

CRD FRIENDS

NEWSLETTER



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COSMIC RAY DIVISION OF YEREVAN PHYSICS INSTITUTE EXTENDS THE ARMENIAN GEOPHYSICAL MONITORING AND FORECASTING NETWORK TO ARTSAKH



Shushi Technological University gets an Electric Field Measuring (EFM) instrument on its roof to become the newest node of the Armenian Geophysical Monitoring and Forecasting Network.

The comprehensive monitoring and prediction of potentially dangerous processes in the earth's magnetosphere, atmosphere, and the ecosystem are important for evaluating risks due to storms, threats to human life, and impacts on the economy. In particular, monitoring and forecasting geophysical phenomena is important to ensure the safety and operability of complex technical facilities upon which society depends. Recent natural disasters have made this quite evident.

Further development of Armenian geophysical research strengthens Armenia's scientific and technological potential, and lays the ground for awareness and readiness to respond to the unprecedented challenges of the 21st century.

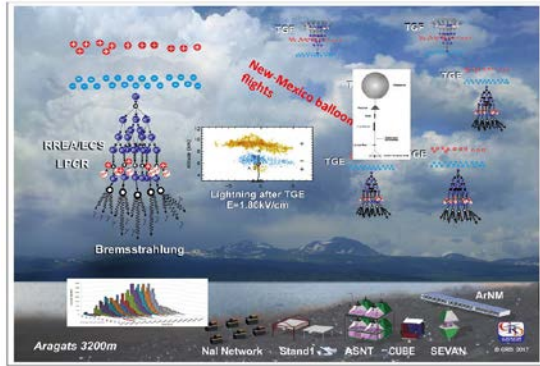
CRD's *Armenian Geophysical Monitoring and Forecasting Network* was launched in 2016. Its main goal is to expand and upgrade an integrated network of particle detectors, electric field monitors and lightning detectors in strategic locations in Armenia and abroad. It will further the establishment of space weather and thunderstorm forecasting services aimed at early recognition of various anomalous phenomena in the earth's atmosphere and in near-earth space.

In addition to the installation of new monitoring equipment in a number of locations, this project includes an internet portal with remote data storage, a user-friendly interface to view data, and training for the site's host and students.

The initial phase of the project has been completed. Results can be seen on the Cosmic Ray Division's WEