keep high technological level of our research, but also if we adopt effective marketing strategy will bring money to institute. YerPhI was known for the particle detector design and commissioning. AANL continues this tradition. We continue the new detector and electronics design and commissioning by developing:

- fission fragments (FF) detector, Low Energy Nuclear Interaction Chamber for photo-fission, photo-disintegration and photo-neutron experiments at Extreme Light Infrastructure – Nuclear Physics (ELI-NP);
- Low energy neutral particle spectrometers for the research of natural radioactivity;
- SEVAN worldwide hybrid particle detector network aim to improve the fundamental research on particle acceleration in vicinity of sun and space environment conditions. The new type of particle detectors will simultaneously measure changing fluxes of most species of secondary cosmic rays, thus turning into a powerful integrated device for exploration of solar modulation effects;
- Geophysical parameters measuring network in Armenia for the comprehensive monitoring and prediction of potentially dangerous processes in the magnetosphere and atmosphere of the Earth or evaluating risk in various areas of the economy;
- Fast Integrated and Synchronized Sensors System (FISSS), a multichannel universal device providing triggering and monitoring operations with signals from sensors

measuring elementary particle traversal and energy; electric and geomagnetic fields, waveforms of radio signals from atmospheric discharges with GPS Time Synchronization;
- A remote method for the measurement of intracloud electric field based on the LIDAR system using precise polarization technique;
- High-energy muon monitoring in the low background underground laboratory. The careful estimation of the muon flux created by cosmic rays in the atmosphere and penetrated deep underground is of crucial importance for modern neutrino experiments.

Purchasing of new spectrometers, modern electronics and computers allows developing mentioned above projects as well as to prepare lab works for the master students. Physicists from isotope department, applied physics department and CRD prepared laboratory works for students that will be a basis of experimental physics curriculum to be offered for all Armenian universities. Experimental physics classes are equipped with particle detectors, electronics and computers. Students perform measurements, data analysis and write reports on their research.

The current research activities, scientific instrumentation and education of experimental physicists require purchasing of modern detectors, electronics and computer/networking equipment. In 2016 the new precise spectrometer was purchased for the experiments on rare decays in the underground low background lab, fast numerical oscilloscopes were purchased for the TGE-lightning correlation studies on Aragats. New servers, networking equipment, scanners and printers were purchased for the IT department.

Maintenance of institute infrastructure in 2016 includes repairs of the buildings and crucial infrastructures. The most important works were: renovation of the vestibule of institute main building (N 22); change of the electrical bulbs used for illumination of institute territory by the economical LED systems; installation of video control and security systems with appropriated software; planting of a garden consisted of~ 130 fruit trees. Repairs of the buildings and infrastructure at Nor Amberd international conference center included new water-evacuation system, repairs of the roof of the station tower and of transformer substation. The international conference center in Nor Amberd was repaired and now meets stringent international standards for holding workshops and small-scale symposia. Also was repaired the roof of Aragats electrical substation, 2 transformers fired by lightning stroke and caterpillar-vehicle Bobr for the winter transportation. New Japanese vehicle Ohara and minibus Hyundai were purchased by the funds of charity program for supporting CRD operations. In 2017 we plan to repair the institute computer center and provide it with air conditioning, repair institute entrance (check point), repair roads, continue to repair building roofs, start changing the windows in the institute buildings for heat preservation.

Number of publications in peer reviewed journals and participation in international forums continue to be high comparing with other Armenian institutions. However, we have to pay attention if YerPhI scientists are corresponding authors in collaborative publications. When number of authors reaches several thousands the exact contribution of YerPhI employees should be scrutinized.

Institute seminars continued in 2016; 10 talks from institute employees and invited lecturers were delivered (see Attachment 11). The weekly seminars in CRD continued ~ 10 years without any terminations. It allows apparent progress in scientific research, development of new scientific directions where CRD is one of world leaders. Unfortunately, other large departments fail to organize regular presentations and discussions of the scientific results. We still expect that theory department will perform educational seminars for CRD young scientists started several years ago,

but then abruptly stopped.

Program to support and motivate young scientists was successfully continued (30 young scientists participated in various international conferences and summer schools, see Attachment 12); Unfortunately due to overall decay of high education in Armenia number of students in 2016 diminished, we have problems to attract new talents for work in our collaborations in CERN, DESY and Jlab. PhD defenses are listed in the Attachment 13. In 2017 for the first time we have no candidates for 2 PhD position allocated to institute.

Master courses started operation in national lab in 2014 (see list of PhD and master students in Attachment 14). Programs were prepared and lectures started in the field of the experimental high-energy physics and astrophysics. In the first year emphasis was made on working in labs with particle detectors and electronics. Four master students successfully finish the first year program. During second year emphasis was made to teach them analyze data, make physical inference and write scientific papers. Students' prepare a report for TEPA conference and participate in preparation of a paper in the conference proceedings. Near 20 students of Yerevan State University and other universities attended the Summer school on Space science. Students attended lectures and labs of national center as well as the Aragats research station. In 2017 we will continue summer school recruiting best scholars from all Armenian schools, not only from Yerevan. The institute young scientists actively participate in preparing exams for selecting appropriate students.

Directorate of AANL establishes special regulation for hiring new employees by competition and examination. 8 young scientists and 6 engineers were employed in 2016 according to this procedure. Each was present on directorate meeting for interview.

A new electronic library was established. All YerPhI preprints are now available in library WEB site. New software and new possibilities for journal search are planned in collaboration with International Atomic Energy Agency (IAEA).

For the informing institute employees and students on seminars, calls for grant, and scientific news of common interest several services were established in institute. The WEB site of institute was maintained regularly by posting picture of the day, clip of the day, and information from AANL director on most important research achievements in science and other. Also we post meteorological information, pictures of the skies above Aragats, the lightning activities. The press releases were regularly issued reflecting research activities; conferences and current live of institute (see Attachment 15).

There were several drawbacks in 2016. Due to delays in nominating the operator of Diagnostic center, the experiments with 18-MeV proton beam of new IBA cyclotron were again postponed. The IBA engineers cannot come to put already installed accelerator into operation.

In spite that directors board each month on special meeting discussed attendance of YerPhI employees the situation is far of being satisfactory.

AANL director met with LHC experiments spokespersons. Armenia participation is highly appreciated, however several problems exist: group leaders excessive age, lack of students, rather weak activity of the Armenian scientists in various collaboration commissions and in scientific papers preparation, and absence of special topics where our scientists are among collaborations leaders. For Armenia as developing country it is very important to use the possibilities offered by CERN in education, industrial development and innovation. Unfortunately, use of these possibilities is negligible. CERN collaboration leaders ask to pay more attention to participation of young scientists and students in instrumentation and data analysis. It proves once more necessity to develop the experimental facilities in Armenia both in accelerator and astroparticle physics. Also the size of fee to be paid by AANL for appearing in the author list was discussed (see financial

information about CERN-YerPhI accounts and overall expanses to CERN business travel in the Attachment 22). Afterwards all movements in CERN-YerPhI accounts will be reported to institute senior financial officer. AANL director and chair of the board of trustees send a number of letters to CERN officials explaining that Armenia as country will low income have not to pay full fee for appearing of senior scientists in the authors list of LHC scientific publications (see details in Attachment 16).

The most difficult problem to be solved in 2017-2018 is the change of the institute leadership. The age of director, deputies and heads of departments is approaching 70. A group of possible substitutes for the department heads positions was created 2 years ago and nominated persons were trained by participation in the international collaborations and conferences; some of them already have administrative experience on institute level. However, the list of possible candidates for the institute leading positions is very short (see Attachment 23); and candidates need additional training. Without preparing and nominating young leadership for national lab in 3-5 years we will not be able to reach any of AANL strategic goals. We cannot be late to lost the last yang PhDs: in last 10 years from 29 PhDs only 6 are still working in institute and they also are applying for the positions abroad. Only one student defending PhD based on CERN research is still working in AANL.

It is why the summer schools and conferences, strengthening of master courses, participation in new initiative of networking technological university is of greatest importance (see possible AANL contribution in Attachment 17). We have to use our international collaborations to recruit and educate new students. As well we have to use our advanced research having international priorities for attracting new talents. For it we should activate work with Armenian universities and schools. The situation with physical education in Armenia is far from being satisfactory (see our opinion in Attachment 18).

Of course, the research activity in high-energy physics and astrophysics and high-energy atmospheric physics should be continuing with not less bustle as in the former years (see reports of department leaders below).

The emeritus employees Prof. Mamidjanyan and Prof. Yeritsyan were awarded by the YerPhI medal for their scientific achievements and multiyear service for national lab.

2. SUMMARY OF THE SCIENTIFIC ACTIVITIES OF AANL DEPARTMENTS

2.1. Experimental Physics

In the reporting period, the research groups of the department have been taking part in the high-energy physics experiments carried out at international research centers, such as CERN-LHC, JLAB-Hall A, B, C, D and HESS-CTA.

In the Compact Muon Solenoid (CMS) experiment on the Large Hadron Collider (LHC) at CERN, our researchers took their part in the search for the narrow resonances produced in ($\sqrt{s}$)=13 pp-collisions in double-jet systems. The data on the invariant mass of double jets did not prove the existence of resonance particles that correspond to the integral luminosity of 2.4 fb-1. Measurement of the integral luminosity corresponding to 4.0 fb-1 luminosity carried out in 2016 did not confirm the narrow resonance with 3.4 σ standard deviation discovered in about 750-GeV photon pair system in 2015. The efficiency and clarity of selection of (VBF $H\rightarrow\tau-\tau+$) tagging hadron jets in the process of Higgs boson production by vector-boson fusion in the CMS end cup hadron calorimeter have been estimated. In the ATLAS Experiment, the simulation of the Tile calorimeter signal in a high pile-up environment has been improved. At HL-LHC there has been

set up an experimental unit that permits to assess the use of multi-anode PMTs. The ALICE group continued the processing of the data on the muon pair production in the invariant mass range of M<1.5 GeV at 8 GeV pp-collisions. The efficiency of Minimum Bias Trigger has been estimated with the help of different empiric fits – Gaussian was used to describe ω(782) and φ(1020), Voigt function – to describe ρ(770) and polynomial + exponent – to describe the background. On the go is the work on the development of ALICE's computation environment as well as on the Monte Carlo simulation of the processes that make their contribution into the double muon spectra. The possibility for particle trajectories restoration by the Cellular Automata technique on the Muon Forward Tracker has been assessed. The JLAB (Hall A,B,C,D) teams continued processing and analyzing the 2016 data basically due to impossibility of visits from Yerevan. A prototype of a 200-channel ECAL for the multichannel electromagnetic calorimeter SBS (Super BigBite Spectrometer) has been designed. In the Catania division of INFN, A. Shahiyan took part in the construction and testing of GEM detector (Gas Electron Multiplier). The study of the short-range nucleon correlations has been continued within the Data Mining program. The Patch Panels for the High-Threshold Cherenkov Counters (HTCC) have been designed with the help of AutoCAD. These panels will allow connection of 48 high-voltage and 96 signal cables to another system. E. Ghandilyan successfully defended his Ph.D. thesis on "Proton-Antiproton Pair Coherent Photoproduction on Deuterium Target at CLAS". The electromagnetic calorimeter of SHMS and the aerogel Cherenkov counter have been tested by exposing to cosmic rays. There were carried out investigations related with the spectrometer (NPS calorimeter) of neutral particles that consist of 1200 PbWO4. Our team has made Monte Carlo calculations for choosing detectors to be used in the TCS experiment. In the commissioning run of the GlueX experiment, the Armenian team has taken part in the testing of their designed slow control system. Scheduled Investigations have been carried out within the themes on "The Time Processor with Extended Dynamic Range" and "Decayed Particle Spectrometer". As the launch of C18 cyclotron was postponed, theoretical estimations were carried out using the TALYS 1.8, TENDL2015, MENDL2P and EMPIRE 3.2 models and the results were compared with the existing experimental data from different authors. The investigation of astrophysical sources with the help of Cherenkov imaging telescope arrays of HESS and CTA collaborations went on in 2016.

Together with the specialists from JINR, Dubna, Russia, a technical proposal has been drawn up for the future contract to be signed between them on calibration of CsI crystals by the low-intensity electron beam of LUE-75 linear accelerator; these crystals will be used in the experiment Mu2e (FNAL, USA).

2.2. Cosmic Ray Physics (CRD)

The CRD have an impressing profile of the investigations in the new emerging field of high-energy physics in the atmosphere. New designed particle detector networks and unique geographical location of Aragats station allows to observe in last 7 years numerous thunderstorm ground enhancements (TGEs), i.e., enhanced fluxes of electrons, gamma rays, and neutrons detected by particle detectors located on the Earth's surface and related to the strong thunderstorms above it, helped to establish a new scientific topic—high-energy physics in the atmosphere. Relativistic runaway electron avalanches (RREAs) are believed to be a central engine initiating high-energy processes in thunderstorm atmospheres. RREAs observed on Mount Aragats in Armenia during the strongest thunderstorms and simultaneous measurements of TGE electron and gamma- ray energy spectra proved that RREAs are a robust and realistic mechanism for electron

acceleration. TGE research facilitates investigations of the long-standing lightning initiation problem. For the last 5 years we were experimenting with the "beams" of "electron accelerators" operating in the thunderclouds above the Aragats research station. Thunderstorms are very frequent above Aragats, peaking in May–June, and almost all of them are accompanied with enhanced particle fluxes. The station is located on a plateau at an altitude 3200 asl near a large lake. Numerous particle detectors and field meters are located in three experimental halls as well as outdoors; the facilities are operated all year round. All relevant information is being gathered, including data on particle fluxes, fields, lightning occurrences, and meteorological conditions. In one of 2016 publications in Phys.Rev. D we analyze huge thunderstorm that took place at Mount Aragats on August 28, 2015, we show that simultaneous detection of all the relevant data allowed us to reveal the temporal pattern of the storm development and to investigate the atmospheric discharges and particle fluxes.

The day was stormy, electric field disturbances continuous, lightning strikes enormous, and the electron accelerator above provided evidence on several long, low- energy TGEs and intensive and energetic enhancements. For the first time we describe and analyze not only isolated TGE events, but also the whole temporal history of the long duration thunderstorm, including high- and low-energy TGEs, periods of positive and negative lightning strikes, meteorological conditions, and disturbances of the near- surface electric field. By scrutinizing a particular stormy day at Aragats we demonstrate operation of the "moving electron accelerator" generated high-energy (up to 6 MeV) bremsstrahlung gamma photons when RREA is above the station and low-energy (0.4–2 MeV) Compton-scattered gamma rays when a strong electric field moved several kilometers away from the station. NaI spectrometers registered additional (compared to the fair weather day) ∼1.8 million gamma rays in total. TGE differential energy spectra were estimated by the network of the NaI spectrometers for 4 TGE episodes. Three of them contained only low-energy gamma rays with energies below 2 MeV; large TGE with maximal flux at 23:19 also contain gamma rays with energies up to 6 MeV. The spectrometer data are confirmed by the count rate measurements of other ASEC detectors. The 1-minute time series of the CUBE detector with an energy threshold above ∼4 MeV does not demonstrate any enhancements for the low-energy TGEs. The same time series demonstrates pronounced peaks with very high statistical significance for the high-energy TGE. The energy spectra are of a broken power law type. Due to the very large number of registered gamma rays we estimate spectra for each of the TGE events. We fit our spectra with two power law dependences that allow physical inference on the possible origin of two gamma-ray populations.

In another paper published in 2016 in Astroparticle Physics Using 1-s time series, we investigated the relationship between lightning and particle fluxes. Lightning flashes often terminated the particle flux; in particular, during some TGEs, lightning events would terminate the particle flux thrice after successive recovery. It was postulated that a lightning terminates a particle flux mostly in the beginning of a TGE or in its decay phase; however, we observed two events (19 October 2013 and 20 April 2015) when the huge particle flux was terminated just at the peak of its development. We discuss the possibility of a huge EAS facilitating lightning leader to find its path to the ground. To the best of the authors' knowledge, this is the first study of its kind to provide vast evidence on simultaneous detection of TGEs, disturbances of the electrostatic field, and lightning. Lightning flashes terminated the particle fluxes very often; during some TGEs, lightning terminated the particle flux thrice. Only a negative lightning can terminate TGEs. No TGE is terminated by a positive lightning. Our findings need to be confirmed by measurements

with a microsecond time scale, which are planned for 2016–2017 at Aragats. It is very important to correlate particle flux enhancements and lightning events on millisecond time scales. The lightning is a powerful source of electromagnetic radiation and can affect DAQ electronics and produce fake signals. However, the particle flux does not change immediately with a huge pulse of electromagnetic radiation, but with the rearrangement of the electric fields in the cloud after depositing the negative charge to the ground by a lightning. Furthermore, there is a delay of at least several tens of milliseconds between these processes. Therefore, in order to avoid possible interferences and fake signals in the particle detectors, we plan to add a precise time stamp to each registration in the muon detector.

On our traditional TEPA conference (October 3-6, Nor Amberd, 2016) 30 participants from Russia, USA, Germany, Israel, and Armenia present 20 plenary talks and 10 posters in 6 sessions: Research of the Thunderstorm ground enhancements (TGEs) observed by particle detectors located on earth's surface; Research of the Terrestrial gamma-ray flashes (TGFs) observed by the orbiting gamma- ray observatories; Relation of Lightning to the TGE and TGF; Monitoring of TLEs and thunderstorms from the orbit; Cloud electrification and atmospheric discharges: measurements and applications; Instrumentation, muon detection. 2 round table discussions held: Databases in high-energy atmospheric physics: description and ways to establish cooperation; Do lightning discharges produce relativistic particles? Visit to Aragats research station near the south summit of Aragats Mountain coincide with the installation of new detectors measuring UV and IR radiation from the lightning bolt (collaboration YerPhI- SINP).[1]

Symposia participants agree that the topic of High-Energy Physics in Atmosphere (HEPA) is well progressing:

- There is big activity in several countries to establish surface particle detectors for research in TGE physics;
- RB/RREA model with CR seeds rather satisfactory explains TGE measurements worldwide;
- Planned research of TLE and TGF from orbit can be coupled with surface measurements;
- The established links with meteorology, atmospheric electricity, Atmospheric Cherenkov Telescopes (ACT) experiments, look very promising;
- Planned lightning mapping array will be very important addition to Aragats facilities;
- New fast electronics will reveal origin of TGE and TGE-lightning relations;
- Broad collaboration with Space and Lightning physics experiments will significantly improve research and understanding in the new emerging HEPA field.

2.3. Theoretical Physics

Theory Division consists of several small groups, working on different problems of modern theoretical physics. Currently we have 17 doctors of science, 21 Ph.D. and 4 students. The activities of the members of the Theory Division cover a large area from mathematical and theoretical high-energy physics to the condensed matter theory, statistical physics, quantum mechanics and thermodynamics. The main directions of investigations in 2016 were: Theoretical high-energy physics: phenomenology, quantum field theory and integrable models.

We present the contribution associated with the chromomagnetic dipole operator O-8 to the

double differential decay width d Gamma/(ds(1)ds(2)) for the inclusive process (B) over bar -> X-s gamma gamma. The kinematical variables s(1) and s(2) are defined as s(i) = (p(b) - q(i))(2)/m(b)(2), where p(b), q(1), q(2) are the momenta of b quark and two photons. This contribution (taken at tree level) is of order alpha(s), like the recently calculated QCD corrections to the contribution of the operator O-7. In order to regulate possible collinear singularities of one of the photons with the strange quark, we introduce a nonzero mass m(s) for the strange quark. Our results are obtained for exact ms, which we interpret as a constituent mass being varied between 400 and 600 MeV. Numerically it turns out that the effect of the (O-8, O-8) contribution to the branching ratio of (B) over bar -> X-s gamma gamma does not exceed +0.1% for any kinematically allowed value of our physical cutoff parameter c, confirming the expected suppression of this contribution relative to the QCD corrections to d Gamma(77)/(ds(1)ds(2)).

Using AGT correspondence we express the simplest fully degenerate primary fields of Toda field theory in terms of an analogue of Baxter's Q-operator naturally emerging on the N = 2 gauge theory side. This quantity can be considered as a generating function of certain chiral operators constructed from the scalars of the N = 2 vector multiplets. In the special case of Liouville theory, exploring the second order differential equation satisfied by conformal blocks including a primary field which is degenerate at the second level (BPZ equation) we derive a mixed difference-differential relation for Q operator. Thus we generalize the T-Q difference equation known in Nekrasov-Shatashvili limit of the Omega-background to the generic case.

A major limitation of many heat engines is that functioning demands on-line control and/or an external fitting between the environmental parameters (e.g., temperatures of thermal baths) and internal parameters of the engine. We study a model for an adaptive heat engine, where due to feedback from the functional part-the engine's structure adapts to given thermal baths. Hence, no on-line control and no external fitting are needed. The engine can employ unknown resources; it can also adapt to results of its own functioning that make the bath temperatures closer. We determine resources of adaptation and relate them to the prior information available about the environment.

We calculate the nonlinear susceptibility and the resonant Raman cross section for the paramagnetic phase of the ferromagnetic quantum Ising model in one dimension. In this region, the spectrum of the Ising model has a gap. The Raman cross section has a strong singularity when the energy of the outgoing photon is at the spectral gap omega(f) approximate to m and a square root threshold when the frequency difference between the incident and outgoing photons omega(i) - omega(f) approximate to 2m. The latter feature reflects the fermionic nature of the Ising model excitations.

We apply previous results on the O(N) Bethe Ansatz to construct a general form factor formula for the O(N) Gross-Neveu model. We examine this formula for several operators, such as the energy momentum, the spin-field and the current. We also compare these results with the 1/N expansion of this model and obtain full agreement. We discuss bound state form factors, in particular for the three-particle form factor of the field. In addition, for the two particle case we prove a recursion relation for the K-functions of the higher level Bethe Ansatz.

Lattice models are useful for understanding behaviors of interacting complex many-body systems. The lattice dimer model has been proposed to study the adsorption of diatomic molecules on a substrate. Here we analyze the partition function of the dimer model on a 2M x 2N checkerboard lattice wrapped on a torus and derive the exact asymptotic expansion of the logarithm of the partition function. We find that the internal energy at the critical point is equal to

zero. We also derive the exact finite-size corrections for the free energy, the internal energy, and the specific heat. Using the exact partition function and finite-size corrections for the dimer model on a finite checkerboard lattice, we obtain finite-size scaling functions for the free energy, the internal energy, and the specific heat of the dimer model. We investigate the properties of the specific heat near the critical point and find that the specific-heat pseudocritical point coincides with the critical point of the thermodynamic limit, which means that the specific-heat shift exponent lambda is equal to infinity. We have also considered the limit N -> infinity for which we obtain the expansion of the free energy for the dimer model on the infinitely long cylinder. From a finite-size analysis we have found that two conformal field theories with the central charges c = 1 for the height function description and c = -2 for the construction using a mapping of spanning trees can be used to describe the dimer model on the checkerboard lattice.

Diffusive radiation generated when a charged particle crosses a disordered stack of plates in the infrared region is considered. The main mechanism causing radiation is multiple scattering of electromagnetic field that is more effective in a medium with near to zero average dielectric permittivity. To obtain such a system we suggest using a stack of plates with a negative dielectric constant that, with a positive vacuum value, makes the average dielectric constant near to zero. Numerical estimates for realistic systems are presented.

We study the properties of the generalized spin-1 Ising-Heisenberg model on a diamond chain, which can be considered as a theoretical model for the homometallic magnetic complex [Ni-3(C4H2O4)(2)-(mu(3)-OH)(2)(H2O)(4)](n)center dot(2H(2)O)(n). The model possesses a large variety of ground-state phases due to the presence of biquadratic and single-ion anisotropy parameters. Magnetization and quadrupole moment plateaus are observed at one- and two-thirds of the saturation value. The distributions of Yang-Lee and Fisher zeros are studied numerically for a variety of values of the model parameters. The usual value sigma = -1/2 alongside an unusual value sigma = -2/3 is determined for the Yang-Lee edge singularity exponents.

2.4 Computational Physics And IT Division

The activities were distributed in two main directions:

1. Computational physics and data analysis
2. Support and development of computing and networking infrastructure of YerPhI

The following works related to the point 1 were performed:

- Studies of statistical features for the new pseudo-random numbers generator MIXMAX
- Developing and creation of the new effective approach (algorithm) with essentially lower time and memory consuming for multidimensional Kolmogorov-Smirnov test numerical computation
- Studies of thermodynamics and statistical physics problems for systems following the Markov chains behavior
- Monte Carlo studies of the cosmic rays physics problems with GEANT4
  - Analysis of data collected by HERMES and OLYMPUS experiments:
  - Studies of multiplicities for neutral (π^0,η) mesons in deep inelastic scattering with the data collected by HERMES
  - Studies of medium induced change of kaons spectra electro-produced on various nuclear targets (HERMES)

- Studies of spin asymmetry in exclusive electro-production of mesons with unpolarised beam and polarized target (HERMES)
- Independent analysis of data collected by OLYMPUS in order to estimate possible systematics

The following works related to the point 2 were performed :

- The YerPhI local network development, replacement of old hubs with the new ones (Layer2) in order to increase the efficiency of network functioning
- .New powerful cluster (SuperServer 7047GR-TRF: CPU 2 x 8x2-Core Intel Xeon Processor E5-2665 2.40GHz, Memory: 8 x 16GB PC3-10600 1333MHz DDR3 EC) was installed as a main element of the YerPhI computing global cluster. All necessary system and applied software were installed: Mathematica package, ALPS package for parallel arithmetics, CERNLIB including GEANT4 etc. The loading of this powerful server is mainly done by CT&IT , also TH and CR divisions.
- All 6 main YerPhI buildings are covered with WiFi
- The safety of YerPhI mail server is increased by means of hard checks against viruses like :"Spam, Phishing", the limits for "ssi" users is installed
- By help of INIS (IAEA) experts the "Invenio" repository was installed which is basis to create the YerPhI electronic library, the most of YerPhI preprints are already included in this repository
- New optical segments were added for cosmic stations network (3 on Aragats and 2 in Nor-Amberd). The CP&IT experts provide systematical monitoring and support for all CRD servers
- The new collaboration is started with DESY IT in direction of newest information technologies (OpenStack Cloud Platform), which has already become the basic components (CERN) and will become the stabdard for all high energy physics centers. Also YerPhI has to move from pure GRID technology to the cloud like architecture.

2.5. Applied Physics

1. Radiation defects formation in silicon crystals with different specific resistivity

Silicon crystals are basic elements for technology of electronic devices, which are using in environments with different radiation and it is important to study their radiation hardness. The influence of high-energy electrons (3-50 MeV) on the silicon crystals conductivity with different resistivity was investigated. It was shown that radiation defects formation depends on irradiation energy, intensity, dose and specific resistivity of silicon sample, moreover, clusters occurred in samples with higher specific resistivity at lower irradiation dose).

2. Investigation of optical and photoelectric properties of semiconductor single crystals.

High-energy electron irradiation caused defect energy levels within band-gap are found based on investigation of photoconductivity spectra of silicon single crystals.

Besides, exciton absorption spectra of high-energy electron irradiation on GaP single crystals with nitrogen (N) and zinc oxide (ZnO) as an isoelectron mixture has been investigated. The obtained results show, that there are two types of excitons related with nitrogen atom: fast

quenching and radiation resistant.

3. Spectroscopic study of wide-gap materials

During 2016complex study of silicate compounds has been performed using low-temperature high-resolution spectroscopy methods. Particularly the luminescence properties of these compounds, energy transfer mechanisms, influence of electron radiation has been investigated. All these compounds are important structural materials for application in such fields, as protective layers in cosmic industry, etc. and obtained experimental results are important not only for application, but also for theoretical studies. The results of these works have been published in local papers.

Besides these works the works done before concerning 1) $MgAl_2O_4$և $MgAl_2O_4:Mn^{2+}$ materials and particularly the role of neutron irradiation on these materials, 2) discovery of F^+ point defects in hafnia and zirconia nanopowders, 3) thermostimulated luminescence processes in $Li_2B_4O_7$ (LTB),LTB:Cu,LTB:Ag and LTB:Cu,Ag crystals.

4. Fast resonant target vibrating wire scanner for photon beam

We propose a new type of wire scanner for beam profile measurements, based on the use of a vibrating wire as a scattering target. Synchronous measurements with the wire oscillation allow to detect only the signal coming from the scattering of the beam on the wire. This resonant method enables fast beam profiling in the presence of a high level of background. The developed wire scanner, called resonant target vibrating wire scanner, is applied to photon beam profiling, in which the photons reflected on the wire are measured by a fast photodiode. In addition, the proposed measurement principle is expected to monitor other types of beams as well, such as neutrons, protons, electrons, and ions.

A new method for fast transverse beam profiling, where a vibrating wire is served as a resonant target, has been developed. The speed of scan up to a few hundred mm/s provides opportunity to make a set of beam profiles at different directions of the scan within a reasonable measurement time. This profile set allows us to reconstruct 2D beam profile by filtered back-projection algorithm. The new method may be applied for proton, X-ray, gamma, and neutron beams, and can also be of interest in tomography including medical applications. The method has been tested experimentally by means of laser beams

5. The Modeling of Space Biology Certain Problems in Earth Conditions.
Goal:

Using the technical capabilities of CANDLE Institute investigating the results of the effects of 3.6 MeV electron beam, ultra-low temperature and vacuum on the survival of number of bacteria (strains E. coli K-12 AB-1157, AB-2463, BL-1114 and Pseudomonas sp. A-27).

Main results of the reporting period:

It's shown that after incubation of the strain *E. coli K-12 AB-1157* during 96 hours at deep freeze (-196 ^{0}C) about 65% of the total number of cells stays alive.

The preliminary data for dose-effect curve for the same strain are obtained. The works will be continued for data collection to ensure the statistical accuracy and also the collaction of data for other strains.

2.6. Isotope Investigation and Production

1. The new technology of molybdenum target cryogenic cooling has been created and development. A test experimental measurement has been carried out by heating the target under powerful laser beam and heating using liquid nitrogen. Shown the principal opportunity of such a method of cooling. As a theoretical base of that the calculation of thermo physic processes has been done using Finite Element Methods (ANSYS). Calculation has been done for no uniform distribution of particles inside the proton beam.
2. To obtain ^{99m}Tc the enriched isotope ^{100}Mo should be irradiated under proton beam. This isotope consists in the natural Molybdenum by only ~9% so it is very expensive – costs around 2000 US$ per gram. Therefore after irradiation and ^{99m}Tc extraction it should be recovered until metallic consistency for multiple use. Preparation of special layout based in particular on very high temperature oven (~1400 ^{o}C) has been mounted, the technology of recovery was completed, and test recovery has been successfully carried out.
3. The preparatory jobs were continued to obtain medicine intended radioactive isotopes using proton beam from C18 cyclotron. High-voltage and signal cables have been installed between experimental and remote control room. Special metallic support have been repaired and installed in the experimental hall for experimental layout.
4. Previous years study of scintillation crystals for use in High Energy Physics were started. An investigation of **GGG:Ce** monocrystals absorption and irradiation properties has been carried out, spectra of photo luminescent of Ce^{3+} transient in 5d-4f area has been obtained. The dependence of light output on Ce^{3+} consistent is shown under 22.16KeV X-ray influence .Results are submitted to **Materials Chemistry and Physics journal.**
5. The neutron scintillation counter with 0.5x0.5 sq.m. sizes has been studied for ARAGATS Cosmic Ray station. The registration efficiency and time resolution have been measured under cosmic ray in 9 section of counter plane. After testing that counter has been installed on ARAGATS station and so far on-line raw data from this counter are presented in Internet.
6. For Master courses of YerPhI two lab. works have been prepared and students studied methods of registration and data analyzing of some physical processes. These laboratory works named “Compton scattered gamma-quanta investigation using NaI(Tl) detector” and “Gamma-quanta interaction with matter”. One more lab. work is under preparation targeted to measure dependence of cosmic muons rate on zenith angle of registration.
7. PhD student Gevorg HARUTYUNYAN successfully defends his PhD thesis titled “Accelerator based methods of Technetium99m production – target preparation and processing and beam monitoring technologies”.
8. 3 articles were published, one article is accepted for printing in **Nuclear Medicine and Biology(April 2017),** and one article is submitted to **Materials Chemistry and Physics.**

2.7. Center for Cosmology and Astrophysics

The studies were concentrated on the following problems:

http://cosmo.yerphi.am)

Satellite testing of General Relativity; the resulting paper was highlighted on the cover of European Phys. J. C (March, 2016);

Dark energy and the arrow of time;

Conformal cyclic cosmology;

PLANCK's view of galactic halos.

Results of the test of General Relativity via the measurement of the Earth's dragging of inertial frames were obtained using about 3.5 years of laser-ranged observations of the LARES, LAGEOS, and LAGEOS 2 laser-ranged satellites together with the Earth gravity field model GGM05S produced by the space geodesy mission GRACE. We measured $\mu = (0.994 +- 0.002) +- 0.05$, where μ is the Earth's dragging of inertial frames normalized to its general relativity value, 0.002 is the 1-sigma formal error and 0.05 is our preliminary estimate of systematic error mainly due to the uncertainties in the Earth gravity model GGM05S. The obtained result is in agreement with the prediction of General Relativity.

The arrow of time and the accelerated expansion are two fundamental empirical facts of the universe. We advanced the viewpoint that the dark energy (positive cosmological constant) accelerating the expansion of the universe also supports the time asymmetry. It is related to the decay of metastable states under generic perturbations, as we show on example of a microcanonical ensemble. These states will not be metastable without dark energy. The latter also ensures a hyperbolic motion leading to dynamic entropy production with the rate determined by the cosmological constant.

Then, universal compression and decoding mechanisms, e.g. the Lempel-Ziv-Welch algorithm, were considered that could reveal non-random structures in compressed bit strings. The efficiency of Kolmogorov stochasticity parameter for detection of non-randomness is illustrated, along with the Zipf's law. The universality of these methods, i.e. independence on data details, can be principal in searching for intelligent messages.

Cosmic microwave information can contain encoded signals on various physical processes, including e.g. considered within the scheme of conformal cyclic cosmology (CCC). The latter concerns the information transmission from aeon to another. This was considered in relation to the Fermi paradox. The PLANCK satellite data on the cosmic microwave background were shown to confirm the previous results on the low variance patterns obtained with WMAP data.

PLANCK's data have been used to study the M33 (Triangulum) galaxy and a substantial temperature asymmetry was found with respect to its minor axis projected onto the sky plane. This temperature asymmetry correlates well with the HI velocity field at 21 cm, at least within a galactocentric distance of 0.5 degrees, and it is found to extend up to about 3σ from the galaxy center. We conclude that the revealed effect, that is, the temperature asymmetry and its extension, implies that we detected the differential rotation of the M33 galaxy and of its extended halo.

Talks at conferences, seminars at several Universities, as well as lectures in series *Frontiers of modern physics* and *ANNL Summer School* have been delivered.

3. THE AGE STRUCTURE OF THE AANL

Total number of employees above 70 years is 22; below 35 years – 68. See, age distribution in Figure 1 and Table 1. The employee age based Key performance indicators (KPI, see attachment 2) equals K = N <35 / N>70 = 70/21 = 3.1. Before start of hiring of master students this number was below 1. Overall number of employees decreases from 2009 to 2015 by 158 persons: 499 in 2009, 416 – in 2013, 367 – 2014. 341 – 2015, 332 – 2016. However, the age distribution proves that in 5 years, when the major peaks in the age distribution will move above 70 years area YerPhI scientific activities will dramatically shrink. We have very few senior scientists in age 35-55 to take over and continue scientific activity in all contemporary directions. Therefore, we have to think from now which directions (where we have international recognition and priority) we should support to remain a major player on the worldwide scientific map.

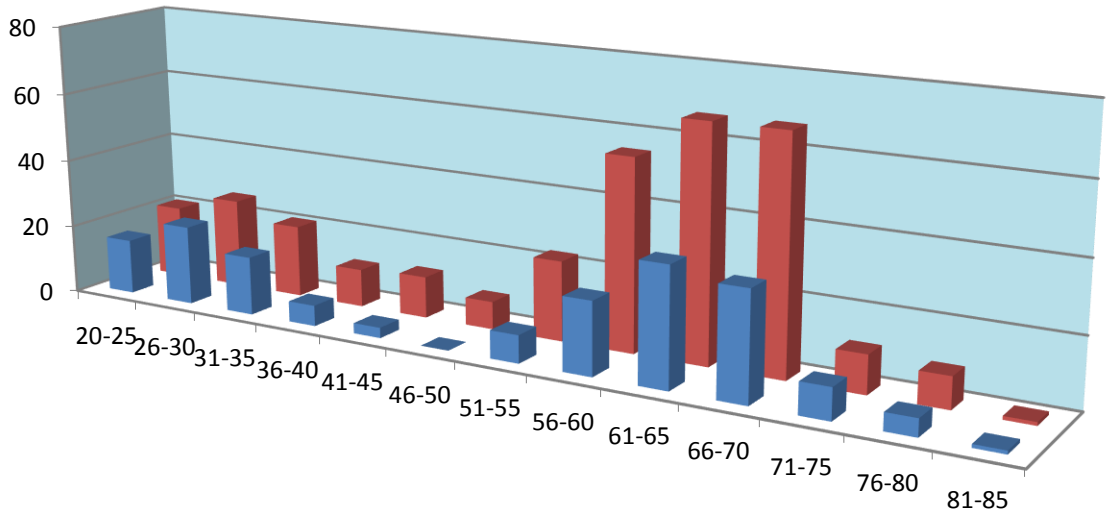

Figure 1. AGE distribution of the AANL employees; red – all employees, blue – scientific personnel.

Table 1. Age structure of AANL employees

(1.012017)

№ n/n	Division (department, service)	Breakdown on age											TOTAL
		till 35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	(person)
1	Directorate	1	0	0	0	0	0	0	3	0	0	0	4
2	Administration	3	1	2	0	3	6	3	4	0	1	0	23
3	Experimental Physics Divizion	20	1	1	0	2	10	11	13	8	2	1	69
4	Theoretical Physics Divizion	14	2	2	0	4	7	8	3	2	0	0	42
5	Cosmic Ray Division	7	1	5	1	1	5	8	12	0	2	0	42
6	Computational physics and IT division	8	1	0	1	0	2	1	2	0	0	0	15
7	Applied Physics Department	3	0	0	0	1	0	11	3	0	1	0	19
8	Isotope Research and Prod. Department	5	0	0	0	1	2	3	6	1	0	0	18
9	Cosmology and Astrophysics Centre	5	0	0	0	0	0	1	0	0	0	0	6
10	Industrial and household services	2	3	3	4	8	18	13	14	1	3	0	69
11	Security guard	1	1	0	2	3	5	6	7	0	0	0	25
	IN TOTAL:	69	10	13	8	23	55	65	67	12	9	1	332

4. AANL PUBLICATIONS AND CITATIONS

The mission of A.Alikhanyan national laboratory as it was declared in its strategic plan is to perform world-class research in Armenia in the field of high-energy particle physics and astrophysics, in theoretical physics and material science. To achieve these goals scientists of the national laboratory perform sophisticated experiments on own experimental facilities and participate in worlds biggest scientific collaborations. Number of articles published in peer review journals by YerPhI annually is the ~35% of the country's overall published articles (Fig. 2) and, what is more essential, over 76% of citations to all Armenian scientific research belongs to YerPhI scientists (Fig 3).

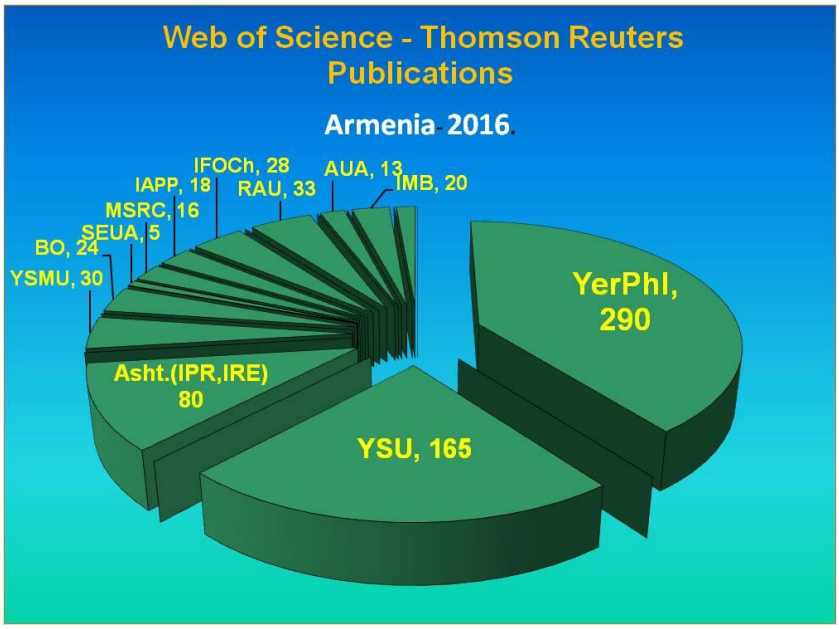

Figure 1. The diagram of the distribution among major institutions of scientific papers published by Armenian scientists

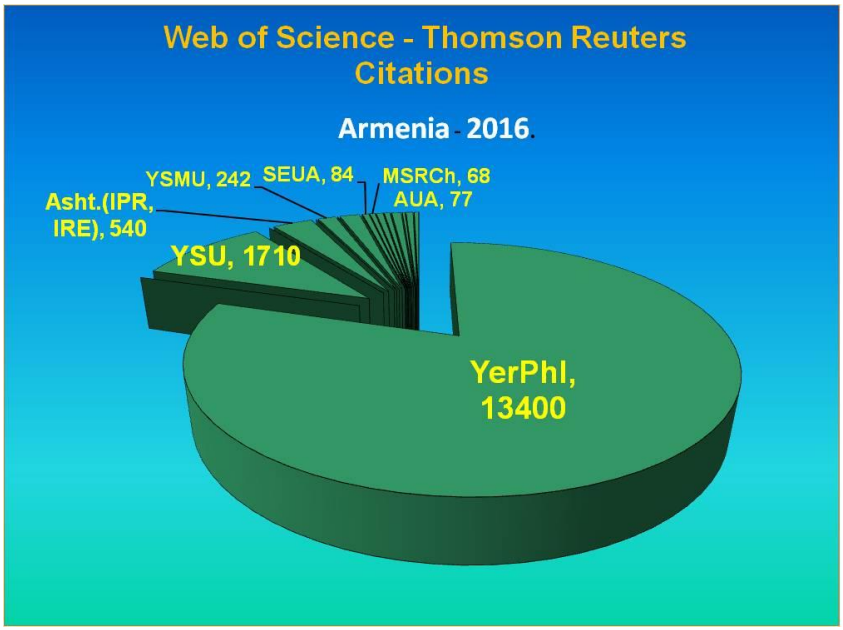

Figure 2. The diagram of the citations to scientific paper published by Armenian scientists

5. AANL SCIENTIFIC COUNCIL MEETINGS, SEMINARS, PHD DEFENDS, BUSINESS TRIPS, AGREEMENTS

The 2016 AANLs seminars are listed in the Attachment 11. Only few International grants are currently active in institute (see Attachment 19)

Among 89 business trips made by AANL employees in 2016, 67 were for joint research (including 22 CERN/DESY/JLab), 22– participation in the conferences and schools.

In 2016 AANL Scientific Council held 6 meetings. In 2016 AANLs Professional Council # 024 approved 4 PhD theses and 2 doctor of science thesis.

AANL have very wide international collaborations (see Attachment 20). New letters of intend, MOUs and agreements are signed in the 2016 (see Attachment 21).

6. AANL BUDGETARY ISSUES

The AANL budget is more or less stabilized in last 5 years (Table 2).

Table 1. National lab income from state, own profits and international grants

Եկամուտներ

YerPhI income **Երֆիի եկամուտներ**	**2016; AMD;** **1$=480.45AMD**	**2015; AMD;** **1$=477.83AMD**	**2014; AMD** **1$=415.65AMD**
Base funding Բազային ֆինանսավորում	806,760,500 AMD 1,679.177$	835,500,000 AMD 1,748.500$	752,000,000 AMD 1,809.200$
Project funding Թեմատիկ ֆինանսավորում	81,549,400 AMD 169,700$	73,158,800 AMD 153,100$	73,317,600 AMD 176,400$
Scientific conf. from Base funding Գիտաժողով Բազային ֆինանսավորումից	6,100,000 AMD 12,696$	2,340,000 AMD 4,900$	-
Conference ICTP Գիտաժողով ICTP	7,702,000 AMD 16,000$	-	-
DESY (salary)	25,561,000 AMD 53,200$	30,450,000 AMD 63,730$	31,687,400 AMD 76,200$
Rent of space Տարածքի վարձակալություն	27,477,000 AMD 57,200$	30,419,000 AMD 63,660$	29,710,600 AMD 71,500$
Sales Վաճառք	1,520,000 AMD 3,200$	3,050,000 AMD 6,400$	94,497,200 AMD 227,300$
Other Այլ	28,056,200 AMD 58,400$	25,538,000 AMD 53,450$	23,067,800 AMD 55,500$
YERPHI INCOME **ԵՐՖԻԻ ԵԿԱՄՈՒՏՆԵՐ**	**2016; AMD;** **1$=480.45AMD**	**2015; AMD;** **1$=477.83AMD**	**2014; AMD** **1$=415.65AMD**
Base + project **Ընդ. Բյուջեից**	**894.409,900 AMD** **1,861,609$**	**911.000,000 AMD** **1,906,500$**	**825,300,000 AMD** **1,985,600$**
Own profits **Ընդ. սեփական եկամուտ**	**90,316,200 AMD** **188,000$**	**89,457,000 AMD** **187,220$**	**178,963,000 AMD** **430,600$**
State + own **Ընդ. Բյուջե + սեփական**	**984,809,900 AMD** **2,049,766$**	**1,000.450,000 AMD** **2,093,750$**	**1,004,300,000 AMD** **2,416,100$**

Table 2. National lab expenditures

Ծախսեր

YerPhI expenditures **ԵրՖԻԻ ծախսեր**	**2016; AMD** **1$=480.45AMD**	**2015; AMD** **1$=477.83 AMD**	**2014; AMD** **1$=415.65 AMD**
Salary Աշխատավարձ	656,977,000 AMD 1,367,420$ (68.2%)	625,287,000 AMD 1,308,600$ (65.3%)	632,714,800 AMD 1,522,230$ (62.0%)
Electricity Էլեկտրաէներգիա	65,303,000 AMD 135,900$ (6.5%)	69,875,000 AMD 146,230$ (7.3%)	65,659,000 AMD 157,970$ (6.4%)
Gas Գազ	23,589,000 AMD 49,100$ (2.4%)	21,865,400 AMD 45,760$ (2.3%)	18,271,200 AMD 43,960$ (1.8%)
Phone Հեռախոս	3,394,000 AMD 7,100$ (0.3%)	2,893,000 AMD 6,050$ (0.3%)	3,594,000 AMD 8,650$ (0.3%)
Water Ջուր	8,886,000 AMD 18,500$ (0.9%)	11,746,000 AMD 24,580$ (1.2%)	13,087,000 AMD 31,480$ (1.3%)
Internet Ինտերնետ	216,000 AMD 450$ (0.02%)	1,826,000 AMD 3,820$ (0.2%)	3,692,000 AMD 8,900$ (0.4%)
Taxes Հարկեր	14,926,000 AMD 31,100$ (1.5%)	34,473,000 AMD 72,140$ (3.6%)	21,972,600 AMD 52,860$ (2.1%)
Business Travel Գործուղում	24,331,000 AMD 50,600$ (2.4%)	34,685,900 AMD 72,590$ (3.6%)	40,083,000 AMD 96,430$ (3.9%)
Fuel Վառելիք	9,207,600 AMD 19,200$ (0.9%)	10,415,500 AMD 21,800$ (1.1%)	13,805,800 AMD 33,210$ (1.3%)
Materials & equipment Նյութեր և սարքավորումներ*	93,091,700 AMD 193,759$ (9.7%)	95,985,700 AMD 200,880$ (10.03%)	144,525,200 AMD 347,700$ (14.1%)
Capital & current repairs Կապիտալ և ընթացիկ	31,076,600 AMD 64,682$ (3.2%)	14,433,000 AMD 30,210$ (1.5%)	19,587,500 AMD 47,120$ (1.9%)
Andamavchar Անդամավճար	-	-	20,000,000 AMD 48,100$ (1.9%)
Scientific conf. Գիտաժողով	13,802,000 AMD 28,727$ (1.4%)	2,340,000 AMD 4,900$ (0.2%)	-
Other Այլ ծառայություններ և ծախսեր	17,152,000 AMD 35,700$ (1.8%)	31,213,500 AMD 65,330$ (3.3%)	29,079,300 AMD 69,960$ (2.8%)
Total **Ընդամենը**	**961,951,900 AMD** **2,002,189$**	**957,037,000 AMD** **2,002,890$**	**1,026,071,000 AMD** **2,468,600$**

Դրամական միջոցների և դրանց համարժեքների մնացորդը՝

առ 01.01.16թ. – 154,686.5 հազ. դր. այդ թվում՝ 101210,6 հազ. դր. ավանդ
25585.0 հազ. դր. պարգևավճար

առ 01.01.17թ. – 177,544.5 հազ. դր. այդ թվում՝ 110354,8 հազ. դր. ավանդ
5300.0 հազ. դր. պարգևավճար

14510.0 հազ. դր. ձեռք է բերվել սարքավորումներ 17թ-ին, որը արտացոլված է Սարք, սարքավորումների տողում

****Նյութեր, սարք, սաքավորումներ - 93,091,700 դրամ, այդ թվում սարք, սարքավորումներ – 67,660,720 դրամ: Տես հավելված 1***

Huge losses due to finishing of international grants support (mostly ISTC and CNCP) were compensated by the RA funding. AANL scientists are making efforts to win scientific grants (RA thematic funding and "best" scientists awards). Currently there are 18 thematic projects performing in institute (funds received 81,549,400 AMD) and 17 scientists enter the most effective Armenian scientists made by National committee of science (selected by ~20 parameters, additional funds 9,180,00 AMD).

The fraction of funds spent for equipment and materials makes ~10% of budget (Table 3). It allows purchasing of modern fast electronics and computers for advanced research and scientific instrumentation development in institute and for equipping classes for teaching master students and for establishing the experimental physics-teaching center for participating in Network University. Communal expenses stabilized on the level of ~10%. Simultaneously the quality of water supply, Internet speed, and phone connections is significantly improved in 2016. The electricity expanses in the AANL campus were 52,078,000 AMD (80%) and on the high altitude research stations Aragats and Nor Amberd – 13,225,000 AMD (~20%). Gas expenditures in the ANNL campus were 20,589,000 drams (~86%) and on the high altitude research station Nor Amberd – 3,289.000 (14%).

According to the World Bank, Armenia has a level of the lower middle income country which leads to Armenia getting reduced of any fees by 51.2%. Thus, we have to pay reduced fees to all collaboration, journals and other international organizations. After the negotiations of institute director with CERN officials and a letter from chair of YerPhI board of trustees (see attachment 14) the expenses for CERN fees dramatically reduced. In 2017 we expect income of CERN collaborations: 10,000 SF from beam department and 6,000 from ATLAS experiment. The funds from ATLAS-YerPhI account (previously hidden from YerPhI administration) were used for purchasing equipment and establishing PM testing lab. The master student performs important tests with this equipment in YerPhI, now continuing in Geneva. Thus, we return to main policy of YerPhI: not to spend money for international collaboration, but profit from them both scientifically and by obtaining free equipment materials and funds! Unfortunately, Armenia now is not in the situation to give money abroad only for having some families in the author list of thousands of co-authors. Surely, expenses for business travel of young scientists and engineers to CERN were fulfilled completely but we try to avoid double funding from CERN and institute that was common in the previous years.

Attestation of scientific and engineering personnel performed in 2016 allows significantly enlarge salary of institute scientists and engineers and active young scientists (see Table 4). Six yang scientists were moved to the senior positions. Minimal salary of institute full time employees (scientific, engineering and technical personnel) was established 100,000 drams. Minimal senior scientists salary was established 140,00 drams and leading scientists – 160,00 drams. It allows apparent growth of mean month salary including additional payments reaching ~162,700 drams.

Table 3. Institute employees' salaries change after attestation in 2016 (thousand of AMD)

Category	N of employees	Without additional payments		With additional payments	
		Mean Salary	Mean	Mean	Mean Salary
		Before att.	After attestation	Before att.	After att.
Scientific	119	112.3	128.9	211.1	222.1
Engineers/tech	130	98.5	119.6	122.5	141.1
Support	83	81.8	95.6	99.0	111.2
Total	332	99.3	116.9	148.4	162.7

The distribution of the funding between AANL departments is shown in the Table 5 and distribution of purchased equipment and materials in Tables 6 and 7.

Table 4. Distribution of the AANL department funding

Department	AMD	%
Admin.	24,044,216	3.66
Maintenance/Accountants	79,062,693	12.03
Exp. Physics	133,263,398	20.28
Theory	126,296,956	19.22
Astrophysics Center	11,878,069	1.81
CRD	82,884,340	12.82
IT	29,259,503	4.45
Applied	40,086,187	6.11
Isotopes	35,458,781	5.4
Supporting personnel	94,742,857	14.42
Total	656,977,000	

Table 5. Distribution of the purchased materials among institute departments

	Base funding	Thematic funding	DESY	YerPhI-YSU	Total AMD 1$=480.45AMD	%
Total Materials	22,624,979	588,500	2,000,001	217,500	25,430,980AMD 52,931$	
Maintenance and repairs Yerevan	12,058,990				12,058,990AMD 25,099$	47.5%
Maintenance and repairs NA.,Aragats	7,122,814				7,122,814AMD 14,825$	28.0%
Exp. Phys. dep.	882,787	236,500			1,119,287AMD 2,330$	4.4%
Theory	329,898	35,000		217,500	582,398AMD 1,212$	2,3%
IT	526,992	277,000	996,917		1,800,909AMD 3,748$	7.0%
Izotopes+Applied	1,703,498	40,000	1,003,084		2,746,582AMD 25.099$	10.8%

Table 6. Distribution of the purchased equipment among institute departments

	Base funding	Thematic funding	DESY	YerPhI-YSU	Total AMD 1$=480.45AMD	%
Total Equipment	54,013,620	9,518,400	3,092700	1036000	67,660,720AMD 140,828$	
Storage	4,666,697				4,666,697AMD 9,713$	6.90%
Adm.	358,000		245000		603,000AMD 1,255$	0.90%
Exp. Phys. dep.	17,528,510	2,948900			20,477,410AMD 42,621$	30.30%
Theory		1,837,000		1,036,000	2,873,000AMD 5,980$	4.20%

CRD	16,906,360	3,773,500			20,679,860AMD 43,043$	30.60%
IT	10649951		2847700		13,497,651AMD 28,094$	20.00%
App.Phys + Isotope	2,453,700	959,000			3,412,700AMD 7,103$	5%
Service	1,450402				1,450,402AMD 3,019$	2.10%

The distribution of equipment and materials between institute departments reflects research activities and requests of the department leaders. According to policy of strengthening experimental research in AANL, the directorate highly encourages orders to modern equipment and satisfies almost all request that were received in 2015-2016.

ATTACHMENT 1. Recommendations of Scientific Council

According to identified key components of overall strategy of National Lab., the Scientific Council recommends the following main areas of activities for coming 10 years:

The participation in experiments at CERN and JLAB, in existent and planned Atmospheric Cherenkov Telescope networks (HESS, MAGIC, and CTA).

Participate in the data preservation and analysis activity using databases from high-energy physics (DESY, CERN, Jlab) and astrophysics (PLANCK, LARES, FERMI, LOMONOSOV) experiments.

Investigations at the cosmic ray research stations of National Lab. Research on theory of elementary particles.

Investigate possibilities and perform nuclear physics experiments on modernized electron synchrotron ARUS and on Cyclon-18 cyclotron.

Provide high-tech services to different branches of Armenian science and industry.

The brief description of overall activities of the National Lab for the coming 10 years is the following:

Experimental Physics on Accelerators Abroad

- Physics beyond standard model, structure of matter, three-dimensional picture of the nucleon, quark-gluon plasma, electric and magnetic form factors, nucleon-nucleon short-range correlations, hadronization in nuclei, Drell Yan processes, etc.
- For achieving these goals, research groups from national lab will continue participation in high-energy physics experiments on accelerators abroad: CERN LHC (ATLAS, CMS, ALICE, COMPASS – hardware upgrade, data analyses, and continuation of experiments in 2015).
- DESY (HERMES, H1, OLYMPUS, - data analysis in DESY, 2013, after 2014 – participate in data preservation stage, mostly in national lab).
- JLAB (Halls A,B,C,D -hardware upgrade, data analysis, development of physics projects for CEBAF 12 GeV machine to be commissioned in 2015) .
- JINR (BECQUEREL – emulsion microscopic treatment, NICA – spin physics).
- Participation in joint programs in nuclear physics with Notre-Dame University, USA;
- MAX-lab, Lund, Sweden, participation in the nuclear physics experimental program, detector development;
- MAMI, Mainz, Germany, detector development, experiment proposals; Nuclear Physics
- Proton-nucleus interactions, photo-fission, cluster structure of excited light nuclei, stellar nucleo-synthesis, isotope production and research, etc. For achieving these goals research groups from national lab will explore possibilities to modernize electron synchrotron ARUS (launch 75 MeV acceleration mode on the accelerator injector and use 216 m long synchrotron ring as stretcher as well as design and introduce the automatized beam parameters control), and will prepare and perform nuclear physics experiments on the IBA Cyclon 18/18 cyclotron.
- Accelerator Techniques and Research

- Modernizing the electron synchrotron to provide beams for the low energy nuclear physics experiments. The LINAC 75 MeV electron beam of duration 0.7 μsec will be stretched up to 3-5 msec.
- Automated testing and control of all accelerator subsystems including the electron beam parameters will support operation of the ARUS in new regime.
- Developing of the nonlinear Raman spectroscopy diagnostic methods. Experimental research of interaction of the laser beams with the electron beam in the homogeneous magnetic fields.
- Accelerator diagnostics and instrumentation based on the vibrating wire technology: transversal profiling and diagnostics of charged and neutral particles and hard photon beams.

Theoretical Physics

- Heavy Quark and Flavor Physics
- Spin in QCD and Related Hadron Phenomenology Neutrino Physics
- Physics Beyond the Standard Model
- Higher spin interacting quantum field theory, AdS/CFT and and dualities in gauge theories
- Investigations in low dimensional physics (d=1,2,3,4): Applications to non-critical strings and condensed matter physics
- Quantum and Classical Phase Transitions in Spin Systems Statistical physics of disordered systems
- Quantum Information Theory
- Integrability in d=4 super Yang Mills theories
- Powerful coherent radiation sources and new effective methods of acceleration Cosmology studies including general relativity theory.
- Electrodynamics of complex form cavities and waveguides, the electromagnetic field interaction with relativistic electron bunches.

Cosmic Ray Physics

- Research of fine structure of all particle energy spectrum in energy region above the first knee.
- Registration of the Extensive air showers initiated by primary gamma rays.
- Investigation of the solar-terrestrial connections and solar accelerators by the networks of particle detectors located in Armenia (ASEC network in Aragats, Nor Amberd, Yerevan) and worldwide (SEVAN network, Armenia, Croatia, Bulgaria, Slovakia and India).
- Research of Thunderstorm Ground Enhancements and atmospheric electricity by the networks of particle detectors with low threshold, electrical and geomagnetic field meters, and lightning detectors.
- Search of rare processes in underground laboratory of Avan salt mine.
- Participate in the HESS and MAGIC collaboration, and started CTA collaboration.

Material Physics

- Investigation of the materials and devices in extreme physical conditions; in-situ study of the crystal modification induced by electron and ultraviolet irradiations in the temperature range 120 to 450K and high vacuum; radiation stimulation of materials by protons (18 MeV Cyclotron).
- Research of the radiation defect formation in condensed materials, research of the mechanisms of electron excitation in doped crystals.

Nuclear Medicine

- Production of the 99mTc isotope with 18 MeV proton beam from C18/18 cyclotron.
- Investigation of the production possibilities of the medicine intended isotopes such as Cobalt-57, Copper-64, Gallium-67, Gallium-68, Indium-111, Indium-114m and others.

Services

- Development of the technologies for the processing of highly active radionuclides with the use of natural Armenian minerals (zeolite, clinoptilolite, basalt) for the Armenian nuclear power plant.
- Development of physical methods for the express analysis of organic and inorganic materials, dating of archaeological evidences and objects of cultural heritage.
- Element/isotope diagnostic bench on the basis of EMAL-2A energy-mass-analyzer.
- Comprehensive monitoring and prediction of potentially dangerous atmospheric and extra-atmospheric processes; global climate change research.
- Monitoring of the cosmic ray variations for obtaining information on Space Weather conditions and alerting on upcoming radiation storms.
- Development of techniques ensuring precise welding of materials used in particle accelerator technologies.

High Productivity Calculations and Data Analysis

- Launch high productivity cluster; support GRID system.
- Support data preservation activity.
- Support storage and access to databases with information from high energy physics, cosmology and astrophysics experiments, as well as from ASEC and SEVAN networks of particle detectors.
- Create “Knowledge Center” for analysis of huge amount of data collected at different
- HEP centers, Plank observatory, as well the data on cosmic rays.
- Create and maintain advance tools for data storage, multidimensional complex statistical analysis and physical inference.

Scientific Instrumentation

- Construction of silicon strip detectors with readout electronics for low energy nuclear physics experiments.
- Construction of the variety of calorimeters, Cherenkov detectors and neutron detectors for experiments at CEBAF 12 GeV machine.
- Fabricate and test RF phototube, low-pressure MWPC. Fabricate and test of radio frequency photomultiplier tubes, RF PMTs, RF timing detectors of secondary electrons, detectors based on low-pressure MWPCs.
- Fabrication of the radiation detectors and electronic devices (thermoresistors, heat sinks) on the basis of diamond and diamond for high temperature applications.
- Fabricate CsI based low threshold particle spectrometers.
- Fabricate hybrid particle detectors for the Space Weather monitoring.

Technological/Business Applications

- Production of the biomedical instruments for investigation of the effects of ionization radiation.
- Production of the biosensors for environmental monitoring.
- Production of chitin/chitosan systems, synthesis and research of their new modification.
- Technological lasers applications. Industrial furnaces production.
- Solar energy based electrical/heating systems.
- High-pressure vessels repair/attestation.
- Liquid gases production.
- Development and creation of high spatial resolution X-ray image detectors for the medical diagnostic systems.

ATTACHMENT 2. Strategic Plan for A.Alikhanyan National Laboratory (Yerevan Physics Institute)

Executive summary

The Strategic Plan of the A.Alikhanyan National Laboratory aimed at the declaring the mission of the national lab, developing of increased laboratory capacity; requiring policy adoption and strategic planning and implementation of activities appropriate for Armenia.

The development of laboratory capacity within Armenia is a long-term endeavor, which requires the support of the government and industry, as well as in- country stakeholders, multilateral agencies, donors, the private and public sectors, communities, and others.

Vision: A. Alikanyan national lab has distinctive expertise and insights relating to high-energy physics and astrophysics, nuclear physics, scientific instrumentations and multivariate data analyses, as well as in education. National lab should serve for the positive influence and impact to national values through research, education and innovation programs. National lab provides opportunities for intellectual, personal and professional growth. Learning and working at national lab will foster high professionalism, quick, well-rounded minds, well equipped to succeed in our fast-changing world.

Mission: Perform world-class research in Armenia, participate in world-biggest scientific collaborations, and offer scientific instruments and services for Armenian nuclear medicine, industries and cultural studies. Establish high standards of education in master and PhD courses; demonstrate that science and education can really provide development of Armenia.

The key components of overall strategy:

- Focus on high impact research that advances knowledge and its application, and in which national lab has major achievements having international recognition and leadership.
- Inject a spirit of enterprise into education and research, and develop impactful between education and research, within a dynamic “no-walls” environment.
- Develop advanced services for the Armenia industry, environmental monitoring and preserving cultural heritage.
- Develop advanced technological processes and high productivity computation facilities for Armenian science and industry.
- Nurture committed alumni to be key members of the lab community, who will actively support national lab towards its Vision and Mission.
- Adopt and adapt best practice governance and management, for optimal administration, management of resources, staff and student services.

Brief summary of the scientific activities

Brothers Abraham Alikhanov and Artem Alikhanyan founded in 1943 Yerevan Physics Institute (YerPhI) as a branch of the Yerevan State University. Later high-altitude Cosmic Ray stations were founded on the slopes of Mount Aragats. Among the key results of YerPhI in the early years were the discovery of protons and neutrons in cosmic rays, and the establishment of the first evidence of existence of the particles with masses between that of muons and protons. The high altitude research stations have remained the main research base of the Cosmic Ray Division (CRD) of YerPhI until now. Among the CRD achievements there were: discovery of

sharp knee in light components of primary cosmic rays, detection of the highest energy protons accelerated on the Sun, and the creation of the Aragats Space environmental Center in 2000 for studies of the solar-terrestrial connection, where CRD becomes one of the world's leaders.

The 6 GeV electron synchrotron was accomplished in 1967. During 1970-1991 synchrotron was operated with energies up to 4,5 GeV and in Experimental Physics Division were obtained significant results, including: hadronic properties of photons in π- meson photo-production on nuclei; structures of nucleon resonances in multi-polarization experiments, structure and characteristics of nuclear matter, important properties of X-ray transition radiation and channeling in monocrystals. Thanks to these achievements physicists from Yerevan Physics Institute started from 1985 are successfully participating in the large international collaborations.

Traditional topic of YerPhI is the development of new particle detectors. Wide spark chambers and transition radiation detectors are examples of the experimental techniques developed and implemented in YerPhI. During the last years groups of scientists from Yerevan Physics Institute have actively participated in intermediate and high energy physics experiments abroad (JLAB, DESY, CERN-LHC, MAX-lab, MAMI), exploring the meson and nucleon

structures, electromagnetic interactions of the nucleon, quark-hadron duality, short range nucleon-nucleon correlations, quark hadronization in nuclear medium, physics beyond standard model, Higgs boson searches, quark-gluon plasma, fission and fragmentation of nuclei and hypernuclei and many other topics, as well as constructing experimental hardware and develop the software for data acquisition and analysis.

The theoretical department assure major achievements in the following areas: B-meson physics, QCD and Related Phenomenology, Neutrino physics, Quantum Field Theory, String/M-theory, Integrable Models, Statistical physics, Condensed Matter and Quantum Information. These results are internationally recognized and highly cited.

In the mid-1980s in YerPhI was developed the concept of stereoscopic approach in Very High Energy gamma-ray astronomy using multiple Imaging Atmospheric Cherenkov Telescopes (IACT). This concept was materialized in the very successful IACT system (HEGRA). After first success, Armenian physicists successfully participate in operation of the IACT systems on the Canary Islands (MAGIC) and in Namibia (H.E.S.S.).

In the course of many years, the Applied Physics Department of YerPhI successfully investigates electron-energy structure of new wide-band laser materials using synchrotron radiation in various spectral regions. The investigations were carried in DESY and will be continued in MaxLab- II (Sweden).

Organization structure and human recourses management

1. Lab board appoints director of national lab and chair of the board signs contract with director for 5 years.
2. Director of the national lab appointed two deputies, chief accountant, scientific secretary and five assistants of director (human recourses management, security, economics, office management, international connections) and sign contract with them.
3. National lab adopted two-level internal organizational structure, consisting of departments where relevant scientific and technical groups operate.

Figure 4 . Administrative structure of AANL

4. The appointment to the position of the heads of departments should be realized for up to 5 years period and they should sign contracts with national lab director. The contract with heads of groups is realized for up to 3 years.
5. The age limit of 65 years is stated for the heads of departments and groups; in exceptional cases (started from 2014 no contracts are signed with older candidates to group or department leader positions) until the age of 70. The limiting age for other national lab employees is 65 years, for doctors of science– 70
6. The age limit for consultants/advisers is 85 for academicians and 75 for doctors of science.

National lab adopted following list of scientific positions.

- intern
- researcher
- senior researcher
- leading researcher
- Scientific /Consultant-Advisor Notification:

a) Intern position is assigned to the young professionals currently engaged in higher Educational system (master courses) and those who are doing their PhD in national lab.
b) Intern-researcher position («Postdoc» status) is assigned by competition to young scientists, having PhD degree; prior to postdoc competition the competition for opening postdoc position should be hold in the national lab departments.
c) Lab's director in accordance with the recommendations of the Scientific Advisory Committee decides distribute the intern-researcher positions among lab departments.
d) Researcher, senior and leading researcher positions are assigned by depending on the overall score based on several criteria (H-index, leadership, work with students, etc.).
e) To the scientific /technical/consultant position are appointed scientists and engineers with age above 65 years old (no more than 5 persons in each department).

7. Special commission appointed by lab's director makes the attestation of the national lab employees periodically. Each employee should present to commission following documents:

- Filled standard attestation form
- List of publications with abstracts during last 5 years Best 3 publications (according to author's opinion) List of graduate students
- List of reports on the international conferences, invited talks List of organized conferences
- Title and date of last thesis, place of defense
- Total list of publication
- List of managed grants.

8. In exceptional cases department leaders can employ personnel for the period up to 6 months for work of strategic importance (not more than 2 employees).
9. Director reserves the right to appoint his advisors, doctor of science, academicians.
10. The business trips of national lab employees to foreign countries are organized according special regulation; duration of business travel should not exceed 6 months.
11. The hours of workweek are fixed to 40. Automatic system is calculating the working hours according to which the actual salary is assigned.
12. According to the national regulations administration provides 24-day vacation to all employees; vacation may be provided in two parts; in exceptional cases vacation can be given additional vacation without payment.
13. National lab affords all measures to increase the professional skills of young scientists (send them to summer schools and conferences, invite professor for lecturing, organize summer schools in Armenia) and to provide proper working conditions (repair office, seminar rooms, provide modern computers).

1. Administration obligations, economical and property management issues

1. Provide full and timely logistical support for the implementation of the linear functions of the National Lab, such as:
2. Ensure efficient utilization of the office spaces, carrying out necessary maintenance and repairing activities
3. Purchase modern equipment for high precision measurements.
4. Install modern security equipment for the offices and experimental laboratories.
5. Organize the efficient provision of irrigation water for the whole territory of the National
6. Lab to guarantee the green and clean environment.
7. Select an operator, through a competitive tender, for establishing restaurants and cafes on the lab's premises.
8. Optimize and manage the vehicles' park, giving priority for smaller number of cars but with appropriate power and environmentally friendly engines.
9. Optimize the workshops and provide it with modern tool kits and technological equipment.
10. Organization of workshops and conferences (logistics).

11. Develop and implement non-current assets (immobile property) management strategy:
12. Establish criteria for selecting the buildings requiring capital restoration and build up a renovation and restoration long-term master plan.
13. Ensure energetic efficiency of the buildings.

2. Establish procedures for providing the premises for short time (up to 1 year) lease to the third parties. Provide assistance to CRD employees in preparing grant applications and develop a sustainable fundraising strategy:

- Provide timely information to the staff about relevant funding opportunity announcements.
- Negotiate with Republican agencies to open funding possibilities for the researchers.
- Reduce dependency on a single income stream; improve chances to operate independently.
- Create a sustainable funding base and build up reserves to safeguard financial future.

3. Organize international expertise of the projects submitted for funding, form commissions and project accepting committees; provide recommendations for republican funding bodies for selected projects.
4. Implement the financial management of the National Lab:
    - Prepare annual budget. Discuss with national board the priorities, and due to the board decision decide ongoing expenditure, which must be met from ongoing income streams, and reserves.
    - Provide accounting and material resources "house-keeping" according to the best corporative standards.
    - Each year prepare comprehensive report for the annual audit.
5. Provide access to national lab information, Internet recourses, high productivity computing, scientific publications, and libraries of applied programs, printers, and telephones.
6. Establish small business innovation research (SBIR) and small business technology transfer competitive funding.
7. Provide secure storage of the isotopes and radioactive materials according to MAGATE standards.
8. Providing touristic and recreation services

Key performance indicators (KPI) for organizational performance evaluation

The national lab is guided by a sharp programmatic vision, by a strategic plan formed by this vision, and by a constant striving for managerial excellence and effectiveness in implementing the plan. A systematic program to refine work processes is underway with the aim of achieving the greatest programmatic output for a given funding level. Management has renewed their efforts to continuously strengthen a culture of high performance that extends to all areas of work, and underscores the importance of safe operation as a core institutional value.

Among the major KPIs to be used to evaluate the national lab performance are:

- Number of publications in the peer reviewed journals each year and the sum of the impact factors of the journals.

- Number of citations made to publications of national lab employees made in the assessed year.
- Number of master and PhD students, defends of PhD theses.
- The ratio of the numbers of employees under 35 years old to number of employees above 70 years old.
- The percent of the funds spent to the new equipment and materials relative to the total budget.
- The percent of funds spent on business travel relative to the total budget. The percent of funds spent for repairs relative to the total budget.
- Total income from high technology services.
- Number of new agreements with Armenian and international organizations.

ATTACHMENT 3. The Board of Trustees of AANL

1. N. Yeritsyan – Deputy president of Central Bank of RA (Executive board member)
2. K. Harutyunyan – Deputy minister of Science and Education (Board member)
3. S. Harutyunyan - Chairman of the State Committee on Science (Board member)
4. A. Ghukasyan – Chief executive officer of "Byblos Bank Armenia" CEO (Board member)
5. A. Papoyan - Director of Institute for Physical Research of the National Academy of Sciences of Armenia (Board member)
6. Kh. Nerkararyan – Professor at Faculty of radio physics of Yerevan Physics Institute (Board member)
7. Z. Baghdasaryan – The President and CEO of "Tahoe Associates", a private investment entity in USA (Board member)
8. A. Kaplanyan - The Chief Executive Officer of Memoir Systems (Board member)
9. R. Strauch - Chairman of The Roda Group (Board member)

ATTACHMENT 4. Election of the AANL Scientific Council and it's Governing Body

ՈՐՈՇՈՒՄ № 2017/01/24-02

«Ա. Ի. ԱԼԻԽԱՆՅԱՆԻ ԱՆՎԱՆ ԱԶԳԱՅԻՆ ԳԻՏԱԿԱՆ ԼԱԲՈՐԱՏՈՐԻԱՅԻ (ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ)» ՀԻՄՆԱԴՐԱՄԻ ՀՈԳԱԲԱՐՁՈՒՆԵՐԻ ԽՈՐՀՐԴԻ

ք. Երևան 2017 թվականի փետրվարի 24

«Ա. Ի. ԱԼԻԽԱՆՅԱՆԻ ԱՆՎԱՆ ԱԶԳԱՅԻՆ ԳԻՏԱԿԱՆ ԼԱԲՈՐԱՏՈՐԻԱՅԻ (ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ)» ԳԻՏԱԿԱՆ ԽՈՐՀՐԴԻ ԿԱԶՄԻ ՀԱՍՏԱՏՈՒՄ

Հիմք ընդունելով «Հիմնադրամների մասին» Հայաստանի Հանրապետության օրենքի, ինչպես նաև հիմնադրամի կանոնադրության դրույթները,

ՀԻՄՆԱԴՐԱՄԻ ՀՈԳԱԲԱՐՁՈՒՆԵՐԻ ԽՈՐՀՈՒՐԴԸ ՈՐՈՇՈՒՄ Է

(ա) Հաստատել հիմնադրամի գիտական խորհուրդը հետևյալ կազմով՝

1. Մարգարյան Ամուր
2. Սիրունյան Ալբերտ
3. Մկրտչյան Համլետ
4. Ղավալյան Վասակ
5. Դաշյան Նատալյա
6. Ասատուրյան Արշակ
7. Պողոսով Վալերի
8. Մարուքյան Հրաչյա
9. Ավագյան Ռոբերտ
10. Անանիկյան Ներսես
11. Մանվելյան Ռուբեն
12. Ասատրյան Հրաչյա
13. Պողոսյան Ռուբիկ
14. Չիլինգարյան Աշոտ
15. Հովսեփյան Գագիկ
16. Կարապետյան Տիգրան
17. Սողոմոնյան Սուրեն
18. Հարությունյան Վաչագան
19. Հարությունյան Սուրեն
20. Սահակյան Վարդան

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21. Ավետիսյան Ալբերտ
22. Ակոպով Նորայր
23. Դալլաքյան Ռուբեն
24. Թարոյան Սարգիս
25. Մարդոյան Լևոն առաջարկված է ՀՀ ԿԳՆ կողմից

Ներսես Երիցյան
Հոգաբարձուների խորհրդի նախագահ՝ _____

Ռ. Դալլաքյան
Նիստի քարտուղար՝ _____

Սույն որոշումը կազմվել է 24.02.2017թ.-ին, բաղկացած է 2 էջից:

ATTACHMENT 5. Attestation of AANL Scientific and Engineering Personnel

ԱԱԳԼ-ում գիտնականների որակավորման գործընթացի բարելավումը նախատեսված է ՀՀ կառավարության կողմից հավանության արժանացած միջազգային գիտական խորհրդատուների առաջարկներում: Հետևաբար, հաշվի առնելով այդ ասպարեզում համաշխարհային լավագույն փորձը, ԱԱԳԼ Հոգաբարձուների խորհուրդը մշակել է ինստիտուտի համար ԱԱԳԼ գիտաշխատողների որակավորման ընթացակարգ, որը կառավարության որոշումից բխող, այն մանրամասնող իրավական ակտ է, չհակասելով ավելի բարձր իրավական ուժ ունեցող ակտերին:

Հոգաբարձուների խորհուրդը իր 2016թ.-ի հունիսի 10-ի նիստում հաստատեց որակավորման ընթացակարգը, որը բխում է ազգային լաբորատորիայի ընդունված ռազմավարությունից: Որպես նոր կարգավորում հանդիսանում է ՀՀ ԿԳ նախարարության հաստատած ,Գիտական գործունեության արդյունավետության ցուցանիշի որոշման մեթոդաբանության օգտագործումը որակավորման ընթացակարգում (ՀՀ ԿԳ նախարարի 2016 թ. հունիսի 15-ի N 645-Ա/2 հրամանով հաստատված ,Գիտական գործունեության արդյունավետության ցուցանիշի որոշման մեթոդաբանություն):

Հոգաբարձուների խորհուրդը քննարկեց հիշյալ ընթացակարգը՝ դրա վերաբերյալ անկախ իրավաբանական եզրակացության հետ միասին: Իրավական եզրակացությունը հաստատում է, որ որևէ հակասություն գոյություն չունի գործող օրենսդրության և Հոգաբարձուների խորհրդի կողմից հաստատված որակավորման ընթացակարգի միջև:

Այդուհանդերձ, ՀՀ Կառավարության 3 հոկտեմբերի 2001 թվականի N 935 որոշմամբ սահմանված գիտական կադրերի որակավորման կարգը գլխավորապես հիմնված է սովետական ժամանակաշրջանի կանոնակարգի վրա և ցանկալի է վերանայել: Կառավարության 2001 թվականի որոշումից (այսուհետ որոշում) անցել է 15 տարի և այսօրվա պայմաններում նրա կիրարկումը բերում է բազմաթիվ հակասությունների՝

Առաջինը – որոշման մեջ բերված գիտական պաշտոնների բազմաքանակ ցանկը կարող է չհամընկնել որևէ գիտական կազմակերպությունում գործող պաշտոնացանկի հետ, որը պայմանավորված է տվյալ կազմակերպության առաջադրված խնդիրներով և ընդհանուր ռազմավարությամբ:

Օրինակ՝ հատված ՀՀ Վերաքննիչ դատարանի 2013 թվականի ապրիլի 3-ի նիստի որոշումից "Ներկայումս ՀՀ-ում չկան իրավական ակտեր, որոնք սահմանում են գիտական կազմակերպություններում պարտադիր պաշտոնների անվանացանկ և հատկապես գլխավոր գիտաշխատողի պաշտոն սահմանելու պարտադիր պայման":

Երկրորդը՝ Որոշման մեջ բացակայում է գիտաշխատողի գործունեության արդյունավետությունը բնորոշող օբեկտիվ ցուցանիշների սահմանումը, որը բերում է կամայականությունների: Վերջին տասնամյակում անհատ գիտնականների հետազոտական գործունեության քանակական չափման մեթոդները (Գիտաչափություն) լայնատարած օգտագործվում են ինչպես աշխարհում, այնպես էլ Հայաստանում (տես՝ ՀՀ ԿԳ նախարարի 2016 թ. հունիսի 15-ի N 645-Ա/2 հրամանով հաստատված ,Գիտական գործունեության արդյունավետության ցուցանիշի որոշման մեթոդաբանություն), որոնք, դժբախտաբար, արտացոլված չեն որոշման մեջ: Հիրշի ցուցիչը (H index) հավակնում է ավելի օբյեկտիվ գնահատական տալու գիտնականների գործունեությանը: Ցուցիչը հիմնված է գիտնականի հրապարակումների և այդ հրապարակումների վրա կատարված

հղումների ընդհանուր հաշվարկի վրա:

Գտնում ենք, որ Հոգաբարձուների խորհրդի կողմից ընդունված ընթացակարգի կիրառումը կարևոր գործոն կհանդիսանա Ազգային լաբորատորիայի գիտատեխնիկական հետագա առաջընթացի համար: Գիտնականների որակավորման ընթացակարգը սահմանել է Հոգաբարձուների խորհուրդը ՀՀ գործող օրենսդրությանը որակավորման ընթացակարգի համապատասխանության վերաբերյալ անկախ իրավական կարծիքի հիման վրա:

2016թ. օգոստոս-սեպտեմբեր ամիսներին Ա.Ի. Ալիխանյանի անվան ազգային գիտական լաբորատորիայում իրականացվեց հերթական (ամեն 5 տարին մեկ) գիտնականների որակավորման գործընթացը:

1. Այդ ընթացքում ատեստավորում են անցել ընդհանուր 75 գիտնական, այդ թվում՝
   ա) Առաջատար գիտաշխատող - 12
   բ) Ավագ գիտաշխատող - 22
   գ) Գիտաշխատող – 41

2. Ատեստավորման հանձնաժողովի առաջարկով փոխադրվել են՝
   ա) Ավագ գիտաշխատողի պաշտոնից առաջատար գիտաշխատողի – 7
   բ) Գիտաշխատողի պաշտոնից ավագ գիտաշխատողի – 9 (որոնցից 7-ը 30 - 37 տարեկան հասակի):

3. 75 գիտական աշխատողների աշխատավարձի դրույքաչափերը բարձրացվել են:

Ատեստավորման հանձնաժողովի հասցեին որևէ բողոք կամ դժգոհություն չի եղել:

ATTACHMENT 6. List of Winners of the Best Scientific Papers Competition

Ա. Ի. ԱԼԻԽԱՆՅԱՆԻ անվան ԱԶԳԱՅԻՆ ԳԻՏԱԿԱՆ ԼԱԲՈՐԱՏՈՐԻԱ

(ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ)

Հ Ի Մ Ն Ա Դ Ր Ա Մ

ՀՐԱՄԱՆ

10.03.2017թ. N34/Կ

ԱԱԳԼ տնօրենի 30.11.2016թ.-ի համար 170/Կ հրամանով հայտարարված 2016 թվականի արդյունքներով ԱԱԳԼ-ի գիտնականների հրատարակած լավագույն հոդվածների մրցույթում հաղթող են ճանաչվել հետևյալ 5 աշխատանքները՝

Ալահվերդյան Արմեն, Բաբաջանյան Սանասար,Մարտիրոսյան Նարեկ, - *"Adaptive Heat Engine"*

Պողոսյան Ռուբիկ, Պողոսյան Գաբրիել, - *"VEV of Baxter's Q-operator in N=2 gauge theory and the BPZ differential equation"*

Չիլինգարյան Աշոտ, Հովսեփյան Գագիկ, Մնացականյան Էդուարդ, - *"Mount Aragats as a stable electron accelerator for atmospheric high-energy physics research"*

Պողոսով Վալերի, Գուլքանյան Հրանտ, Այվազյան Գ.Մ.,Պողոսյան Լևոն, - *"Search for rare decay modes of Californium"*

Մինասյան Հայկ, - *"One-step Solution Processing of Ag, Au and Pd@MXene Hybrids for SERS"*

ՀՐԱՄԱՅՈՒՄ ԵՄ՝

1. Վերոհիշյալ 5 աշխատանքների հեղինակներին տալ համապատասխան հավաստագրեր և դրամական պարգևավճարներ:

2. Մրցույթին մասնակցած ներքոհիշյալ աշխատանքների հեղինակներին պարգևատրել խրախուսական մրցանակներով՝ դրամական պարգևավճարների տեսքով:

Ղավալյան Վասակ, - *"Synthesis and characterization of new chitosan-based Schiff base compounds"*

Բաբուջյան Հրաչյա, - *Probing strong correlations with light scattering: Example of the quantum Ising model"*

Մկրտչյան Համլետ, - *Precision Electron-Beam Polarimetry at 1 GeV Using Diamond Microstrip Detectors*

Գուրզադյան Վահե, Խաչատրյան Հարություն, Միրզոյան Սերգեյ, - *A test of general relativity using the LARES and LAGEOS satellites and a GRACE Earth gravity model*

Հովհաննիսյան Կորյուն, - *"On some possibilities of Felwi realization"*

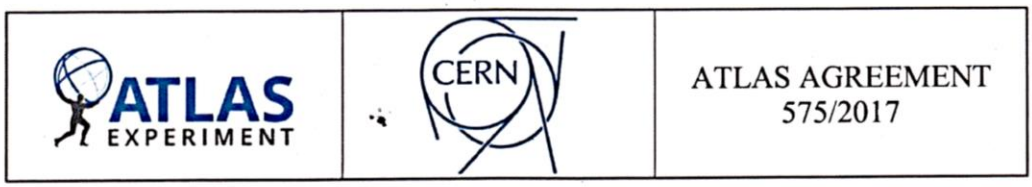
Ալեքսանյան Էդուարդ, - *"Recombination luminescence of Cu and/or Ag doped lithium tetraborate single crystals"*

Շահինյան Ալբերտ, - *Measurements of d(2)(n) and A(1)(n) : Probing the neutron spin structure*

ԱԱԳԼ-ի տնօրեն Ա.Չիլինգարյան

Կատ. Թարոյան

ATTACHMENT 7. CERN Collaboration Agreements and Directors Opinion on CERN Activities



KE3543/ATLAS

ATLAS AGREEMENT No. 575/2017

30 January 2017

Technical Support for ATLAS

BETWEEN

The **ATLAS Collaboration**
Represented by the ATLAS Resources Coordinator

on the one hand,

AND

The **Alikhanian National Science Laboratory (ANSL)**, Yerevan
Represented by its ATLAS Team Leader

on the other hand,

hereafter collectively referred to as the "Parties" and separately as "Party";

CONSIDERING THAT:

- ANSL has signed the "Memorandum of Understanding for Collaboration in the Construction of the ATLAS Detector" (MoU, ATLAS RRB-D 98-44 rev.);
- ANSL has signed the "Memorandum of Understanding for the Maintenance and Operation (M&O) of the ATLAS Detector" (MoU for M&O, CERN-RRB-2002-035);
- ANSL contributes to the ATLAS construction and M&O common items and activities (MoU Annex 10C; MoU for M&O Annex 9).

IT IS AGREED AS FOLLOWS:

ARTICLE 1 SCOPE OF THE AGREEMENT

1.1 The purpose of this Agreement is to define the work packages assigned to experts from ANSL in the domain of maintenance and operation of the ATLAS detector (the "Activities"), as well as the related financial arrangements. It is understood that this Agreement is subject to the provisions of the ATLAS M&O MoU. In case of divergence, the provisions of the ATLAS M&O MoU shall apply.

ARTICLE 2 OBLIGATIONS OF THE PARTIES

2.1 ANSL Contributions:

ANSL shall provide qualified personnel (ANSL experts) with the necessary skills and competence to execute the work packages detailed in **ANNEX 1**.

The ANSL experts shall at all times comply with the rules of conduct and safety in force at CERN.

2.2 ATLAS Contributions:

ATLAS shall provide the technical infrastructure and necessary tooling for the execution of the Activities.

Subject to the provisions of CERN's Staff Rules and Regulations, each ANSL expert based at CERN shall be appointed as associated member of CERN's personnel for the duration of his or her agreed stay at CERN and shall receive a subsistence allowance at standard rates in force at CERN, to be funded by ATLAS common funds.

By way of contribution to the costs incurred by ANSL for the execution of the Activities, ATLAS shall pay to ANSL an amount of 4'200 CHF per three-month interval, funded by ATLAS common funds. ANSL shall invoice ATLAS for each three-month interval and payment shall be made by CERN within thirty (30) calendar days from receipt of a corresponding invoice from ANSL.

ARTICLE 3 AMENDMENTS AND DURATION

3.1 This Agreement may be amended in writing by the Parties. It may be terminated by either Party in writing with at least six (6) months notice, but shall otherwise remain in force as long as ANSL is a member institute of the ATLAS Collaboration in accordance with the MoU for M&O, CERN-RRB-2002-035.

ARTICLE 4 COORDINATION

4.1 All documents concerning this Agreement shall bear the reference:

ATLAS Agreement No. 575/2017

4.2 The performance of this Agreement shall be co-ordinated by the following persons:

For CERN:

Fido Dittus, email fido.dittus@cern.ch
ATLAS Resources Coordinator
Phone +41 22 767 1211

For ANSL:

Laura Sargsyan, email Laura.Sargsyan@cern.ch
ATLAS ANSL Team Leader
Phone +41 22 767 6530

ARTICLE 5 DISPUTE SETTLEMENT

5.1 Any differences arising from the execution of this Agreement that cannot be settled amicably shall be submitted to the ATLAS Spokesperson who shall propose solutions in the best interest of the ATLAS Collaboration.

Signed in Geneva,

for the ATLAS Collaboration

.....
Fido Dittus
ATLAS Resources Coordinator

Date 13.03.2017

for the ATLAS-ANSL Team

.....
Laura Sargsyan
ATLAS-ANSL Team Leader

Date 14.03.2017

for the ATLAS Collaboration

.....
Prof. Karl Jakobs
ATLAS Spokesperson

Date 13.03.2017

for the Alikhanian National Science Laboratory
(Yerevan Physics Institute)

.....
Prof. Ashot Chilingarian
Director

Date 16.03.2017

ANNEX 1 WORK PACKAGES

WP1: Tile Calorimeter activities (0.5 FTE):

- Studies of the down-drift of PMT response during Run1 and Run2;
- Use of MA-PMTs for HL-LHC (optics and electronics feasibility studies);
- Data analysis of the MA-PMTs using Cs source;
- Work on Tile Offline Software;
- Maintenance (Aux boards consolidation, LVPS, etc).

WP2: TDAQ System Administration: computing infrastructure support at Point 1 (1 FTE):

- Monitoring and maintaining the SLIMOS (Shift Leader In Matters Of Safety) desk – computer hardware and software, and application of necessary patches;
- Installation and configuration of the ATLAS media-streaming server to display safety information on monitors distributed throughout the experiment;
- Maintenance and troubleshooting of computers in the Point 1 Design Office;
- Installation and maintenance of safety cameras distributed throughout Point 1, both above and below ground;
- Support, maintenance, and troubleshooting of the numerous ATLAS systems critical to safety operations.

WP3: Support for the ATLAS Technical Coordination (1 FTE):

- Participation in all Opening and Closing of the ATLAS detector during annual maintenance;
- Participation in mechanical consolidation work on ATLAS detector or infrastructure during maintenance periods;
- Machining of parts such as supporting structure for detectors in ATLAS (Muons, AFP, etc.);
- Fabrication of tooling dedicated to detector installation: access platform, lifting and handling tools;
- Participation in the maintenance of the sniffers (gas detection and fire detection);
- Participation in the installation of additional Muon chambers (BMG);
- Participation in the integration of the New Small Wheel.

WP4: Design Office activities in the ATLAS Technical Coordination (1 FTE):

- 3D design and fabrication drawings of various devices and structures in order to consolidate access and detector movement;
- As-built 3D models of many systems to keep up to date the ATLAS CAD database.

COLLABORATION AGREEMENT
REFERENCE KE3564
(THE "AGREEMENT")

BETWEEN: ALIKHANYAN NATIONAL SCIENCE LABORATORY ("ANSL"), established at Yerevan, Armenia, duly represented by Ashot Chilingarian, Director,

AND: THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH ("CERN"), an Intergovernmental Organization having its seat at Geneva, Switzerland, duly represented by Fabiola Gianotti, Director-General,

Hereinafter "Party" and collectively "Parties",

CONSIDERING:

That CERN, an Intergovernmental Organization, is a leading global laboratory in particle physics, providing for collaboration of a pure scientific and fundamental character, with participation by scientific institutes from all over the world;

That ANSL is a research laboratory working in the fields of high-energy physics and astrophysics;

That the Parties have successfully collaborated in the development and maintenance of CERN's Accelerator Control Systems though Collaboration Agreement KE2886 and wish to continue their collaboration under the provisions of this Agreement;

The mutual benefit that the Parties would derive from collaboration between them;

AGREE AS FOLLOWS:

Article 1
Purpose

1.1 Under the terms of this Agreement, the Parties shall collaborate in the development and maintenance of CERN's Accelerator Control Systems (the "Project"). The Parties shall use the results of their collaboration for non-military purposes only.

1.2 Except as agreed otherwise by the Parties, each Party shall bear the cost of its participation in the Project.

Article 2
ANSL's contribution

2.1 ANSL shall contribute to the Project by performing the activities set out in Annex 1, which sets out the scope, including the required resources and duration of the activities and any deliverables, milestones, acceptance procedures, the management of the Project and other relevant information.

2.2 On the date of signature of this Agreement it is foreseen that shall make its contribution through up to three (3) qualified specialists (the "ANSL Experts") who shall have experience in database-related infrastructure, software development and system administration in the Linux and Windows environments and in virtualization technologies.

Article 3
CERN's contribution

3.1 CERN shall contribute to the Project by making available office facilities, equipment (including computers), materials and services (the "Facilities") on the CERN site as required for the execution of ANSL's contribution. They shall remain the property of CERN and are made available without any warranty or liability relating to their use. ANSL shall take proper care of them until the completion of its contribution. The Parties shall agree on the cost of the repair, or the replacement of any item that cannot be repaired, and such cost shall be deducted from any amount payable by CERN to ANSL under this Agreement.

3.2 In consideration of the administrative overheads to be incurred by ANSL in the execution of its contribution, such as the temporary replacement within ANSL of the ANSL Experts and their training, and taking into account the number of ANSL Experts involved in the execution of ANSL's contribution, CERN shall assist through the payment to ANSL of an amount not exceeding the amount set out in Annex 2.

3.3 CERN's contributions under Article 3.2 shall be subject to receipt of an invoice in duplicate, and where payment is subject to completion of a specific activity, to its acceptance by CERN. Payment details are set out in Annex 2.

Article 4
Technical co-ordination and contact persons

4.1 The overall responsibility of the Project lies with CERN, it being understood however that ANSL shall remain exclusively responsible for the proper performance of its activities.

4.2 The Parties shall each nominate a technical coordinator, who together shall coordinate the technical execution of this Agreement, as well as contact persons, including a designated safety correspondent. Their names and contact details are set out in Annex 3.

Article 5
Experts

5.1 Each Party shall ensure the selection of experts with the necessary skills and competences to execute the Project on its behalf, taking into account the nature and the environment of their activities.

5.2 During their presence at CERN, the ANSL Experts shall be appointed as Project Associates pursuant to the conditions set out in the CERN Staff Rules and Regulations from which it follows that, for the entire duration of the association of the ANSL Experts with CERN (i) the ANSL Experts shall be employed by ANSL, (ii) ANSL shall be responsible for their social insurance, (iii) the ANSL Experts shall maintain medical insurance cover adequate in Switzerland and France for themselves and accompanying family members, which shall include cover for occupational illness and accidents for the ANSL Experts, and (iv) the ANSL Experts shall have adequate financial resources to support themselves and accompanying family members. ANSL shall hold CERN free and harmless from liability in connection with the subject matter of this Article.

Article 6
Conduct and safety

6.1 The experts shall comply with the rules of conduct and safety in force at the host Party.

6.2 Any activity, equipment or other item contributed by a Party to the collaboration shall conform to the safety rules, including any specific safety requirements in force at the host Party where such activity will be performed or such equipment or other item will be installed and operated.

Article 7
Intellectual Property

7.1 The disclosure of information under this Agreement does not create any proprietary right for the receiving Party.

7.2 Title in all intellectual property developed in the execution of the Project shall be vested in CERN. CERN shall grant to ANSL a free, non-exclusive license for the use of such intellectual property in the execution of its scientific programme.

7.3 The providing Party provides no warranty in respect of intellectual property made available by it under this Agreement, and the receiving Party shall hold it free and harmless from any liability arising from its use (including, as the case may be, by its partners and contractors) of such intellectual property.

Article 8
Publications

8.1 The Parties shall strive to jointly publish the results of the Project as Open Access publications.

8.2 Insofar as the Parties do not jointly publish the results of the Project, publications by one Party involving results developed by the other Party shall be subject to the latter's prior written approval, which shall not be withheld unreasonably.

8.3 Publications shall acknowledge the Project between the Parties including, whenever appropriate, the experts having taken part in the development of the results covered by the publication.

Article 9
Confidentiality

The Parties agree to execute the Projects in a spirit of openness. However, where, exceptionally, confidentiality is required, the following provisions shall apply:

9.1 Each Party shall treat as confidential any information provided to it by the other Party that is designated as confidential. Except as agreed otherwise in writing, this obligation shall continue for a period of five (5) years from the date of termination of this Agreement.

9.2 The receiving Party shall:

(i) not use confidential information for any other purpose than for the execution of this Agreement;
(ii) limit the circle of recipients of such confidential information on a need-to-know basis and ensure that the recipients are aware of and comply with the obligations as specified in this Article.

9.3 No confidentiality obligation shall apply to information which:

(i) the receiving Party demonstrates was in the public domain prior to its communication by the disclosing Party;
(ii) became part of the public domain after such communication but not through any fault of the receiving Party;
(iii) was already in possession of the receiving Party at the time of signature of this Agreement;
(iv) has been lawfully received by the receiving Party from a third party without any confidentiality obligation; or
(v) has been developed by the receiving Party independently and outside the scope of this Agreement.

Article 10
Liability

10.1 Except as provided in Articles 5.2, 7.3, 11.2 and in this Article 10, each Party shall bear its own loss and damage in connection with this Agreement.

10.2 Subject to Article 10.3, the responsible Party shall indemnify the other Party for its loss and damage resulting from gross negligence or from willful misconduct by the responsible Party, or a violation by the responsible Party of the rules of conduct and safety in force at the host Party.

10.3 Notwithstanding the foregoing, the Parties shall in no event be liable to each other for any consequential loss or damage, such as loss of income or of availability of data or installations.

Article 11
Entry into force, duration and termination

11.1 This Agreement shall enter into force on the date of signature by the last Party to sign. It shall remain in force for as long as necessary to give effect to the Parties' respective rights and obligations under this Agreement.

11.2 In case of a substantial breach by a Party, the other Party may terminate this Agreement in whole or in part if no corrective action satisfactory to the other Party is taken within one (1) month of the issue of a letter of notice by the other Party to the breaching Party.

11.3 Articles 5.2, 7, 9, 10, 11.2, 11.3 and 12 of this Agreement shall survive its termination, howsoever caused.

Article 12
Governing law and dispute resolution

12.1 The terms of this Agreement shall be interpreted in accordance with their true meaning and effect and as a consequence of CERN's status as an Intergovernmental Organization, independently of national and local law. Provided that if and insofar as this Agreement does not expressly stipulate, or any of its terms is ambiguous or unclear, then in those circumstances only and not in respect of this Agreement as a whole, reference shall be made to Swiss substantive law.

12.2 The Parties shall settle any difference concerning this Agreement amicably. Where this is not possible, the Parties shall resort to arbitration in accordance with a procedure to be specified by the Parties. Notwithstanding reference of the dispute to arbitration, the Parties shall continue to perform their obligations under this Agreement.

Article 13
Amendments

Any amendment to this Agreement shall be made in writing and signed by the authorized representatives of the Parties.

Signed on: 27.04.....2017.

Alikhanyan National Science Laboratory
(ANSL)

.....

Ashot Chilingarian
Director

The European Organization
for Nuclear Research (CERN)

Fabiola Gianotti

Fabiola Gianotti
Director-General

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
CERN

ANNEX 1: Activities and Acceptance Procedure(s)

The ANSL Experts shall execute on the CERN site tasks defined in the Work Packages (WP1, WP2) described below in collaboration with the CERN Beams department.

Work package	Description
WP1	System administration of the CERN Accelerator Control System: Installation of servers and desktops including X Windows configuration, virtual machine (VM) creation and optimization, evaluation of future server, desktop and VMs, monitoring and diagnostic of the systems on a daily basis, testing of modifications before deployment to operation, user suport and documentation of procedures for other members of the team.
WP2	Maintainence and support of Atlassian applications: JIRA, Confluence, Bamboo, Crucible, Fisheye, Crowd. Development of the Control Hardware Installation Service Portal, service management, user support and training.

. The work will be performed within the BE-CO Group.

Acceptance procedure:

CERN shall grant acceptance of a deliverable within WP1, and of WP2, after the successful completion of the deliverable within WP1 and of WP2, respectively, and the provision by ANSL of the associated documentation, within two (2) months from the date of such completion.

ANNEX 2: CERN's Financial Contribution

In consideration of the administrative overheads to be incurred by ANSL in the execution of its contribution, and taking into account the number of ANSL Experts specified in this Agreement, CERN shall assist through the payment to ANSL of a total amount not exceeding 86'400 CHF (eighty six thousand four hundred Swiss Francs) over three (3) years.

ANSL shall invoice CERN at six-monthly intervals, it being understood that the amount of the invoice shall be calculated on a pro rata basis, taking into account the volume of the tasks completed by ANSL and accepted by CERN. Payments shall be made by CERN within thirty(30) calendar days after receipt of a corresponding invoice in duplicate from ANSL.

In accordance with CERN's Staff Rules and Regulations, CERN shall pay a subsistence allowance to the ANSL Experts.

On the Participation of the AANL groups in the LHC (CERN) experiments

CERN has made major contributions to our basic knowledge of the world we are living in. That itself is a major cultural achievement, and it has taught us much about how we have arrived at this point in history: right from the moment it all began, 13.6 billion years ago.

CERN's second major area of impact is the education, having educated many generations of top-level physicists, engineers and technicians. Thus CERN as well is providing skilled people to advance the economies of collaborating nations

A third important contribution of CERN is the innovation that results from research that requires technology at levels and in areas where no one has gone before. The best-known example of CERN technology is the World Wide Web, magnet technology, cryogenics, electronics, detector technology and statistical methods. Advanced of the photon and lepton detection have had profound impact in medical imaging.

CERN is increasingly taking a proactive approach towards transferring its innovation, knowledge and skills to society and provides low-entry-threshold mechanisms for companies to engage with CERN technology.

The Large Hadron Collider (LHC) resumed operation (run 2) in end of April 2016 after the year-end technical stop (YETS) started in December 2015. During YETS 18 magnets in the Super Proton Synchrotron (SPS) were changed; an extensive campaign to identify and remove thousands of obsolete cables was performed; 12 LHC collimators have been dismantled and reinstalled after modification of the vacuum chambers and others.

The YETS also gave the experiments the opportunity to carry out necessary repairs and maintenance work with their detectors. In particular, this included fixing the ATLAS vacuum-chamber bellow and cleaning the cold box at CMS, which had caused problems for the experiment's magnet during 2015.

The goal of this second part of Run 2 is to reach 2700 bunches per beam at 6.5 TeV and with nominal 25 ns spacing. In 2016, the focus of the operators will be on ensuring maximum availability of the machine to discover new physics beyond the Standard model. The goal is to reach an integrated luminosity of around 25 inverse femtobarns (fb–1), up from the 4 fb–1 reached by the end of 2015. One fb–1 corresponds to around 80 million collisions.

The 13TeV data open up a new kinematic region of investigation. The final states observed from hard scattering tell a story of which partons participated in the collisions: e.g. top-quark production is related to the gluon composition of the proton, whereas Z-boson production provides insight into the quark sea, and W-boson production on the relationship between the valence quarks. Via hard scattering, one can also test the predictions of perturbative QCD – a key component of the Standard Model.

At 13 TeV centre-of-mass energy, new particles heavier than 1–2TeV could be produced over 10 times more frequently than during Run 1 (8 TeV). The perfect candidate analysis for these data is the search for resonances in the diphoton final state. Preliminary results for this search, shown by CMS and ATLAS in December 2015, generated significant interest within the HEP community because of a simultaneous excess of data with respect to the expected background seen by both experiments at a diphoton mass of about 750GeV. However, only additional data will tell us whether this is an early sign of new physics.

The ALICE collaboration has found a clear signal for what appears to be photoproduction of J/ψ mesons, the lowest vector state of charmonia in collisions with significant nuclear (Pb nuclei)

overlap.

ATLAS (2900 scientists including 1000 students)

Atlas Spokesperson (Dave Charlton), Resources Coordinator (Fido Dittus)

The agreement with ATLAS was signed confirming that 2 technicians and one computer engineer (non staff YerPhI employees) will work for ATLAS experiment till 12/31 2016. The Atlas group is the bigger one among CERN YerPhI groups; unfortunately after passing of Hakobyan Hrachiya we have problems with nominating of group leader. After discussions with ATLAS leadership I decided to nominate as ATLAS group leader for 2016 Sargsyan Laura. For 2017 we have to consider one of our young post-docs experienced with the LHC physics to be nominated as a group leaders for ATLAS (later also for all three LHC experiments we are collaborating). This will partly solve problem with the young qualified people leakage from Armenia. New young leaders will pass the most essential for modern HEP experiments knowledge to the next generations (master diploma and PhD students) in order to provide high level of our collaboration with CERN in future (next 15 years at least).

For clarification and control of the Yerevan-ATLAS account I nominate Kotzinian Aram as a Team Account Manager (TAM). The debt of YerPhI contribution to ATLAS experiment was waved and fee of 6,000 SF will be paid to YerPhI-Atlas account. This money were already used for equipping experimental class for ATLAS students in Yerevan. Yerevan ATLAS group will participate in 4 working packages, see updated agreement with ATLAS experiment above.

SMC experiment

RDMS-CMS 283 members from 27 Russian and Dubna Member State institutions created an organizational structure providing the necessary strength to take responsibility for the construction of detectors for CMS and appear as a single scientific body.

Russia and Dubna Member States CMS collaboration is going to concentrate the most of its efforts at design optimization, building commissioning and operation of substantial part of the CMS detector in following areas:

- Endcap Hadron calorimeters,
- Forward muon station MF1,
- Electromagnetic calorimeter based on PWO crystals,
- Preshower,
- Forward calorimeters,
- MSGCs for Central tracker,
- First Level Trigger and Data Acquisition.

CMS Spokesperson Tiziano Campores, Deputy Kersten Borras,

Spokesperson of CMS collaboration *Igor Golutvin;*
Viktor Matveev, Head of the collaboration board, representative of JINR at Resource Review Board (RRB) meeting.

CMS Yerevan group (group leader *Sirunyan A.*) activity encompasses CASTOR calorimeter calibration and data analysis, proposal of optimization of the segmentation of the front-end hadron calorimeter for the phase 2 LHC upgrade (2024) and others. Unfortunately 2 postdocs involved in CERN experiments simulations and data analysis do not participate in the YerPhI experiments and

have only nominal connections with institute activities. No knowledge transfer from CERN to YerPhI is visible. If we do not interest young scientists working in the international collaborations in domestic research they will leave when find appropriate contracts abroad. Many institutions collaborating at CERN open postdoc positions and it is only question of time when our postdocs win one of these positions. To prevent this "leakage" we need to nominate new yang group leaders for the YerPhI LHC groups.

CMS debt and financial situation will be clarified after I meet with RDMS spokesperson.

ALICE

Alice Spokesperson *Paolo Giubellino*, new elected Spokesperson *Federico Antinori*, Chairperson of the financial board *Adriana Telesca*

ALICE group (group leader *Grigoryan A.*) was involved in GRID computing and optimization of GRID infrastructure. ALICE-GRID node is functioning at YerPhI.

However, present tendency of computing do not favor GRID bright future. More and more collaborations are turning to CLOUD computing. Of course, the existent infrastructure will be supported by CERN, however future of GRID is depending on the successes of the ALIEN platform development. Therefore, I do not foresee successful continuation of GRID activity. The ALICE leadership is interested in participation of the YerPhI-ALICE group in track reconstruction task. Responsible of this task is our former employee *Shahoyan Ruben*, now CERN staff member. He is interested in teaching and incorporating in his group YerPhI-ALICE group members. Another activity of the YerPhI-ALICE group is connected in analysis of di-muon final states. However, this work needs huge simulations and I do not see experts capable of this sophisticated work.

The debt of ALICE group is largest among our CERN groups. I have to understand how funds that were allocated on the Yerevan-Alice account are spent. I was told that most of the funds are charity, however why not to use this charity for closing ALICE debts?

BEAMS department

Head of Department*: P. Collier;* Deputy: *M. Lamont*

In beams department we have one YerPhI employee. According to agreement signed in 2015 CERN transfer salary to Sargsyan Laura and also salary for student that performs her duties when she is abroad.

COMPASS experiment (~240 collaborators from 13 countries and 22 institutes)

Present: Spokespersons of COMPASS Collaboraion *Gerhard Mallot* (CERN) and *Oleg Denisov* (Torino),

COMPASS is the oldest of still running fixed target experiment (more than 25 years) at CERN. Main goal of COMPASS is the study of (UN) polarized nucleon structure in deep inelastic scattering of polarized muons and study of hadron spectroscopy with pion and proton beams. With muon beam, COMPASS obtained very important results on the parton distributions in nucleon. New physics program of COMPASS was discussed during International Workshop "Beyond 2020" (CERN, February 2016). The possibility of delivering anti-proton and kaons beams from CERN SPS opens a new and unique opportunities for better studies of nucleon structure and hadron spectroscopy.

The leading role of Armenian physicists (*Aram Kotzinian* and *Bakur Parsamyan*) in COMPASS physics program development, data analysis and physical inference was underlined by the spokespersons.

Standard monthly subsistence payments at CERN vary from 4100 to 5200 SHF (1 SHF ~ 1EU). 2 technicians and one computer engineer (ATLAS) get whole year subsistence. For each ATLAS employee collaboration transfers to Yerevan-ATLAS account (T226800) 2,000 SHF, now there is 13,794.66 SHF.

Beam department transfer each month 400 SHF for salary paid by YerPhI to computer engineer and for student hired as substitute.

The Yerevan-Alice account is formed by the donations of Gulbenkyan foundation and Swiss Armenians, now the balance of T243700 account is 1,254.68 SHF.

Additionally for the visitors from Armenia LHC collaborations allocate funds equivalent to 1.5-2 month allowance. This money is distributed between visitors according to collaboration spokespersons and RDMS spokesperson agreement with YerPhI group leaders.

The price of accommodation at CERN varies fro 16 to 35 EU.

Using opportunity to participate in CERN-RRB-2016 I met with LHC and COMPASS experiments spokespersons. Armenia participation is highly appreciated, however several problems exist: group leaders rather excessive age, lack of students, rather weak activity of the Armenian scientists in collaboration commissions and in scientific papers preparation, and absence of special topics where our scientists are among collaborations leaders. Also there is a debt of in Armenia contribution to CERN. For Armenia as developing country it is very important to use the possibilities offered by CERN in education, industrial development and innovation. Unfortunately, our use of these possibilities is far from being satisfactory.

We agree with collaboration leaders to pay much more attention to participation of young scientists and students in instrumentation and data analysis. I promise to organize data analysis groups in our IT department and support it with new servers and large memory storage and spent for it a part of our current CERN funding.

I brought to LHC financial coordinators attention on the World Bank regulation concerning Armenia. According to the World Bank, Armenia has a level of the lower middle-income country, which imply for Armenia the 51.2% reduction of any fees payed in International Organizations. A letter to Director General of CERN Dr. Fabiola Gianotti is send suggesting take into account this World Bank regulation.

Dr. Gianotti as well as Dr. Elsen, who is the Chair of the RRB recommend to negotiate with LHC collaborations (independent entities from CERN) for the reducing of the fees. This, ATLAS, CMS (via RDMS-CMS) and ALICE group leaders should as soon as possible start negations for reducing the fees.

The business trips in 2016 should be organized with transparent justification of all financial sources, including YerPhI support, personal allowance from CERN and YerPhI-LHC accounts. Group leaders should present the annual plan of visits for whole group with scientific goals and financial justification, including all sources of support, collaboration debts and request of funds from institute. Only after approval of the plan, visits will be actualized according to update regulation of business trips to CERN and assign YerPhI-LHC group leaders to start negotiations with LHC collaborations for reducing fees (responsible for updating Taroyan and Mikaelyan).

If positive result will not be achieved YerPhI will significantly cut CERN activities. In any case, a new agreement with CERN should be prepared and signed.

The most efficient way to keep our postdocs in institute is to actively include them in the ongoing research in YerPhI. Of course, experiments should be internationally competitive. Calibration of detectors for another party experiment could not attract yang scientists participating in world-largest experiments at LHC. Thus, having competitive and interesting experiment at YerPhI is of vital importance. The ongoing experimental program on high-energy physics in atmosphere is an example of such a program. It use modern particle detectors and electronics; Cosmic Ray division (CRD) of YerPhI is world leader in this very fast developing scientific domain. CRD seminars now attract physicists from almost all YerPhI departments. Aragats particle "accelerator" provides many tens of interesting events each year; research results exploring new physics are published in journals with high impact factor; the annual conference on this topic hold in Nor Amberd attracts many researchers worldwide.

Due to continuous shrinking of YerPhI staff and mean-age physicists "catastrophe" concentration on the topic where Armenian physicists have historical and modern advantage seem to be reasonable and timely. The formal collaboration creation is now under consideration.

Another option is program of experiments in low energy nuclear physics. However, providing of 18 MeV proton beam from IBA medical accelerator is delayed and is doubtful if YerPhI physicists can reach level of world leaders in this domain. However, we will keep this option open and will educated master students for experiments in low-energy nuclear physics.

The master courses on experimental physics started in YerPhI are the best way to educate students and to attach them to experimental work in YerPhI. However to attract students we need to select experiments having internationally recognized importance and broad collaboration or at list having such perspectives. Among experiments having international impact and unique conditions we select ongoing research on high-energy physics in atmosphere on high altitude research stations, experiments planned in low background underground laboratory, medical isotopes production, LIDAR (Light Detection And Ranging) construction. We started to modernize computing and networking equipment in the framework of new-established IT department. We declare 2 calls for hiring qualified personnel for data analysis group in IT department. Appropriate lessons are hold to prepare students to perform diploma theses using mentioned facilities. Working with modern equipment and obtaining world-class result as we hope, will facilitate their joining to experimental work in YerPhI and in Armenia, what was the goal of the program started in YerPhI 5 years ago. This will be more efficient way for keeping young scientists in Armenia comparing with specially preparing students only for international collaborations.

We have many examples that students working only abroad are using this opportunity to get post-doc positions in other institutions and very rarely return to home institution.

A.Chilingarian

10 June, 2016

ATTACHMENT 8. Establishing an Institutional Partnership between DESY and YerPhI

Appendix 9
to the Cooperation Agreement

between

Deutsches Elektronen Synchrotron, DESY
D-22603 Hamburg, Germany

and

A.I. Alikhanyan National Science Laboratory, AANL (YerPhI)
0036 Yerevan, Armenia

1. Introduction

The Yerevan groups are actively involved in present directions of the High Energy Physics (HEP) and Astrophysics Programs at DESY. After fading out the activities in the frame of H1, HERMES and OLYMPUS experiments the main physics activities will be done in the frame of CMS and Belle.

2. Scope

HEP experiments are one of the main consumers of the High Performance Computing (HPC) in area of e-Science, considering numerical methods in real experiments and assisted analysis using complex simulations. Data collection from HEP experiments generates a huge volume with a high velocity, variety and variability. The HEP experiments represent a new challenge for big data science.

The Monte Carlo simulations are important computational techniques in many areas of natural sciences and have significant application in particle and nuclear physics, quantum physics, statistical physics, quantum chemistry, material science, among many multidisciplinary applications.

The Yerevan CMS group together with the DESY CMS group will continue necessary Monte Carlo production and data analysis to investigate the processes of the Higgs boson decay into fermions using the improved computing infrastructure at YerPhI as well as the kinematic studies of the Higgs boson in the vector bosons fusion will be continued. Also necessary works for CASTOR calibration will be continued.

The physics program of the Belle II is complimentary to that one of the LHC experiments. YerPhI is progressing to become a collaboration member of Belle II. YerPhI will contribute in the studies of machine learning which is the base of the analysis techniques. Also the understanding of one of the main sources of background contamination in many channels is crucial. YerPhI will contribute to developments and tuning of the Monte Carlo packages simulating that background: e+e- → qqbar.

One of the important tasks for Belle II collaboration is the tuning of PYTHIA8 Monte Carlo for the fragmentation functions. The parameter list should be tuned requires a huge amount of disk space and CPU time (which is the main limitation to enlarge further this list). YerPhI will contribute to this task providing computer resources as well as qualified experts to work on Monte Carlo tuning.

The physics analysis based on data accumulated by HERMES/OLYMPUS experiments will be continued in according with the agreement between the DESY and HERA collaborating institutes. The CP&IP department will provide all necessary operations for the transfer and storage of the HERMES/OLYMPUS data and realize the effective access to it. Also the CP&IT data analysis group will perform necessary GEANT4 simulations for the experimental studies of high energy atmospheric physics based on data provided by the YerPhI cosmic rays department.

YerPhI will continue the practice to send the master and PhD level students to work at DESY with the CMS and Belle groups, especially for hardware works. Within the activities toward the upgrade of silicon detectors in the detector assembly facility (DAF) at DESY contributions are envisaged, enabling an excellent opportunity to get training in the field of modern technologies at DESY.

3. Local infrastructure at YerPhI for applications in HEP

The computer center will continue to provide all necessary services to the YerPhI CMS group connected with kinematic studies of associated HIGGS production of the vector boson fusion process. As well all necessary services will be provided for a new activities related to the Belle physics. Some additional work should be done by the YerPhI computer center for installing and supporting the HERMES/OLYMPUS experimental data base and providing access for Yerevan HERMES/OLYMPUS group physicists.

The AANL Computational Physics and IT (CP&IT) department is supporting all aspects for IT and computing services for YerPhI staff and different directions of activities related to common researches in HEP and Astrophysics. The CP&IT infrastructure for HEP research activities at AANL consists of:

- Central computing devices, including 80 servers granted from DESY
- LAN infrastructure in Yerevan connecting more than 400 computers and servers
- Core IP services (mail, www, ftp, voip)
- Control and storage for physics data
- Communication infrastructure with manageable switches

Ongoing activities include:

- Support and updating of the installed GPU servers and corresponding software;
- Support and updating of the installed YerPhI servers EPOS, PYTHIA8 CERN based codes to provide the massive Monte Carlo simulations;
- Support and updating of the installed multivariate visualization programs for preserving and statistical analysis of multidetector multi-channel experiments;
- Developing of special "imaging" servers for storage and treatment of the imaging information according to the "Big Data" concept;

4. Technical Activities at AANL

- Improvement of necessary hard/soft systems for supporting all necessary calculations and simulation for the DESY groups (LHC/CMS and Belle) and remaining of HERA experiments.
- Local YerPhI network extension and optimization
- Continuation of the multivariate visualization system and statistical analysis (ADEL) development and enlarging
- Continuation of activities with enlargement ad refining of a fileover system related to servers, network switches and services
- Development of cloud like (Open Stack technologies) systems for the clustered and shared (GRID) computations, also for communications in cooperation with the DESY IT.

5. Common Physics activities

The common physics activities are planned in three areas:

a) CMS related points

- Higgs physics at CMS :
  - Measurement of the couplings and CP quantum numbers of the Higgs boson through the vector boson fusion (VBF) mechanism followed by the $H \rightarrow \tau\tau$ decay with the CMS detector at centre-of-mass energy of 13 TeV.
  - Investigation of the Drell-Yan process with leptonic decays of Z boson as a major background for the Higgs boson production: measurements of the Z boson production in association with two jets in via VBF process.
  - Validation of various event generators (POWHEG, aMCatNLO, Madgraph) of the Z boson production to be used in the studies of the Higgs boson properties in the $H \rightarrow \tau\tau$ decay mode.
- QCD physics at CMS:
  - Start a new analysis: measurement of $dn/d\eta$ vs pseudorapitity of the particles produced in pp collisions at $\sqrt{s}$ =13 TeV.

b) Belle II related points:

- Tuning of PYTHIA8 Monte Carlo to study the continuum spectra for Belle II physics. YerPhI will contribute providing computer resources as well as qualified experts to work on Monte Carlo tuning.
- Besides the MC tuning, YerPhI will contribute also to the future Belle II data analysis.

c) Remaining physics analysis points:

- Continue with the physics analysis of the data collected at HERMES/OLYMPUS experiments to study key items of hadron fragmentation and distribution functions for nucleon and nuclei.

6. Cost and compensation:

The effort provided by AANL (YerPhI) at DESY in Hamburg and in Yerevan will be compensated by DESY. DESY will contribute to the CP&IT, CMS and Belle II activities of AANL an amount of 2000 € per month, including a 10% overhead for the local administration. The grant shall be used in equal parts for the technical and for physics analysis activities.

Any payment of DESY will be done by bank transfer to an account specified by AANL (YerPhI). Payments are done 4 times a year and are due upon receipt of a call of funds as well as the report mentioned below.

Local activities at AANL (YerPhI) are co-ordinated by Prof. N. Akopov, who acts as budget holder. Dr. A. Avetisyan performs the reporting, Dr. M. Fleischer will act as contact person at DESY. The budget holder and the reporter prepare a short-listing of activities and expenses at the end of each quarter.

7. Duration and Amendments

The Appendix will become effective upon signature by both parties. It will terminate after 2 years unless extended by mutual agreement in writing.

Changes of this Appendix have to be agreed upon in writing and shall be signed by both parts.

DESY and AANL (YerPhI) reserve the right to terminate or propose a modification of the agreement at any time if the progress of work cannot be assured in a proper way.

Hamburg, 1.5.2017
On behalf of DESY

Prof. Dr. Joachim Mnich
Director of Research

Yerevan, 1,05.2017
On behalf of AANL (YerPhI)

Prof. Dr. Ashot Chilingaryan
Director

Yvonne Umhey
Legal Officer

Dr. Manfred Fleischer
Deputy Director of Research

Prof. N. Akopov
Budget Holder

ATTACHMENT 9. MES-BMBF Call for the Establishment of the Armenian-German Institutes Partnership

Appendix 1

Ministry of Education and Science RA	MES-BMBF Call For the Establishment of the Armenian-German Institutes Partnership	German Federal Ministry of Education and Research

Project code (filled at SCS)	

Project title: Establishing an Institutional partnership between DESY and YerPhI	
Research area: Astroparticle physics, High Energy Physics in the Atmosphere	
Keywords: Imaging Atmospheric Cherenkov Telescopes, Very High Energy Gamma Ray Astronomy, Cherenkov Telescope Array (CTA), atmospheric monitoring, atmospheric particle acceleration, LIDAR sensing, particle detectors, fast electronics, multivariate visualization	
Armenian project coordinator:	German project coordinator:
Title/position/degree: Prof. A.Chilingarian	Title/position: Dr J Knapp
Institution: A.Alikhanyan national laboratory (Yerevan Physics Institute)	Institution: Deutsches Elektronen-Synchrotron (DESY)
Telephone: +37410352041	Telephone: +49 33762 77349
E-mail: chili@aragats.am	E-mail: johannes.knapp@desy.de
Project Summary (up to 500 words)	

ATTACHMENT 10. Case for Support: Global Coordination of Atmospheric Electricity Measurements (GloCAEM)

Background and Scientific Rationale

Earth's electrical environment has been studied since the 1750s but its more recent applications to clouds and climate highlight the incompleteness of our understanding, in part due to lack of suitable global measurements. Research has shown that Earth has a "Global atmospheric Electric Circuit" (GEC), through which charge separation in thunderstorms sustains large scale current flow around the planet and into fair weather regions (e.g. Rycroft et al, 2000). The GEC sustains the fair weather electric field, which is present globally in regions which are not strongly electrically disturbed by weather or pollution, and can be measured routinely at the surface using well established instrumentation such as electric field mills (e.g. Nicoll, 2012). Measurements of electric field are fundamental to our understanding of how thunderstorm activity may be varying within our changing climate, which is something that cannot at present be assessed by global lightning networks (due to changes in sensitivity of the lightning networks over time). The global nature of the GEC means that in order to fully understand the processes within the circuit, many measurements must be made at different locations around the world.

Significance of international collaboration to project

Investigating the scientific questions posed in the previous section requires the collaboration of scientists around the world and cannot single handedly been achieved by any one research group, nor at the national level. International cooperation in terms of data sharing is essential to understand the global nature of atmospheric electricity, which, as mentioned previously has received renewed interest in recent years in terms of its effect on aerosol and cloud microphysics. To date no global network of fair weather atmospheric electricity measurements has ever existed, therefore, given the growing number of groups now involved in atmospheric electricity monitoring, such a proposal is timely. The need for an international network is clear from the strong letters of support by a number of project partners and it is expected that once formed, the network will attract many more researchers who are actively making fair weather atmospheric electricity measurements. From the 6 project partners and the University of Reading, it will be possible to collate electric field measurements from at least 12 different worldwide locations, the likes of which has never before been attempted. The international network will provide a forum in which focused discussion on measurement techniques, including standardization of practices, instrumentation and calibration, as well as definition of fair weather conditions, can take place, as well fostering future scientific collaboration beyond the end of the project.

Contributions from Project Partners

The following section details the various project partners involved in the proposal who have committed to becoming actively involved in the network, either through provision of data, staff time, or computer resources:

- Russian Academy of Science (Russia): Prof. Eugene Mareev
- Interdisciplinary Center Herzliya (Israel): Prof. Yoav Yair
- Democritus University of Thrace (Greece): Assoc. Prof. Konstantinos Kourtidis

- University of Evora (Portugal): Dr Hugo Gonçalves Silva
- Polish Academy of Science (Poland): Dr Anna Odzimek and Dr Mareck Kubicki
- Aragats Observatory (Armenia): Prof. Ashot Chilingarian
- Network Legacy

The main legacy of the project will be the data archive that has been generated as a result of the international collaboration of the project partners, which will ensure the long term preservation of rare atmospheric electrical data. Secondly, the community of researchers which have been brought together as a result of the network will provide ample opportunity for many future long term scientific collaborations. Only through a dataset such as this will studies on the global influence of space weather events on atmospheric electricity be possible, and short term variations in the global electric circuit (on the scale of minutes and hours) relevant to clouds will be able to be investigated in detail for the first time. During the second workshop a strategy to ensure the continuation of the network will be agreed upon, such as setting up an international society or organising sessions at conferences, which will prolong the life of the project beyond its proposed end date.

ATTACHMENT 11. List of AANL Seminars 2016

The ALICE Muon Physics: selected items from the current analyses, and future perspectives by Antonio Uras

Optimization of Back Hadron Calorimeter segmentation using tagging jets registration properties in VBF H->ττ process by A. Tumasyan

Pseudorapidity distributions of charged particles in proton-proton collisions by the CMS and TOTEM experiments by V Khachatryan.

Study of coherent hadron-antihadron photoproduciton on deuterium with CLAS by Yeranuhi Ghandilyan

KOMAC accelerator facility (Korea): precise out-vacuum proton beam monitoring system based on vibrating wire by Suren Harutyunyan

Common problems of Space Weather by Jean Lilensten

Extreme light infrastructure nuclear physics (ELI-NP): present status and perspectives by Dimiter Balabanski

Testing General Relativity with LARES satellite by Vahagn Gurzadyan

Vector mesons polarization vs color transparency by Sergey Gevorgyan

Experimental hint for gravitational CP violation by Vahagn Gharibyan

ATTACHMENT 12. List of Young Scientists/Students Who Were Supported For Participating In Conferences And Summer Schools in 2016

Vachik Khachtryan

Vardanush Papikyan

Hripsime Mkrtchyan

Narine Manukyan

Roza Avetisyan

Vahan Hovhannisyan

Tigran Karapetyan

Vahagn Ivanyan

Hayk Gevorgyan

Gevorg Nazaryan

ATTACHMENT 13 . List of The PhD Theses Defended in AANL (2016)

Name	Academic Degree	Title of PhD and supervisor's name
Shamamyan Anahit	Phd	"Peculiarities of the undulator radiation of charged particles and beams with modulated density" Supervisor: Dr. L. Gevorgyan
Harutyunyan Gevorg	PhD	"Accelerator based methods of Technetium99m production – target preparation and processing and beam monitoring technologies" Supervisor: Dr. A. Avetisyan
Gyurjinyan Armen	PhD	"Studying atomic nuclei based on symmetry and clusters models" Supervisor: Academician R. Avagyan
Ghandilyan Yeranuhi	PhD	"Coherent photoproduction of proton anti-protn pair on deuterium with CLAS" Supervisor: Dr. S. Stepanyan

Also 2 Doctor of science thesis were defended in 2016 by Sargsyan Gor and Oganesyan Koryun

ATTACHMENT 14. The List of YerPhI PhD and Master Students

Ցուցակ

01.01.16

Ա. Ի. Ալիխանյանի անվան ազգային գիտական լաբորատորիա

Ասպիրանտները

Առկա ուսուցում

1. Գյուրջինյան Արմեն Վարդանի 2013-2016 Ռ. Ավագյան,
2. Հարությունյան Գևորգ Սուրենի 2013-2016 Ա.Ավետիսյան,
3. Բաբաջանյան Սանասար Գարնիկի 2014 – 2017 Ա.Ալլահվերդյան,
4. Մարտիրոսյան Նարեկ Հենրիկի 2014 – 2017 Ն. Ակոպով,
5. Էլբակյան Հայկ Վաչագանի 2014 – 2017 Ա. Մարգարյան,
6. Պողոսյան Հայկ Ռուբիկի 2015 – 2018 Ն. Անանիկյան,
7. Պողոսյան Գաբրիել Ռուբիկի 2015 – 2018 Ռ.Մանվելյա,

Հեռակա ուսուցում

1.Պողոսյան Արմեն Ռուբիկի 2012-2016 Ն.Իզմաիլյան,
2.Պողոսյան Հասմիկ Ռուբիկի 2013-2017 Գ. Սարկիսյան,
3. Մկրտչյան Հռիփսիմե Վարդանի 2013-2017 Ա. Չիլինգարյան,
4.Ապրեսյան Ելենա Անդրանիկի 2014-2018 Ա. Սեդրակյան,

Մագիստրոսները

Առկա ուսուցում

Բադալյան Անուշ Հովիկի 2015 – 2017

Գրիգորյան Արմինե Աշոտի 2015 – 2017

Մանթաշյան Սիեր Արարատի 2015 – 2017

Մանուկյան Անդրանիկ Արմենի 2015 – 2017

ATTACHMENT 15. Press Releases of AANL in 2016-2017

Press Release N-1, 2016

08 April, Yerevan. Azerbaijan continues attacking Armenia, now in hyperspace: Yerevan Physics institute site was hacked

On April 8 the Yerevan Physics Institute site has been hacked by the Azerbaijani flags of different Muslim countries and insulting slogans against Armenians. At this moment YerPhI site is closed and restoration attempts are carried out. These attacks will not harm the ongoing project at A.Alikhanian National Lab.

Press Release N-2, 2016

23 May 2016 Prof. Jean Lilensten's Visit At A. Alikhianian National Laboratory

On these days A. Alikhanian National Science Laboratory is hosting Prof. Jean Lilensten, research director at the Institut de Planntologie et d'Astrophysique de Grenoble (France) and one of the founders of the Space Weather discipline in Europe.

On May 23, 2016 prof. Lilensten delivered a lecture titled "Recent advances in auroral physics: the polar light polarization to the YerPhI master and PhD students. The audience was very interested in the Sun influence on different aspects of life on the Earth.

Next lecture was held on May 24, 2016 at YerPhI seminar hall and was titled „Common problems of Space Weather„.

During his visit, prof. Lilensten will visit some of the YerPhI divisions, discuss the cooperation between two institutes, the possibility of joint master and PhD program. His visits will also include Nor Amberd and Aragats Research Stations and Sevan.

Cosmic ray Division of YErPhI has an intensive program of the Space Weather research creating the world-wide network of particle detectors named SEVAN (Space Environmental Viewing and Analysis Network).

The nodes of SEVAN on Aragats, in Bulgaria, Slovakia and other countries are uninterruptedly follow Sun to report large eruptions and dangerous solar bursts.

Fig. 1. YerPhI students and some of young employees at Prof. Jean Lilensten lecture

Fig.2. Prof. Jean Lilensten delivering lecture to YerPhI master and PhD students

30 May 2016, Yerevan The First Master Courses Thesis Defense At A. Alikhanian National Laboratory (YerPhI)

On May 30, 2016 the first student Tatevik Sargsyan of Master Courses at YerPhI has defended her master thesis "Study of elemental composition of obsidian by X-ray fluorescence method". The study was performed by using an advanced energy-dispersive X-ray fluorescence spectrometer ARL QUANT'X, which was commissioned by the help of the State Committee of Science of RA. The supervisor of this thesis was Dr. Suren Soghomonyan (YerPhI). After listening to the report of the student, reviewers' comments and student's answers, examination commission assigned a master degree to Tatevik Sargsyan.

Next year 4 master students of YerPhI are going to defend their master thesis at YerPhI. The primary goal of the Master's program started at the Yerevan Physics Institute (YerPhI – A. Alikhanyan National Laboratory) in 2014 was to impart expertise in current research topics based on a deep knowledge of the fundamentals of experimental physics. YerPhI physicists with broad international expertise teach research methods, data analysis and modeling, critical evaluation of scientific findings, and the ability to proceed methodically in high-energy physics and astrophysics. Building on the knowledge gained during the first two semesters, these abilities were strengthened during the one-year-long research phase of the third and fourth semesters.

We congratulate Tatevik Sargsyan and wish her fruitful work in this field at the national lab.

Fig. 4. Master thesis supervisor Dr. Suren Soghomonyan makes some comments about the thesis

1 September 2016, SUMMER SCHOOL AT A. ALIKHANIAN NATIONAL SCIECE LABORATORY

On August 29 a Summer School titled “High-Energy Physics In Atmosphere And Cosmic Rays” launched and were carried out from August 29 through September 1 in seminar halls and teaching classes of A. Alikhanyan National Laboratory – Yerevan Physics Institute (YerPhI).

10 lecturers were introducing the students the hottest topics of cosmic ray and atmospheric physics, cosmology, applied research and IT technology and others. 20 students from Yerevan State University, Armenian State Pedagogical University and Armenian State Slavonic University were participating in this summer school.

During laboratory works, students assembled systems of particle detectors and calculated proportion of generated medical isotopes.

The last day of school students visited high altitude research station Aragats of YerPhI. On altitude of 3200 m world-largest center for monitoring of the secondary cosmic rays is located. Students were being demonstrated the networks of particle detectors registering charged and neutral components of cosmic rays and other precise equipment for research in the fields of Galactic cosmic rays, Solar physics, Space Weather and atmospheric physics including investigations of enigmatic lightning initiation.A.Alikhanyan national lab provides to student modern experimental facilities encouraging them to be a part of scientific endeavor.

Mission of the National lab includes as one of most important segments anticipates establishment of the high standards of education in Master and PhD programs for demonstrating that science and education can really provide development of Armenia. National lab has already started Master courses in 2014 for physics students. The formal aim of the MSc in Physics is: "To provide a high quality education in Physics which prepares students for research in an academic environment, national research laboratories and industry."

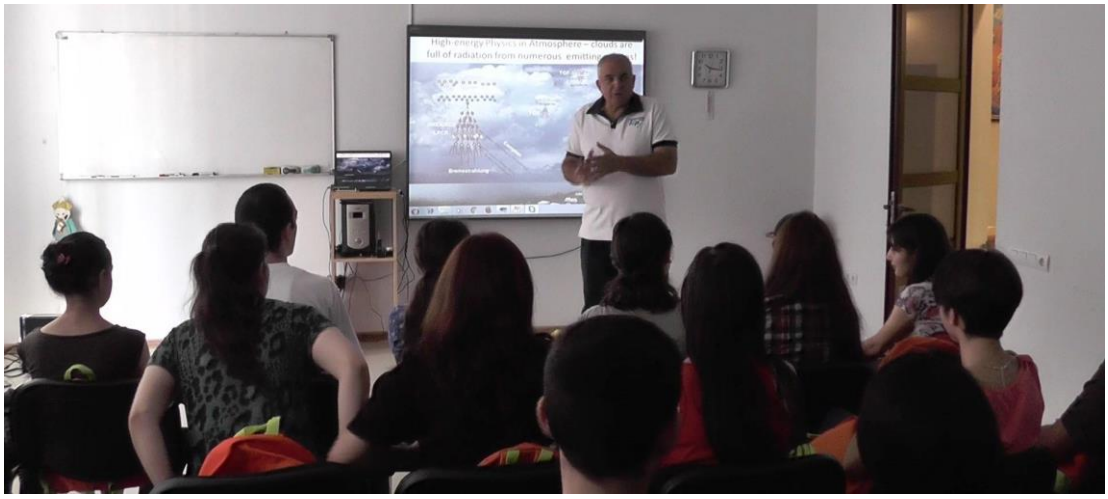


Fig 1. YerPhI Director Ashot Chilingarian opens the summer school and delivers the opening lecture.

6 October 2016, Lightnings and Particle fluxes from the Thunderclouds

Thunderstorms and Elementary Particle Acceleration; Yerevan, Armenia, 3-7 October 2016. The problem of how lightning is initiated inside thunderclouds is probably one of the biggest mysteries in the atmospheric sciences. The relationship between thundercloud electrification, lightning activity, wide-band radio emission and particle fluxes has not been yet unambiguously established. One of the most intriguing opportunities opened by the observation of the high-energy processes in the atmosphere (so-called Thunderstorm ground enhancements – TGEs) is their relation to lightning initiation. Lightnings and TGEs are alternative mechanisms for discharging of the atmospheric "electric engine" and synchronized observation of both phenomena helps to understand better the both. To discuss these high-energy phenomena, the conference on Thunderstorms and Elementary Particle Acceleration was held at the Nor Amberd International Conference Center of the Yerevan Physics Institute (YerPhI) in Armenia. The Cosmic Ray Division of YerPhI and Skobeltsyn Institute of Nuclear Physics of Moscow State University organized the workshop; YerPhI and the Armenian State Committee of Science sponsored it. Thirty scientists and students from the United States, Germany, Israel, Russia, and Armenia attended. Presentations focused on observations and models of the high-energy emissions in thunderclouds; on termination of particle fluxes by lightnings; multivariate observations of thunderstorm atmospheres from the earth's surface and from the space; radio emissions produced by atmospheric discharges and particle fluxes; influence of the Extensive air showers (EASes) on lightning initiations and others. Discussions covered questions such as the following: Do particle fluxes initiate lightnings? Do EASes helps to unleash -CG lightnings? Is TGE and TGF currents competitive with lightning current? What is mechanism of particle flux termination? The workshop participants agreed that it would be useful to compare vast amount of experimental data on TGE observed by Armenia, Japanese, Slovakian and USA in various conditions by different particle detectors to check the models of particle origin in thunderclouds. The presentation slides and discussion videos are available on the conference website,

http://crd.yerphi.am/Conferences/tepa2016/home .

TEPA 2016 participant

Press Release N-6, 2017

13 January 2017, International Atomic Energy Agency (IAEA) provides technical support to YerPhI in organization of Electronic library.

On January 13 YerPhI director A.Chilingarian met with Wei Huang director of Planning, information and knowledge management department of nuclear energy and Michail Chudakov, Deputy Director General, head of the department of nuclear energy. Both IAEA leaders express strong interest in helping YerPhI to establish modern scientific library. IAEA gathers nuclear data, information and knowledge resources on the peaceful use of nuclear energy and makes it available to its Member States, contributing to advancing research and development and helping countries achieve the United Nations Sustainable Development Goals."The project has not only allowed YerPhI to acquire and reuse the scientific information, but has also introduced modern technologies to support the operation of Armenia's research facilities," said Zaven Akopov, INIS coordinator at the IAEA. Installation on the servers of the YerPhI IT department of the digital repository "Invenio" will not only provide access to YerPhI preprints and other scientific information, but also provides possibility to develop special data bases with scientific data collected during experiments in high-energy physics worldwide with participation of YerPhI physicists and unique data collected at Aragats stations.

The head of IT department of YerPhI N. Akopov and YerPhI director A.Chilingarian visiting IAEA headquarters in Vienna

More information on https://www.iaea.org/newscenter/news/armenias-physics-research-legacy-saved-through-pixels

3 February 2017, A NEW EUROPEAN STRUCTURAL FUNDS RESEARCH PROJECT ON HIGH-ENERGY PHYSICS IN ATMOSPHERE STARTED IN CZECH REPUBLIC

Prague, 3 February, 2017: The first meeting of the international Scientific Advisory Committee (SAC) of the project "Research Center of Cosmic Rays and Radiation Events in the Atmosphere, CRREAT" took place in Řež and Prague on 1-3 February 2017.

The project named "Research Center of Cosmic Rays and Radiation Events in the Atmosphere, CRREAT" started in December 2016 within the structural funds Operational Programme Research, Development and Education (Strengthening capacity for high-quality research). The EU promotes enhancing research and innovation (R&I) teams, infrastructure and capacity to develop R&I excellence, and promotes establishment of new centers of competence, in particular those of European interest.

The project is led by the Nuclear Physics Institute (NPI) of the Czech Academy of Sciences (CAS) and gathers research groups from partner organizations, the Institute of Atmospheric Physics of the CAS and the Faculty of Electrical Engineering of the Czech Technical University in Prague The project is gathering around a key international scientist, the project director, who in this case is Karel Kudela (Slovakia), seconded by his deputy Ondřej Ploc (NPI).

The SAC, composed of international scientists from seven countries, will oversee the overall direction of the project and partial R&D activities. Its members will provide feedback on the project's objectives and its interim results, especially with regard to the latest trends in international research.

The project is focused on

- Deepening knowledge about the relation between the atmospheric phenomena and ionizing radiation (IR);
- Clarifying phenomena causing variations of the secondary cosmic rays (CR) in the atmosphere;

The next meeting of the SAC overlooking the first project results will take place in the Czech Republic at the end of the year 2017.

Project research objectives largely coincide with ongoing research on Aragats Mountain performed by physicists of Cosmic Ray Division (CRD) of Yerevan Physics Institute. CRD physicist last years in all details investigate new physical phenomenon, named TGE – thunderstorm ground enhancements, i.e. intense fluxes of electrons, gamma rays and neutrons originated in the thunderstorm atmospheres. The first results on the relationship between the storm activity and TGE, on lightning initiation process obtained by CRD physicists in 2016 are now prepared for publication in the proceedings of annual symposia "Thunderstorms and elementary particle acceleration" (TEPA 2016).

After SAC meeting a special session was devoted to SEVAN particle detector network operated in Eastern European countries developed by CRD in the framework of UN program

during international heliophysical year 2007. One of the projects outcomes CRREAT would be to become a node of SEVAN network. As Armenia is now eligible to participate in the Horizon 2020 the project, CRREAT opens new areas of cooperation.

Project and SAC members in Prague near the building of Department of radiation dosimetry of Nuclear Physics Institute of the Czech Academy of Sciences

Press Release N-8, 2017

6 March 2017, Next step of collaboration between UNIST, Ulsan, Korea and Yerevan Physics Institute

The Memorandum of understanding between Ulsan National Institute of Science and Technology (Ulsan, Republic of Korea) and Yerevan Physics Institute was signed in July 2016.”The purpose of Memorandum was to establish a general framework of collaboration in building strong science programs of mutual benefit to advance the research goal of the UNIST and YerPhI and to promote cooperation between the institutes. The base for collaboration was cooperation between Accelerator Diagnostic Group (head - Dr. S. Arutunian) of YerPhI and Dr. M. Chung (head of Intense Beam Accelerator Laboratory, ULSAN) in successful installation of Vibrating Wire Monitor with large aperture in the Korean Multi-purpose Accelerator Complex (KOMAC) in March 2016.

In the frame of Memorandum a visit of the graduate student of IBAL, UNIST Dongnyung Choe to YerPhI took place in February-March of 2017. The aim of visit was to involve Mr. D.

Choe into a new concept of Resonant Target - Vibrating Wire Monitor that essentially raises the speed of profiling process. This type of monitor is planned to use in new accelerator facilities in Korea (e.g. in DIRAMS, Dongnam Institute of Radiological and Medical Sciences).

In order to investigate further research on Beam loss Monitor many types of scintillator and other detectors has been covered during his visit with the help of Dr. Albert Avetisyan and Dr. Levon Poghosyan.

In Isotope production division: Ella Lazareva, Dongnyung Choe, Grigoryan Armine

Visit to salt mine low-background hall: Ella Lazareva, Dongnyung Choe, Dr. Levon Poghosyan

Vist to CANDLE Prof. Vasili Tsakanov, Dongnyung Choe, Dr. Suren Arutunian

Presentation of visit results on seminar of Cosmic Ray Division

Dr. Tigran Karapetyan presents an advanced Cosmic Ray detector of SEVAN (Space Environmental Viewing and Analysis Network)

Press Release N-9, 2017

10 March 2017 MUON FLUX MONITORING STARTED IN UNDERGROUND LABORATORY (SALT MINE)

Physicists from Yerevan Physics Institute restarted experiments in the underground low-background laboratory with updated modern equipment. The laboratory is placed in the Avan salt mine, which is located within Yerevan limits, at the depth of 240 m.

Very low background counts due to low-radioactivity of the salt gives big advantages in the research of the rare nuclear processes. The new purchased High Purity Germanium Detector (HPG - GCD-20180) with its multi-channel analyzer BOSON (both are products of Baltic Scientific Instruments, Latvia) will highly enlarge the scientific potential of the underground laboratory. We plan to use the developed scientific infrastructure for the started nuclear physics research program on the 18-MeV proton cyclotron located on premises of Yerevan Physics Institute.

The depth of laboratory determines the rather high muon energy threshold of 150 GeV. The estimated value for mean muon flux at the depth of the laboratory is about 0.05/m2/s. Muon detecting system consisting of two pairs of 50 x 50 x 5cm3 scintillators. Each pair is registering coinciding muon traversals to eliminate the environmental noise. The mean value of muon flux registered by a pair of scintillators equals to ~47 per hour. The further increasing of detector will allow to investigate the correlation between the underground muon flux and the upper air temperature, including, so called, sudden stratospheric warming (SSWT). The muon-induced events are one of the main concerns regarding background in deep underground facilities where modern neutrino experiments are located. The careful estimation of the muon flux created by cosmic rays in the atmosphere and penetrated deep underground is of crucial importance for the neutrino experiments

The Internet connections established in salt mine allows on-line correlation analysis between highest energy muon events and muons registered on the Aragats high-mountain stations (energy range 1 – 5000 MeV). The muon count rates from the salt mine on-line enter the Cosmic Ray Division’s database and are assessable for the analysis via user-friendly multivariate visualization platform ADEI.

Fig. 1. A railway transportation system to underground laboratory.

Fig. 2. The staff of underground laboratory. From left to right: S. Amirkhanyn, A. Aleksanyan, T. Kotanjyan, L. Poghosyan

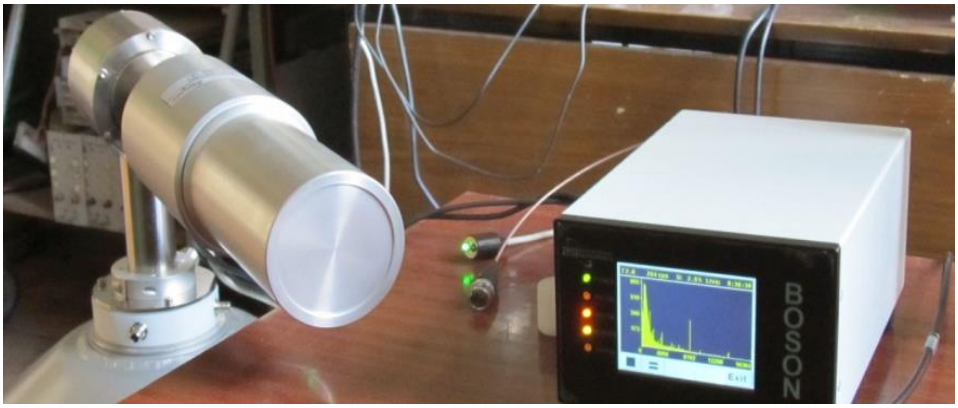


Fig. 3. The new HPGe-detector with its analyzer BOSON

23 March 2017, NEW VEHICLE FOR ARAGATS WINTER OPERATION

Cosmic ray division of the Yerevan physics institute purchased a Japanese vehicle "Ratrak Ohara Caliber" manufactured by the Ohara Corporation.

Ratrak is a tracked vehicle equipped in front with a dozer blade. It is driven by diesel engine provided velocity up to 20 km/hour. Due to their mobility and low ground pressure (~0.040 kg/cm.sq) and low centre of gravity accompanied with large contact area Ratrak can handle very steep gradients. The weight of vehicle is 3.5 t and it can transport up to 8 people and a lot of luggage.

The transportation of Ratrak from Japan to Batumi (Georgia) started on 18 March and will took a month. The Ratrak was purchased by the money collected by USA Armenians to support CRD high altitude station operation.

Ratrak Ohara «Caliber»

Press Release N-11, 2017

10 April 2017, Cambridge-Yerevan Sister City Association (CYSCA), MIT Armenian Society, and the National Association for Armenian Studies and Research (NAASR) to Host Lightning, Climate Change and Other Exciting Scientific Challenges Panel

Cambridge, MA: The Cambridge-Yerevan Sister City Association (CYSCA), along with the MIT Armenian Society and the National Association for Armenian Studies and Research (NAASR) announces a panel discussion on lightning, climate change and other exciting scientific challenges.

This event is being held as part of the annual Cambridge Science Festival on Monday, April 17, 2017 from 7:00-9:00 pm at the Massachusetts Institute of Technology's (MIT's) Building E51, Room 315, 70 Memorial Drive, Cambridge. The moderator will be Mike Wankum, meteorologist, WCVB-Channel 5 Boston.

The distinguished panel of scientists will consist of Prof. Ashot Chilingarian, Director of the Yerevan Physics Institute and head of its Cosmic Ray Division (CRD) in Yerevan, who has been invited to Cambridge specifically for this event. The five other panelists will include: Dr. Areg Danagoulian, Assistant Professor, Nuclear Science and Engineering at MIT; Dr. Joseph Dwyer, Professor and holder of the Peter T. Paul Chair in Space Sciences, Department of Physics, University of New Hampshire; Dr. Bagrat Mailyan, from the Cosmic Ray Division in Armenia and the Geospace Physics Laboratory, Florida Institute of Technology; Dr. Ningyu Liu, Associate Professor, Department of Physics, University of New Hampshire; and Dr. Earle R. Williams, research scientist at MIT whose studies include physical meteorology, cloud microphysics, radar meteorology, and volcanology.

The discussion is intended for the general public and will explain recent research topics dealing with atmospheric physics, thunderstorms, lightning initiation, and the influence of powerful solar storms on the near-earth environment. Much of this research is intended to allow prediction of dangerous weather events such as lightning, hail storms, radiation storms, and geomagnetic storms; all of which can cause immense physical and economic damage.

Admission is free and the public is invited. Refreshments will be provided after the program. For questions or more details, contact Alisa Stepanian at asteoanian@aol.com or 617-501-1215.

This event is sponsored by the Cambridge-Yerevan Sister City Association (CYSCA), the MIT Armenian Society and the National Association for Armenian Studies and Research (NAASR).

ATTACHMENT 16. Letters of Nerses Yeritsyan and Ashot Chilingarian to CERN officials

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅՈՒՆ
Ա. Ի. ԱԼԻԽԱՆՅԱՆԻ ԱՆՎԱՆ
ԱԶԳԱՅԻՆ ԳԻՏԱԿԱՆ ԼԱԲՈՐԱՏՈՐԻԱ
(ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ)
ՀԻՄՆԱԴՐԱՄ

REPUBLIC OF ARMENIA
A. I. ALIKHANYAN NATIONAL
SCIENCE LABORATORY
(YEREVAN PHYSICS INSTITUTE)
FOUNDATION

0036 Երևան, Ալիխանյան եղբայրների 2, հեռ.(37410) 341 500, ֆաքս (37410) 349 392 • 2 Br. Alikhanyan str., 0036 Yerevan, tel.(37410) 341 500, fax. (37410) 349 392

"13" 07 2016թ. № 01-14/222

ALICE spokesperson Paolo Giubellino
(paolo.giubellino@cern.ch)

Chairperson of ALICE Collaboration Board Peter Braun-Munzinger (p.braun-munzinger@gsi.de)

Chairperson of ALICE Financial Board Adriana Telesca
(Adriana.Telesca@cern.ch)

Dear ALICE collaboration leaders,

I would like to extend our gratitude for long standing cooperation with the ALICE experiment. After an extensive international review and advice we revitalized our cooperation in 2009-10, which served our esteemed institutions well. Now, in light of some new adverse challenges I am writing this letter to request your reconsideration of fees for our participation in the CERN ALICE experiment.

With an estimated per-capita GDP of US$ 3,830, Armenia is considered as a low middle-income country by the UN institutions. The impact of the external shock, including the 2008 global financial crisis, on rural and urban poverty has been dramatic—the poverty rate increased from 27.6% in 2008 to 32% in 2013. In spite of these adverse circumstances and conflict with neighboring Azerbaijan, Armenia continue to fund fundamental research and allocate more than $250,000 as fees for participation in the CERN LHC experiments by supporting business trips of AANL (YerPhI) employees to participate in LHC current activities of 2010-2015. This year we have already supported Mrs. Papikyan and will support Mrs. Manykyan and Mrs. Abramyan for working in the ALICE group in Genève.

However, now we request to reduce fees according to our country classification by the World Bank (starting from 2015). Our correspondence with CERN General Director Dr. F.Gianotti suggest that it is the sole privilege and responsibility of Collaboration team leaders to reduce countries' fees unable to pay full fee. ATLAS collaboration has already agreed to waive full fees for 2015 and 2016.

Thank you very much for understanding.

Sincerely yours,

Nerses Yeritsyan

Chairman
AANL (YerPhI) Board of Trustees,
Deputy Governor of the Central Bank of Armenia

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅՈՒՆ
Ա. Ի. ԱԼԻԽԱՆՅԱՆԻ ԱՆՎԱՆ
ԱԶԳԱՅԻՆ ԳԻՏԱԿԱՆ ԼԱԲՈՐԱՏՈՐԻԱ
(ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ)
ՀԻՄՆԱԴՐԱՄ

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"10" 05 2016 թ. № 01-14/166

Director General of CERN Dr. Fabiola Gianotti

Dear Dr. Gianotti

Thank you very much for inviting to participate in CERN-RRB-2016. I use this opportunity to meet with LHC and COMPAS experiments spokespersons.
Armenia participation is highly appreciated, we discuss several problems: group leaders rather excessive age, lack of students, and absence of special topics where Armenian scientists are among collaborations leaders, etc... For Armenia as developing country it is very important to use the possibilities offered by CERN in education, industrial development and innovation. Unfortunately our use of these possibilities is far from being satisfactory.

We agree with collaboration leaders to pay much more attention to participation of young scientists and students in instrumentation and data analysis. I plan to organize data analysis groups in our IT department and support it with new servers and large memory storage and spent for it a part of our current CERN funding.

In this regard, the Chair of the Board of Trustees of the Yerevan Physics Institute Dr. Nerses Yeritsyan who is also the Deputy Chair of Central Bank of Armenia suggested bringing to your attention the World Bank rule for developing or a lower middle-income countries (Armenia is such a country). According to the World Bank, Armenia has a level of the *lower middle income country* which leads to Armenia getting reduced fees from international organizations by 51.2%;

http://databank.worldbank.org/data/reports.aspx?source=2&country=ARM&series=&period=

and http://data.worldbank.org/country/armenia.

Dear Fabiola, please, consider if this regulation can be applied to Yerevan physics Institute contribution to CERN experiments.

Ashot Chilingarian

Director

9 May 2016

ATTACHMENT 17. Establishing of New Experimental Physics Eductional Center of YerPhI

Առաջիկա տարիներին Երևանի ֆիզիկայի Ինստիտուտը կմիանա հետազոտական (տեխնոլոգիական) համալսարանի ստեղծելու գործընթացին և կընդգրկվի նմանատիպ համալսարաններ ցանցի մեջ: Դա թույլ կտա ինտեգրել գիտությունը, կրթությունն ու արտադրությունը մի ընդհանուր դինամիկ շղթայի մեջ: Դա առաջին հերթին պայմանավորված է նրանով որ ինստիտուտը ունի բարձր վարկանիշ, միջազգային ասպարեզում մեծ հեղինակություն և կարող է դառնալ հետազոտական համալսարանների ցանցի կորիզը:

Երևանի ֆիզիկայի Ինստիտուտում հետազոտական համալսարանի էքսպերիմենտալ բազայի ստեղծումն ուղղակի ռազմավարական նշանակության անհրաժեշտ նախաձեռնություն է Հայաստանի համար, որը թույլ կտա ներարկելու ձեռնարկատիրական հոգին կրթության և հետազոտության մեջ, զարգացնել փոխներգործությունը կրթության և հետազոտության ընթացքում՝ թափանցիկ դինամիկական միջավայրում:

Կուժեղացվի Երևանի ֆիզիկայի ինստիտուտի դերը Հայաստանում գիտության և կրթության զարգացման գործում, օգտագործելով նրա ավանդական կապերը երկրի գիտատեխնիկական և կրթական կառույցների հետ և լայն մասնակցությունը միջազգային գիտական նախագծերին, ԱՄՆ և Եվրոպայի արագացուցչային համալիրներում իրականացվող համատեղ գիտափորձերին:

Ա. Ալիխանյանի անվան ազգային լաբորատորիայում կշարունակվեն մագիստրատուրայի դասընթացները, որոնց նպատակներն են՝ ներկայիս հետազոտական խնդիրների հիման վրա տարածել փորձարարական ֆիզիկայի հիմնարար, խորը գիտելիքներ: Ինստիտուտում աշխատող բարձր որակավորում ունեցող 30 գիտությունների դոկտորներից և 87 թեկնածուներից շատերը ուսանողներին կսովորեցնեն հետազոտական մեթոդների, տվյալների վերլուծությանը եւ մոդելավորման, գիտական բացահայտումների քննադատական գնահատման, բարձր էներգիայի ֆիզիկայի և աստղաֆիզիկայի մեթոդաբանական ուսումնասիրության հիմունքները:

Ինստիտուտում կշարունակվեն տեխնոպարկի ստեղծման աշխատանքները որոնք հանդիսանում են հետազոտական համալսարանների բաղադրիչ մասը և որոնք բնական, տեխնիկական գիտությունների ոլորտները ընդգրկող կառույցներ են, որովհետև արդյունաբերության համար այդ գիտություններն են խթանիչ:

Համաշխարհային մակարդակի լաբորատոր աշխատանքների կազմակերպումը ինստիտուտում կնպաստի ուսանողների անմիջական ներգրավմանը գիտական հետազոտությունների մեջ: ԱԱԳԼ-ի ուսանողների, ասպիրանտների և երիտասարդ գիտնականների ուսումնական գործընթացը կատարելագործելու, երիտասարդ մասնագետների որակավորումը բարձրացնելու, ուսումնական ենթակառուցվածքների բարելավման նպատակով հայտարարվել է ԱԱԳԼ-ի գիտական բաժանմունքներում լավագույն լաբորատոր աշխատանքների կազմակերպման մրցույթ, որի պայմաններն էին՝

Լաբորատոր փորձերը պիտի համապատասխանեն տվյալ ուղղություններով աշխարհի հեղինակավոր ուսումնական կենտրոններում անցկացվող լաբորատոր փորձերի մակարդակին:

Լաբորատոր փորձերը պետք ուղեկցվեն տեսահոլովակներով, սխեմաներով, ցուցադրական նյութերով, ունենան իրենց տեքստային նկարագրությունները, բացատրությունները, պահպանվեն անվտանգության կանոնները:

Մրցույթային հանձնաժողովի առաջարկությամբ ինստիտուտի բաժանմունքներում ստեղծված լավագույն լաբորատոր աշխատանքները պարբերաբար ներկայացվում են պարգևատրման:

Լաբորատոր աշխատանքերի ցանկ

ՏԻԵԶԵՐԱԿԱՆ ՄՅՈՒՈՆՆԵՐԻ ԴԵՏԵԿՏՈՒՄԸ

LUMEN - Լյումինեսցենցիոն Սպեկտրոսկոպիայի լաբորատոր սարքավորում: Պինդ մարմնային դիէլեկտրիկ նյութերի գրգռման և լյումինեսցենցիայի սպեկտրերի չափումները տարբեր ջերմաստիճաններում:

NaI(Tl) դետեկտորով գամմա-քվանտների կոմպտոնյան ցրման ուսումնասիրությունը

Գամմա-ճառագայթման փոխազդեցությունը նյութի հետ

Սցինտիլացիոն դետեկտորով լիցքավորված մասնիկների գրանցման արդյունավետությունը

Մյուոնի կյանքի միջին տևողության չափումը

Բարոմետրական գործակիցների հաշվարկը SEVAN դետեկտորում գրանցող տարբեր երկրոդային մասնիկների հոսքերի համար:

ATTACHMENT 18. Our Opinion on Physical Education in Armenia

Անհնար է պատկերացնել որևէ երկրի բնականոն զարգացում, առանց բնական գիտությունների: Այդ գիտությունների շարքում ֆիզիկան հանդիսանում է այն գլխավոր շարժիչ ուժը, որով պայմանավորված է համընդհանուր գիտական առաջընթացը: Ֆիզիկան լոկ փաստերի և հավասարությունների հավաքածու չէ, այն տիեզերքի զարգացման հայեցակարգն է, որի միջոցով մենք ձգտում ենք հասկանալ ինքներս մեզ:

Ֆիզիկա առարկայի ուսուցման վիճակը Հայաստանում

Հայաստանում ֆիզկայի զարգացումը հիմք է դրվել 1933թ-ից ԵՊՀ-ում և Մանկավարժական ինստիտուտում ֆիզմաթ ֆակուլտետների հիմնադրմամբ: Գիտության այս ճյուղը սկսեց զարգանալ 1940-ական թվականների սկզբին, երբ Ալիխանյան եղբայրները կատարեցին գիտարշավ դեպի Արագած սար՝ տիեզերական ճառագայթների ուսումնասիրության նպատակով: Այս գիտարշավից հետո հիմնադրվեց Երևանի Ֆիզիկայի ինստիտուտը, իսկ ԵՊՀ-ում ստեղծվեց միջուկային ֆիզիկայի ամբիոն: 1940-ականների վերջին արդեն իսկ մշտապես գործող ԵրՖԻ-ի Արագած բարձր լեռնային գիտակայանում կատարված տիեզերական ճառագայթների ուսումնասիրությունները զգալիորեն խթանեցին տեսական մտքի զարգացումը և այդ իսկ պատճառով ԵՊՀ-ում բացվեց տեսական ֆիզիկայի ամբիոն: 1950-ականների վերջին ԵՊՀ-ում արդեն իսկ գործում էին տեսական ֆիզիկայի, ընդհանուր ֆիզիկայի, աստղաֆիզիկայի, ռադիոֆիզիկայի և պինդ մարմնի ֆիզիկայի ամբիոնները:

Հիմնականում ԵրՖԻ-ի նախկին աշխատակիցների ջանքերով ստեղծվեցին նոր Ֆիզիկայի ինստիտուտներ, օրինակ

- Ռադիոֆիզիկայի և Էլեկտրոնիկայի ինստիտուտը (1960թ.)
- Ֆիզիկական հետազոտությունների ինստիտուտը (1968թ.)
- Ֆիզիկայի կիրառական պրոբլեմների ինստիտուտը (1980թ.)

Հայաստանի գիտական կյանքում շատ մեծ իրադարձությունն էր 1967թ. ԵրՖԻ-ի 6 ԳէՎ էներգիայով ՙԱՐՈՒՍ՚ էլեկտրոնային արագացուցչի գործարկումը:

Ֆիզիկայի բնագավառում գրանցած մեծ նվաճումների շնորհիվ ԵՊՀ-ի և այլ ԲՈՒՀ-երի ֆիզիկայի ֆակուլտետների դիմորդների և շրջանավարտների թիվը տարեց տարեի աճում էր, ֆիզիկա առարկայի նկատմամբ հետաքրքրությունը մեծանում. համալսարանում հիմնվեցին 9 նոր ամբիոններ և նոր ռադիոֆիզիկայի ֆակուլտետը: Այս ամբիոնները տվեցին մեծաքանակ տաղանդավոր շրջանավարտներ, ովքեր ընդունվեցին Հայաստանի ֆիզիկայի ինստիտուտներ՝ /ամենամեծ քանակը 1970-ական սկզբներին էր, որոնք առ այսօր աշխատում են և հանդիսանում են Հայաստանի ֆիզիկայի հիմնական սերուցքը /ավաղ ծերացող/:

Սակայն արդեն 1980-ականներին ֆիզիկայի նկատմամբ հետաքրքրությունը սկսում է թուլանալ և թե երիտասարդները և թե արդեն աշխատանքի անցած ֆիզիկոսների զգալի քանակություն անցնում են զարգացող ՙբիզնեսի՚ ոլորտը: Հետագայում ընդհանուր հասարակարգի քաղաքականացումը բերում է գիտության և կրթության հետագա նսեմացմանը:

ԽՍՀՄ փլուզումից հետո ֆիզիկայի և հարակից գիտությունների վիճակը ստանում է դաժան հարված: Երիտասարդ և միջին տարիքի տաղանդավոր ֆիզիկոսները աշխատանք են գտնում այլ երկրներում, իսկ մնացածը փորձում են միայն պահպանել ֆիզիկական գոյությունը՝ ֆինանսավորման բացակայության պայմաններում: Այդ հարվածից դեռ չեն կարողացել վերականգնվել գիտական ինստիտուտների մեծամասնությունը. մի քանի գիտական դպրոցներ անվերապահ կորել են: Բայց և այնպես, ֆիզիկայի բնագավառի որոշ ինստիտուտներ ՝ օրինակ ԵրՖԻ-ը, պահպանեցին և դեռ շարունակում են պահպանել Հայաստանում ֆիզիկայի բնագավառում գերազանցության գիտական կենտրոնի իր դերը՝

ունենալով գիտական եզակի ենթակառույցներ և գիտական փորձաքննության հմտություններ:

ԵրՖԻ-ի վերականգնման գործում մեծ դեր խաղաց Հայաստանի կառավարության կողմից հրավիրված մասնագետների միջազգային հանձնաժողովը, որը ԵրՖԻ-ի գիտական ուղղությունները ուսումնասիրելուց հետո, անվանեց ԵրՖԻ-ն Հայաստանի համար յուրահատուկ ռեսուրս և առաջարկեց կրկնապատկել բյուջեն և հիմնել ազգային լաբորատորիա: Այնուհետև Երևանի ֆիզիկայի ինստիտուտը զգալիորեն ամրապնդել է Հայաստանի գիտության առաջատարի իր կարգավիճակը՝ բարձր գիտական վարկանիշ ունեցող ամսագրերում տարեկան հրատարակում է երկրի ամբողջ գիտական հրատարակումների ավելի քան 30%–ը, և որ ավելի կարևոր է, Հայաստանի ամբողջ գիտական արդյունքների վրա կատարված հղումների ավելի քան 70%–ը ըստ Thomson Reuters հեղինակավոր պարբերականի բաժին է ընկնում ինստիտուտի աշխատանքներին: Փաստորեն Երևանի ֆիզիկայի ինստիտուտը իր միջազգային ճանաչմամբ, գիտական ներուժով և կատարվող աշխատանքների մասշտաբներով ու որակով առանձնահատուկ տեղ է զբաղեցնում Հայաստանում: ԵրՖԻ-ի բարձր լեռնային գիտական կայանները ունեն տիեզերական ճառագայթների, արեգակի, տիեզերական եղանակի և մթնոլորտային ֆիզիկայի փորձարարական հետազոտությունների համար ժամանակակից սարքեր և դետեկտորների ցանցեր որոնք գտնվում են Հայաստանում և այլ երկրներում: Զարգացած գիտական ենթակառույցները թույլ են տալիս առաջնակարգ տեղ զբաղեցնել աշխարհում նշված կարևոր գիտական ուղղություններում:

Ունենալով զարգացած գիտական ենթակառուցվածք, աշխարհի ամենազարգացած կենտրոնների հետ գիտական կապեր և ավագ ֆիզիկոսների աշխատող կազմ, ԵրՖԻ-ը՝ հասկանալով սերընդափոխության անհրաժեշտությունը, բացեց մագիստրատուրա՝ տաղանդավոր ուսանողներին փորձարարական ֆիզիկա սովորեցնելու նպատակով: Նաև պետք է նշել միջազգային դպրոցներում և գիտաժողովներում մասնակցելը և լավագույն կենտրոններում աշխատելու հնարավորությունները, որը ԵրՖԻ-ին ընձեռում է երիտասարդ գիտնականներին և ուսանողներին:

Սակայն Հայաստանի գիտական բոլոր հաստատությունները ունեն տաղանդավոր երիտասարդների պակաս և այս խնդիրը տարեց տարի խորանում է: Պատճառը՝ ֆիզիկայի և հարակից գիտությունների նկատմամբ հետաքրքրության բացակայությունը, որը, թերևս, պայմանավորված է դպրոցում՝ աշակերտների տարեց տարի կրթական մակարդակի նվազմամբ:

2016թ. ընդունելության միասնական քննությունների ժամանակ ամենացածր գնահատականները եղելեն ֆիզիկա և մաթեմատիկա առարկաններից: Այսպես՝ մաթեմատիկա առարկայից դիմորդների քանակն եղել է՝ 5198, որից նվազագույն շեմը չի հաղթահարել 672, 20 միավոր ստացել են ընդամենը 87 հոգի, իսկ միջին գնահատականը կազմել է 12.01: Ինչ վերաբերում է ֆիզիկա առարկային, ապա պատկերն ավելի վատ է՝ դիմորդների քանակը 1770, որից նվազագույն շեմը չի հաղթահարել 20.85%, 20 միավոր ստացել են 41 դիմորդ, միջին միավորը կազմում է 11.79:

ԵրՖԻ-ի Մագիստրոսական ծրագրի դասընթացի նպատակն է <<Տալ ֆիզիկայի բնագավառում բարձրակարգ կրթություն, որը կնպաստի գիտական միջավայրում, ազգային հետազոտական լաբորատորիաներում, կամ արդյունաբերության մեջ հետազոտություններ կատարող բարձրակարգ մասնագետներ պատրաստելուն>>: Մագիստրատուրայում 2015թ.-ին սովորել են 4 ուսանող, իսկ ահա 2016թ.-ին առաջին կուրսի ուսանող չկա՝ ընդունելության քննությունը անբավարար հանձնելու պատճառով:

Բավականին տխուր պատկեր է ԵՊՀ-ի ֆիզիկայի ֆակուլտետում, եթե 2010թ. ընդունվել են ընդհանուր 126 դիմորդ, իսկ մագիստրատուրա՝ 56, ապա 2016թ. 76 դիմորդ բակլավրիատ, 44-ը՝ մագիստրատուրա:

2014թ.-ից մենք կազմակերպեցինք կրթական հատուկ ծրագիր դպրոցական երեխաների համար: Ծրագիրը բավականին մատչելի էր, հարմարեցված էր ավագ դպրոցի աշակերտների համար, սակայն երկար կյանք չունեցավ՝ աշակերտների և որն ավելի զարմանալի է՝ նրանց ուսուցիչների ցուցաբերած անհետաքրքրվածության և հետևաբար շատ քիչ ներգրավածության պատճառով:

Յուրաքանչյուր տարի ԵՐՖԻ-ում կազմակերպվում են ամառային դպրոցներ ԲՈՒՀ-երի ֆիզիկայի ֆակուլտետների ուսանողների համար: Սակայն այս դպրոցները ևս փաստում են, որ կրթական մակարդակը խիստ նվազում է:

Նույն պատկերը կարելի տեսնել ասպիրանտուրայում, եթե 2010թ.-ին ԵրՖԻ-ում թեկնուծական ատենախոսությունների պաշտպանության թիվը կազմում էր 10, ապա 2016-ին՝ ընդամենը 4-ը, իսկ այս տարվա ընդունելության քննությունները ցույց տվեցին ավելի վատ պատկեր, ասպիրանտուրայի 2 դիմորդների ընդունել ենք պայմանական սկզբունքներով, քանի որ նրանք չկարողացան անցնել նույնիսկ ամենացածր շեմը:

Այս բոլոր խնդիրները հաշվի առնելով, կարելի է եզրակացնել, որ ֆիզիկայի բնագավառում մասնագետների պատրաստումը կկանգնի շատ բարդ խնդրի առջև. այն է՝ շատ բարդ է լինելու գտնել թեկուզ նվազագույն թվի տաղանդավոր աշակերտներ: ԲՈՒՀ-երը կփաստեն, որ վերջին տասնամյակում ուսանողների հետաքրքրվածությունը ուսման նկատմամբ սարսափելի նվազել է, իսկ այն ուսանողները, ովքեր հաջողություններ են գրանցում ուսման մեջ, ցավոք, շատ արագ լքում են հանրապետությունը: Այսպիսի ցածր կրթական մակարդակի պատճառով մոտ ապագայում Հայաստանի ԲՈՒՀ-երը և գիտական կենտրոնները կկանգնեն ֆունդամենտալ և կիրառական գիտության վերացման խնդրի առջև:

Վերջերս ՛՛ԱՅԲ՛՛ դպրոցը դիմել է ֆիզիկայի ինստիտուտներին, որպեսզի հավաքագրեն տարբեր բնագավառների ուսուցիչների, վերապատրաստել նրանց և գործուղել Հայաստանի դպրոցներ՝ կրթական ծրագիրը նորովի մատուցելու և ուսուցանելու համար: Սա անշուշտ ողջունելի է, սակայն չի կարելի սպասել արագ արդյունքների: Այն ինչ քայքայվել է երկար տարիներ, կպահպանվի երկարատև վերականգնում: Այս նախագիծի արդյունքները կկարողանանք տեսնել 5-10 տարի հետո, և այդ ժամանակ ԵրՖԻ-ը մեծ ուրախությամբ կընդունի այն նոր սերնդին, որը հետաքրքրություն ցույց կտա ֆունդամենտալ և կիրառական գիտությունների նկատմամբ:

Ականավոր ֆիզիկոս Յուրի Հովհաննիսյանը առաջարկեց ստեղծել հատուկ պայմաններ տաղանդավոր շրջանավարտների համար՝ հետևելով նրանց վերջին դպրոցական տարիների հաջողություններին: Այնուհետև մրցույթային եղանակով լավագույն շրջանավարտներից կազմել հատուկ ուսանողական-ռազմական ջոկատներ՝ ազատելով կարգային ծառայությունից և կնքել նրանց հետ 10-տարվա պայմանագրեր, որ սովորեն հատուկ դասընթացներ ֆիզիկայի, մաթեմատիկայի և հաշվիչ տեխնիկայի գծով և հետագայում աշխատեն զինվորական գիտահետազոտական ինստիտուտներում:

ՀՀ գիտության կոմիտեն արդեն երկար տարիներ պլանավորում է ստեղծել հետազոտական համալսարաններ:

Այդ համալսարաններում դասախոսների թիվը համարյա հավասար է ուսանողների թվին: Հետազոտական համալսարանը պիտի հագեցված լինի ամենաժամանակակից սարքավորումներով և ուսանողները առաջին տարիներից սկսած կատարեն կարևոր հետազոտական ծրագրեր:

Բացի դրանից կան բազմաթիվ առաջարկներ անհատներից և կազմակերպություններից "փրկել" հայկական գիտությունը: Սակայն ոչ բոլոր առաջարկությունները կարելի է ընդունել. օրինակ, վերջերս հնչած առաջարկը արտերկրից Հայաստան ուղարկել հնացած սարքավորումներ՝ դա չի կարելի անել ոչ մի դեպքում:

Իմ կարծիքով, “արագ լուծումների” ռազմավարությունը դատապարտված է ձախողման միայն մեկ պատճառով. մենք պարզապես չունենք հիմք, որի վրա հնարավոր կլինի արագացնել գիտատեխնիկական զարգացումը Հայաստանում: Համար քառորդ դար Խորհրդային Միության փլուզումից հետո մենք զգալիորեն իջեցրել ենք մարդկային կապիտալի որակը և հիմնավորապես ոչնչացրել կրթական համակարգը, որը պարզապես հնարավոր չէ արագ վերականգնել:

Շատ վտանգավոր եմ համարում համալսարանների դերի անտեսումը: Ոչ թե պետք է այլընտրանքային ուղիներ փնտրել արագ “թռիչք” իրագործելու համար, այլ բոլոր ուժերը և միջոցները պետք է դնել համալսարանների ուժեղացման գործին: Պետք է հասկանալ, որ երկրի տնտեսական գերակայությունը արդյունաբերական արտադրության ոլորտում մնացել է անցյալում: Ածի հիմնական շարժիչ ուժը այսօր հանդիսանում է մտավոր սեփականությունը ստեղծելու և օգտագործելու հմտությունը, որտեղ առանցքային տարրեր հանդիսանում են համալսարանները: Նրանք դառնում են հարթակ գիտահեն տնտեսության համար:

Բայց եթե աշխարհի համալսարանները միավորում են մարդկային և ֆինանսական կապիտալի հոսքը, կատարում են իրենց դերը գործընթացները ձեռներեցության շրջանակներում և էկոհամակարգի նորարարության ոլորտում, ապա Հայաստանում այդ գործընթացը դեռևս չի էլ սկսվել: Մեզ պետք է հայկական համալսարանները վերածել զարգացման նոր մոդելների ձևավորման կենտրոնների, դրանք վերածելով համաշխարհային շուկայում նորարարության մասնակիցների, դարձնելով դրանք գրավիչ երիտասարդ տաղանդների համար:

Վտանգավոր ենք համարում կայացած և դեր ապրող գիտական դպրոցների անտեսումը նորանոր “հայկական գիտության փրկիչների” կողմից. պետք է իրենց բացատրել, որ նոր ուղղություն, նոր գիտական դպրոցի ստեղծումը պահանջում է երկար տարիներ, բայց կարող է մեռնել շատ արագ: Թվացող հեշտ իրականալի և արագ գումարներ բերող ուղղությունները խաբուսիկ են, արդյո՞ք դա գիտություն է, և արդյո՞ք դա կարող է սատարել հայ ազգի մատաղ սերնդի լիարժեք կրթությանը ապագա տարիներին:

Մեր հանրապետության և հասարակության առջև ծառացած խնդիրները բազմաթիվ են ու բարդ: Բայց չպետք է մոռանալ, որ միայն կրթված ազգը շանս ունի գոյատևելու շատ արագ փոփոխվող և բազմաթիվ մարտահրավերներ առաջադրող 21-րդ դարում:

Ա.Ի. Ալիխանյանի անվան ազգային գիտական լաբորատորիան (Երևանի ֆիզիկայի ինստիտուտ), որը թևակոխել է իր պատմության 75 ամյակը, պատրաստ է նեցուկ լինել Հայաստանում ֆիզիկայի ուսուցման գործին՝ օգտագործելով իր հարուստ գիտական ենթակառույցները, հետազոտական և ուսումնական լաբորատորիաները, մագիստրատուրական և ասպիրանտական ծրագրերը և դեռ աշխատունակ ու մրցունակ գիտական կազմը:

Որպես վերջաբան մի ոչ ուրախալի լուր ևս. այս տարի չի կայանալու Հայաստանի Նախագահի հայտարարած մրցույթը ֆիզիկայի բնագավառում. դիմողներ չկան ...

Ա. Չիլինգարյան,
ԵրՖԻ տնօրեն
11.02 2017

ATTACHMENT 19. International Grants

2016 թ. Ա. Ալիխանյանի անվան Ազգային Գիտական Լաբորատորիայում գործող ղրամաշնորհների ցուցակ

Թեմայի համարը	Ֆինանսավորող կազմակերպություն	Ղեկավարի անուն, ազգանուն, հայրանուն	Թեմայի անվանումը	Կատարման ժամկետ
612707, DIONICOS	Marie Curie Actions, FP7-PEOPLE-2013-IRSES	Անանիկյան Ներսես Ս.	Dynamics of and in Complex Systems	2013-2017
295302	Marie Curie Actions, FP7-PEOPLE-2012-IRSES,	Իշմաիլյան Նիկոլայ Շ.	Statistical Physics in Diverse Realization, within the 7th European Community Framework Oscillations	2012-2016

ATTACHMENT 20. List of Scientific Institutions with whom YerPhI Has *Signed Agreements or MOU*

1. Thomas Jefferson National Accelerator Facility
2. Deutsches Elektronen-Synchrotron (DESY)
3. The European Organization for Nuclear Research (CERN)
4. Stanford Linear Accelerator Center (SLAC)
5. Notre Dame University
6. Cherenkov Telescope Array Consortium (CTA)
7. Institute for Structure and Nuclear Astrophysics (University of Notre Dame, USA)
8. Warsaw University of Technology
9. Heidelberg Ion-Beam Therapy Center (HIT);
10. The Universidade Federal de Lavras (UFLA), Brazil
11. Объединенный Институт Ядерных Исследований (ОИЯИ, Дубна)
12. Московский Инженерно-Физический Институт (МИФИ, Москва)
13. Armenian Anti-hailing center of ministry of Emergency.
14. Armenian meteorological center of ministry of Emergency.
15. Lund University – MAX Lab accelerator center.
16. El Instituto de Fisica de la Universidad Nacional Autonoma de Mexico (IFUNAM)
17. Научно-исследовательский институт ядерной физики имени Д.В.Скобельцына (МГУ Москва)
18. HERA/H1 Collaboration Agreement (DESY)
19. Collaboration Agreement Reference KF 2886 (CERN)
20. "Horia Hulubei" National Institute of Physics and Nuclear Engineering, Romania
21. Nuclear Physics Institute of the CAS, Czech Republic
22. KE35/43/ATLAS Agreement

ATTACHMENT 21. New MOUs, Letters and Collaboration Agreements Signed with AANL in 2016

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅՈՒՆ
Ա. Ի. ԱԼԻԽԱՆՅԱՆԻ ԱՆՎԱՆ
ԱԶԳԱՅԻՆ ԳԻՏԱԿԱՆ ԼԱԲՈՐԱՏՈՐԻԱ
(ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ)
ՀԻՄՆԱԴՐԱՄ

REPUBLIC OF ARMENIA
A. I. ALIKHANYAN NATIONAL
SCIENCE LABORATORY
(YEREVAN PHYSICS INSTITUTE)
FOUNDATION

0036 Երևան, Ալիխանյան եղբայրների 2, հեռ.(37410) 341 500, ֆաքս(37410) 349 392 • 2 Br. Alikhanyan str., 0036 Yerevan, tel.(37410) 341 500, fax. (37410) 349 392

"31" 03 2017թ.. № 01-14/78

Spokesperson of MAGIC collaboration
Prof. Mirzoyan R.
Chair of the MAGIC collaboration board
Prof. Maria Victoria Fonseca

Dear Prof. Mirzoyan, dear Prof. Fonseca,

From the very beginning of the MAGIC project the Yerevan Physics Institute participated in MAGIC, working on the Monte Carlo data analysis, AMC- and some slow electronics developments as well as doing shifts in La Palma. Several years ago we froze our participation due to the lack of young researchers for doing shifts. Together with the newly established group from the International Center for Relativistic Astrophysics Network of National Academy of Science (ICRANET of NAS RA), we want to activate our membership in the MAGIC collaboration. In YerPhI we are working on an atmospheric physics program, which could be considered as complementary to MAGIC physics. We would like to resume our activities in the MAGIC collaboration and ask you to consider YerPhI consortium becoming an active member-institution in MAGIC. Our possible contributions could be:

1. YerPhI – Atmospheric physics:
   monitoring of the atmosphere above MAGIC ACTs;
   research of high-energy physics in atmosphere;
   detection of electrons and gamma rays from the TGEs (thunderstorm ground enhancements), intense fluxes of particles of atmospheric origin.

2. International Center for Relativistic Astrophysics Network of National Academy of Science (ICRANET of NAS RA):
   Multi-wavelength data analysis;
   theoretical modeling of the gamma ray point sources;
   analysis of the MAGIC experimental data.

Me and Dr. Narek Sahakyan, head of ICRANET NAS RA, are planning to attend the MAGIC physics workshop at CERN on April 26-28 for clarifying the scientific and organizational issues of resuming our active collaboration in MAGIC.

With warmest wishes,
Prof. Ashot Chilingarian
Director

ՀԱՅԱՍՏԱՆԻ ՀԱՆՐԱՊԵՏՈՒԹՅՈՒՆ
«ՀԱՅԿԱԿԱՆ ԱՏՈՄԱՅԻՆ ԷԼԵԿՏՐԱԿԱՅԱՆ»
փակ բաժնետիրական ընկերություն

Հայաստանի հանրապետություն, Արմավիրի մարզ, 0910, ք. Մեծամոր, հեռ. 374 10 28 42 32, 28 85 80,
ֆաքս 374 10 28 85 80, էլ. փոստ anpp@anpp.am

№ 23/3-319
"14" 02 2017թ.

Директору Ереванского Физического Института
Г-ну А. Чилингаряну

Уважаемый профессор Чилингарян

Руководство Армянской АЭС рассмотрел Ваше предложение о техническом сотрудничестве между Армянской АЭС и ЕрФИ по вопросам, представляющим взаимный интерес, и готово заключить соответствующий договор о техническом сотрудничестве

Надеемся, что научный опыт и знания, накопленные в Вашем институте, будут полезны при решении некоторых практических задач, стоящих перед Армянской АЭС, а также создадут предпосылки для будущих совместных договоров и проектов для получения международных грантов.

С уважением

Генеральный директор Варданян М. Г.

Վ. Աթոյան
33 63

Memorandum of Scientific Collaboration

on the implementation of the

Extreme Light Infrastructure – Nuclear Physics (ELI-NP) Project

between

"Horia Hulubei" National Institute of Physics and Nuclear Engineering, Romania

and

A. I. Alikhanyan National Laboratory (AANL), Armenia

Preamble

The Extreme Light Infrastructure – Nuclear Physics (ELI-NP) project, under implementation in Bucharest-Magurele, Romania, aims at reaching extremely high photon field intensities, for new experiments in Nuclear Physics and related areas, with two large research equipment, a high power laser system and a high intensity gamma beam system. Both pieces of equipment are significantly beyond present-day state-of-the-art. The new research infrastructure promises to break new ground in many areas of science and technology, such as fundamental physics, nuclear physics, astrophysics, accelerators and related technical developments, laser physics and engineering, medicine, and materials science.
The institution responsible with the implementation of the ELI-NP Project is "Horia Hulubei" National Institute of Physics and Nuclear Engineering (IFIN-HH). The Project was approved by the European Commission in September 2012 and the infrastructure will be operational in 2018.

1. Purpose of this Memorandum

The purpose of this Memorandum is to establish a proper framework for cooperation between the signatory parties regarding the implementation of ELI-NP and the development of its scientific programme.

2. The parties

"Horia Hulubei" National Institute of Physics and Nuclear Engineering, hereinafter IFIN-HH, and "China IFSA Collaborative Innovation Center", hereinafter "C-IFSA" are the sole parties to this Memorandum.

IFIN-HH is a national institute for research and development in engineering and nuclear physics, an autonomous institution engaged in non-profit research activities, in the coordination of the Romanian Ministry of Education and Scientific Research.

AANL is a state foundation engaged in non-profit research activities, according to its strategic development program.

Each signing party designates a representative person responsible for the present Memorandum.

3. Areas of cooperation

The undersigned parties agree to cooperate on research topics relevant for the ELI-NP project, for:

- developing the ELI-NP experimental areas;
- defining the experimental programme;
- developing instrumentation;
- training high-skilled human resources in the field;
- promoting ELI-NP as an international user facility;

The signatory parties can customize their relationship so that cooperation may include other areas found necessary for maximizing the success of ELI-NP implementation.

3. Forms of cooperation

The forms of cooperation between the parties shall include:

- Mutual consultation on relevant matters regarding their research programmes and, specifically, the ELI-NP and AANL research topics;

- Concerted actions, such as performing joint experiments, either on the premises of one of the parties or by applying for beam time at other infrastructures;
- Common projects and research programs.

and other forms of similar cooperation.

5. Validity and other Terms governing this Memorandum

This Memorandum will be valid for three years from the date it is signed by both parties and automatically renewed annually unless written notice of intention to terminate is given by one party to the other. Either party may terminate this agreement based on 90 day notice.

Done in Bucharest-Magurele in two original copies, one for each party.

SIGNATURES

IFIN-HH/ELI-NP

Nicolae Victor Zamfir, Director

Dimiter Loukanov Balabanski

02.09.2016

Date

AANL

Ashot Aghasi Chilingarian, Director

A. Margaryan

Amur Tevatros Margaryan

Date

YEREVAN PHYSICS INSTITUTE
AFTER A. ALIKHANIAN

MEMORANDUM OF UNDERSTANDING
BETWEEN
YEREVAN PHYSICS INSTITUTE, YEREVAN, ARMENIA
AND
ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY, ULSAN, REPUBLIC OF KOREA

The Yerevan Physics Institute, Armenia and Department of Physics, Ulsan National Institute of Science and Technology, Republic of Korea (UNIST), collectively herein the "Parties", agree to pursue programme of cooperation in accordance with this Memorandum of Understanding (MOU) towards forging a durable cooperation in graduate-level education and research collaborations.

Article 1: Purpose

The purpose of this MOU is to establish a general framework of collaboration in building strong science programs of mutual benefit to advancing the research goal of the Parties and to promote comprehensive cooperation between the Parties.

Article 2: Collaborative Activities

Collaborative activities can be arranged with responsibilities agreed between the Parties. These activities will be implemented through the following forms:

1. Exchange of scientific and technical personnel (including graduate students and post-docs) and co-opted experts between the Parties in mutually agreed areas of interest.
2. Exchange of technical information and materials, especially in the areas of beam and accelerator diagnostics.
3. Technical assistance, training and consultation.
4. Participation in meetings, workshops, conferences and symposia hold by respective Parties.
5. Implementation of joint research.
6. Facilitating use of scientific equipment, technologies, software and facilities between the Parties.
7. Other activities that the Parties deem to find appropriate.

Article 3: Financing

1. Each Party delegates personnel to the other Party to the extent agreed in Article 2. The cost of each delegation under this MOU shall be provided as follows:

   - As a general guideline the local costs will be the responsibility of the receiving institution; if funding permits, the receiving Party is going to provide travel and accommodation support for the experts from the other Party, invited to perform joint research programs agreed by the Parties.
   - Each institution agrees to provide visitors with the appropriate office accommodation, computer and library facilities, and the full range of other services usually available to visiting scholars.
   - In support of this agreement, no bench or tuition fees will be charged for postgraduate students, in visits for periods up to three months.
   - The host institution will assist visitors to find suitable accommodation.
   - The sending institution will ensure that any visitor has appropriate medical and hospital insurance.
   - Any visit should be confirmed by accepting institution in advance.

2. Each Party shall bear the respective costs of carrying out the intentions of this MOU. Neither Party shall make a claim against the other Party for any expenditure unless such expenditure has been agreed upon in writing among the Parties.

Article 4: Intellectual Property

1. If an invention or a discovery is made or conceived by the personnel of one Party (delegating partner including co-opted experts) while working in an establishment of the other Party (receiving partner), all the patent rights, title and interest thereto shall vest jointly with both the Parties and its exploitation will be subjected to a separate arrangement.
2. In the case of inventions made jointly by delegated personnel and personnel employed by the receiving Party, both the Parties shall be entitled to all the rights arising from the invention equally. All details shall be settled amicably by consultation or negotiation between the Parties in each specific case of joint invention.
3. The delegated personnel under this programme including co-opted experts shall be obligated to disclose jointly to the Parties any patentable ideas that are generated as a result of this collaborative programme.
4. As regard expenditures relating to the protection of Intellectual Property Rights, they would be shared jointly by both the Parties.

Article 5: Regulation

Any disputes, disagreement, or questions, which might arise between the Parties relating to this MOU, shall be amicably settled by the Parties with the understanding. Regarding the disputes related to scientific or technical issues, they will be amicably settled by the Parties.

Article 6: Amendments

The Parties may modify this MOU as jointly determined by written agreement.

1. No Amendment or modification of this MOU shall be valid unless the same is made in writing by the Parties or their authorized representatives and specifically stating the same to be an amendment of the MOU. The modifications/changes shall become part of this MOU and shall be effective from the date on which they are made and executed, unless otherwise agreed to.
2. The Parties undertake to maintain strict confidentiality and prevent disclosure thereof, of all the information and documentation for any purpose other than in accordance with intent of this MOU.
3. Neither Party to this MOU shall assign any rights and obligations to any third Party without consent of the other Party to this MOU.

Article 7: Duration

This MOU shall take effect on the date of signing by the Parties and remain valid for five years. Three months before the date of expiration, the Parties shall consult with each other about the extension of this MOU. This MOU may be terminated by either Party giving not less than six months' written notice to the other Party. The termination of this MOU shall not affect the validity or duration of projects under this MOU, which are initiated prior to such termination.

IN WITNESS WHEREOF, the undersigned duly authorized there to have signed this MOU in two copies in English, both copies being equally authentic. The respective institute will signed the MOU in their native place.

For Yerevan Physics Institute
Yerevan, Armenia

Ashot Chilingaryan
Director

Witness: **Suren Arutunian**

Date: .....

For UNIST
Ulsan, Republic of Korea

Jae-Up Kim
Department Head

Witness: **Moses Chung**

Date: .....

Jefferson Lab
Thomas Jefferson National Accelerator Facility
Exploring the Nature of Matter

June 14, 2017.

Dr. Ashot Chilingarian, Director
Artem Alikhanian National Laboratory
0036 Yerevan, Armenia.

Dear Dr. Chilingarian,

The U.S. Department of Energy operated Thomas Jefferson National Accelerator Facility (Jefferson Lab) is the major and largest international facility in the experimental study of nuclear and hadron structure with electrons and photons. Jefferson Lab's user community includes well over 1,500 user scientists, of which about 1/3 come from international institutions representing 37 countries. We have prided ourselves on a longstanding and very successful scientific collaboration with the Artem Alikhanian National Laboratory (AANL) in Armenia.

Scientists of AANL have played active and visible key roles in Jefferson Lab research as members of collaborations in the experimental Halls, often in leading positons. They have participated in the design and construction of experimental equipment; in providing for proper operation of various experimental equipment, including on-line and off-line support, in data taking, calibrating, and analyzing of experimental data; and in publishing of physics results and presenting at conferences and/or workshops.

In 2017 Jefferson Lab will have completed the 12-GeV Upgrade project, a 338 M$ investment of DOE/Nuclear Science that includes a doubling of the beam energy, a new experimental facility Hall D and major upgrades to Halls B and C. In addition, we have completed a smaller-scale upgrade to Hall A. We are excited to continue our strong scientific collaboration with AANL in this new era of precision electron scattering studies of nuclear matter.

For successful collaboration, folding in the duration of nuclear science experiments from conceptual design through equipment construction and experimental data taking towards scientific publication, it will be necessary in some cases for AANL employees to be at Jefferson Lab for long periods of time, which can be up to about six months per year.

We will provide an appropriate on-site work environment including space, computer access, necessary training, and other items to allow the AANL user scientists to be successful in their scientific research while at Jefferson Lab. We will provide as budgets permit travel support and emergency medical coverage for AANL scientists while working at Jefferson Lab – any such support is to be implemented under an appropriate written contract.

Yours sincerely,

Rolf Ent
Associate Director for Experimental Nuclear Physics at Jefferson Lab

12000 Jefferson Avenue, Newport News, VA 23606 • phone 757.269.7100 • fax 757.269.7363 • www.jlab.org
Jefferson Lab is managed by the Jefferson Science Associates, LLC for the U.S. Department of Energy Office of Science

ATTACHMENT 22. Financial information on CERN collaboration

Team Information

Query Date: 27 Apr 2016
Search Criteria: Team Account Number T226800

Team Account Number	Account Description	Team Account Manager	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoice Administrator
T226800	YEREVAN-ATLAS	Dr. ALBERT SIRUNYAN	YEREVAN PHYSICS INSTITUTE	Att. Prof. Ashot Chilingaryan		Alikhanian Brothers St. 2	AM-	YEREVAN	ARMENIA	

SignaturePriority	holder	Amount
	ALBERT SIRUNYAN	unlimited

Year	Budget	Expenditure	Budget - Expenditure	Cash Balance
2000		0.00		638.22
2001		0.00		554.42
2002		0.00		554.42
2003		0.00		554.42
2004		26.17		528.25
2005		-19.31		547.56
2006		-3,083.33		3,630.89
2007		468.07		3,162.82
2008		41.32		4,121.50
2009		-1,376.39		5,497.89
2010		46.43		5,451.46
2011		-181,696.77		187,148.23
2012	0.00	170,314.56	-170,314.56	16,833.67
2013		-188,760.00		205,593.67
2014		191,783.00		13,810.67
2015		16.01		13,794.66
2016		0.00		13,794.66

Team Information

Query Date: 27 Apr 2016
Search Criteria: Team Account Number T243700

Team Account Number	Account Description	Team Account Manager	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoicing Address	Invoice Administrator
T243700	YEREVAN-ALICE/ NA50	Dr. ARA GRIGORYAN	YEREVAN PHYSICS INSTITUTE	Attn Ara GRIGORYAN	Department PH	CERN	CH-	GENEVE 23	SWITZERLAND	

SignaturePriority	holder	Amount
	ALBERT SIRUNYAN	unlimited

Year	Budget	Expenditure	Budget - Expenditure	Cash Balance
2000		0.00		1,051.00
2001	0.00	0.00	0.00	748.68
2002	0.00	624.12	-624.12	1,129.91
2003		553.58		1,527.33
2004		2,132.08		395.25
2005		4,593.60		1,019.65
2006		2,006.54		1,513.11
2007		2,108.80		2,404.31
2008		1,104.28		2,800.03
2009		415.72		3,884.31
2010		967.59		2,916.72
2011		1,316.36		3,600.36
2012		529.30		3,071.06
2013		937.59		2,933.47
2014		1,081.39		1,852.08
2015		597.40		1,254.68
2016		0.00		1,254.68

Տեղեկանք

Ֆիզիկայի բնագավառում ազոլիական գիտական նեղուժի ապահովում ծրագրի իրականացման համար պետության կողմից ղրամաշնորհի ձևով տրամադրվող ֆինանսական աջակցության և հայ-ֆրանսիական գիտական համագործակցության շրջանակներում ելկկողմ փոխգործակցության գումարների օգտագործման վերաբերյալ

2010 - 2016թթ. ընթացքում

ՀՀ դրամ

	Անվանում								
		2010	2011	2012	2013	2014	2015	2016	Ընդամենը
1	**Անդամավճար**	**23 141 500,00**	**22 800 000,00**	**20 000 000,00**	**20 000 000,00**	**20 000 000,00**	**-**	**-**	**105 941 500,00**
2	**Գործուղում ծնրհ**	**4 305 198,00**	**7 165 987,00**	**10 770 387,00**	**10 664 763,00**	**7 267 287,00**	**8 055 249,00**	**2 942 328,00**	**51 171 199,00**
	այդ թվում								
	Հակոբյան Հ.	293 117,00	1 003 530,00	366 029,00	542 150,00	540 440,00	247 839,00		**2 993 105,00**
	Սիրունյան Ա.	434 864,00	659 574,00	1 185 263,00	1 435 546,00	941 234,00	232 893,00	613 476,00	**5 502 850,00**
	Վարդանյան Գ.		732 300,00	1 696 000,00	1 314 220,00	426 609,00	433 346,00		**4 602 475,00**
	Խաչատրյան Վ.	1 540 142,00	1 625 745,00	2 529 409,00	2 147 754,00	1 584 006,00	1 522 328,00		**10 949 384,00**
	Թումասյան Ա.	1 364 757,00	1 295 581,00	1 895 697,00	2 305 000,00	1 445 030,00	2 068 587,00	594 300,00	**10 968 952,00**
	Գրիգորյան Ա.	209 919,00	246 725,00	267 847,00	637 433,00	216 270,00	266 885,00		**1 845 079,00**
	Աբրամյան Ա.	182 399,00	1 602 532,00	2 059 755,00	1 617 897,00	1 443 663,00	1 207 418,00	572 316,00	**8 685 980,00**
	Կակոյան Վ.	280 000,00							**280 000,00**
	Պապիկյան Վ.*			770 387,00	664 763,00	670 035,00	829 665,00	589 920,00	**3 524 770,00**
	Մանուկյան Ն.*						1 246 288,00	572 316,00	**1 818 604,00**

*Պապիկյան Վ. - 3,524,770 ՂՐամ, որից 2,934,850 ՂՐամ Հայ-ֆրանսիական պայմանագրով

*Մանուկյան Ն. - 1,818,604 ՂՐամ, որից 1,246,288 ՂՐամ Հայ-ֆրանսիական պայմանագրով

15.06.17թ.

CET *Team Transactions*

https://cet.cern.ch/cet/TeamTransactions

Last CET Data Extraction: 15 Jun 2017, bookclosed for May (Stores: May).

Date: 15 Jun 2017

Query: Category of Accounts All Categories and **Budget Code T243700** and **Time Period between 01.01.2016 and 31.05.2017**

Order Code	Approval document	Date	Order Description	Debits CHF	Credits CHF	Running balance CHF
		01.01.2016	**Starting balance**			**1 254,68**
TTID TID07784!	6437610	30.06.2016	Book	34,65		1 220,03
Total		**31.05.2017**		**34,65**	-	**1 220,03**

CET *Team Transactions*

https://cet.cern.ch/cet/TeamTransactions

Last CET Data Extraction: 15 Jun 2017, bookclosed for May (Stores: May).

Date: 15 Jun 2017

Query: Category of Accounts All Categories and **Budget Code T226800** and **Time Period between 01.01.2016 and 31.05.2017**

Order Code	Approval document	Date	Order Description	Debits CHF	Credits CHF	Running balance CHF
		01.01.2016	**Starting balance**			**13 794,66**
CL6669682	6669682	31.01.2017	Arduino (1701-)			13 794,66
CL6669691	6669691	31.01.2017	Microprocessors for experiment automatio (1701-)			13 794,66
CL6670698	6670698	31.01.2017	Interface Card (1701-)			13 794,66
CL6669682	6669682	03.02.2017	Arduino			13 794,66
CL6677121	6677121	06.02.2017	Arbitrary Function Generator (1702-)			13 794,66
CL6677124	6677124	06.02.2017	Oscilloscope numérique, ISO-TECH 200MHz, (1702-)			13 794,66
CL6669691	6669691	22.02.2017	Microprocessors for experiment automatio (1701-)	77,20		13 717,46
CL6669691	6669691	22.02.2017	Microprocessors for experiment automatio (1701-)			13 717,46
CL6670698	6670698	29.03.2017	Interface Card (1701-)	476,23		13 241,23
CL6670698	6670698	29.03.2017	Interface Card (1701-)			13 241,23
CL6669682	6669682	03.04.2017	Arduino (1701-)	111,79		13 129,44
CL6669682	6669682	03.04.2017	Arduino (1701-)			13 129,44
CL6669682	6669682	03.04.2017	Arduino (1701-)			13 129,44
CL6677121	6677121	28.04.2017	Arbitrary Function Generator (1702-)	692,39		12 437,05
CL6677121	6677121	28.04.2017	Arbitrary Function Generator (1702-)			12 437,05
CL6677124	6677124	28.04.2017	Oscilloscope numérique, ISO-TECH 200MHz, (1702-)	1 497,29		10 939,76
CL6677124	6677124	28.04.2017	Oscilloscope numérique, ISO-TECH 200MHz, (1702-)			10 939,76
FD26155		04.05.2017	Frais transport facturer par fournisseur (réservé compta.)	23,77		10 915,99
Total		**31.05.2017**		**2 878,67**	-	**10 915,99**

ATTACHMENT 23. Potential AANL Future Leaders

Ա. Ի. ԱԼԻԽԱՆՅԱՆԻ անվան ԱԶԳԱՅԻՆ ԳԻՏԱԿԱՆ ԼԱԲՈՐԱՏՈՐԻԱ

(ԵՐԵՎԱՆԻ ՖԻԶԻԿԱՅԻ ԻՆՍՏԻՏՈՒՏ)

Հ Ի Մ Ն Ա Դ Ր Ա Մ

ՀՐԱՄԱՆ

11.03.2015թ. N36/Կ.

ԱԱԳԼ (ԵրՖԻ)-ի շարունակական զարգացումը ապահովելու համար, երիտասարդ գիտնականների մասնագիտական առաջընթացի հնարավորություններ ստեղծելու, ինչպես նաև, անհրաժեշտության դեպքում, կառուցվածքային ստորաբաժանման ղեկավարին անհապաղ փոխարինումը ապահովելու նպատակով՝

ՀՐԱՄԱՅՈՒՄ ԵՄ.

1. Հաստատել ԱԱԳԼ (ԵրՖԻ)-ի առաջիկա 5 տարիների ընթացքում փոխարինման ենթակա գիտա-կազմակերպչական ղեկավար պաշտոնների ցանկը, համաձայն սույն հրամանին կից հավելվածի:
2. Կադրերի բաժնին, մեկամսյա ժամկետում մշակել և ներկայացնել հաստատման՝
- Թեկնածուին պահուստային կազմում (ռեզերվում) գրանցելու և ընդգրկելու չափանիշները (զբաղեցրած պաշտոնում աշխատանքային գործունեության արդյունքները, թեկնածուի գործնական և անձնական հատկանիշները, նրա ընդունակությունները սպասվող աշխատանքի հանդեպ, պոտենցիալ հնարավորությունները, թեկնածուի վերջին ատեստավորման արդյունքները և այլն:)
- ԱԱԳԼ-ի գիտա-կազմակերպչական ղեկավար պաշտոնները փոխարինելու ենթակա կադրերի ռեզերվի ձևավորման և վարման գործընթացի հետ կապված աշխատանքների կազմակերպման կարգը.
- ԱԱԳԼ-ի խոստումնալից գիտնականների՝ գիտա-կազմակերպչական ղեկավար պաշտոնները փոխարինելու ենթակա կադրային ռեզերվի թեկնածուների անվանացուցակը.

4. Սույն հրամանը ուժի մեջ է ստորագրման պահից:

ԱԱԳԼ-ի տնօրեն Ա.Չիլինգարյան

Կատ. Սիքաելյան

Հավելված

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հրամանի

Ց Ա Ն Կ

փոխարինման ենթակա ԱԱԳԼ (ԵրՖԻ) հիմնադրամի գիտա-

կազմակերպչական ղեկավար պաշտոնների

- ԱԱԳԼ (ԵրՖԻ) հիմնադրամի տնօրեն
- ԱԱԳԼ (ԵրՖԻ) հիմնադրամի տնօրենի տեղակալ գիտության գծով
- ԱԱԳԼ (ԵրՖԻ) հիմնադրամի տնօրենի տեղակալ ընդհանուր հարցերով
- ԱԱԳԼ (ԵրՖԻ) հիմնադրամի գիտքարտուղար
- Ճորճարարական ֆիզիկայի բաժանմունքի վարիչ
- Տիեզերական ճառագայթների ֆիզիկայի բաժանմունքի վարիչ
- Տեսական ֆիզիկայի բաժանմունքի վարիչ
- Ֆիզիկայի կիրառական հետազոտությունների բաժնի վարիչ
- Իզոտոպների հետազոտման և արտադրության բաժնի վարիչ
- Համակարգչային կենտրոնի վարիչ

Ա Ն Ց Ա Ն Ա Ձ Ա Ն Կ

ԱԱԳԼ (ԵրՖԻ)-ի հիմնադրամի գիտակազմակերպչական ղեկավար
պաշտոնների կադրային ռեզերվի՝ ըստ բաժանմունքների (բաժինների)

Ազգանուն, անուն հայրանուն	Ծննդյան	Զբաղեցրած պաշտոնը	Գիտական	Ծանոթա-
ՏՆՕՐԻՆՈՒԹՅՈՒՆ				
ՓՈՐՁԱՐԱՐԱԿԱՆ ՖԻԶԻԿԱՅԻ ԲԱԺԱՆՄՈՒՆՔ				
1.Խաչատրյան Վարդան Արշալույսի	1984	գիտաշխատող	Ֆ.մ.գ.թ.	
2.Քառյան Գևորգ Արարատի	1983	գիտաշխատող	Ֆ.մ.գ.թ.	
ՏԵՍԱԿԱՆ ՖԻԶԻԿԱՅԻ ԲԱԺԱՆՄՈՒՆՔ				
1.Կարախանյան Դավիթ Ռուդոլֆի	1964	առ. գիտաշխատող	Ֆ.մ.գ.դ.	
2.Ալլահվերդյան Արմեն Էդուարդի	1973	ավ. գիտաշխատող	Ֆ.մ.գ.թ.	
3.Անանիկյան Լև Ներսեսի	1981	գիտաշխատող	Ֆ.մ.գ.թ.	
4.Եղիազարյան Արսեն Գագիկի	1987	գիտաշխատող	Ֆ.մ.գ.թ.	
ՏԻԵԶԵՐԱԿԱՆ ՃԱՌԱԳԱՅԹՆԵՐԻ ՖԻԶԻԿԱՅԻ ԲԱԺԱՆՄՈՒՆՔ				
1. Կարապետյան Տիգրան Թաթուլի	1979	գիտաշխատող	Ֆ.մ.գ.թ.	
2.Մաիլյան Բագրատ Գուրգենի	1985	գիտաշխատող	Ֆ.մ.գ.թ.	
ԿԻՐԱՌԱԿԱՆ ՖԻԶԻԿԱՅԻ ԲԱԺԻՆ				
1.Ալեքսանյան Էդուարդ Մնացականի	1983	գիտաշխատող	Ֆ.մ.գ.թ.	
ԻԶՈՏՈՊՆԵՐԻ ԱՐՏԱԴՐՈՒԹՅԱՆ ԲԱԺԻՆ				
1.Դալլաքյան Ռուբեն Կոլյայի	1987	գիտաշխատող	Ֆ.մ.գ.թ.	
ՀԱՍԱԿԱՀԳԹԱՅԻՆ ԿԵՆԿՀԸՆ				
1.Դերմենջյան Հարություն Հակոբի	1980	ցանց. ճարտարագետ	-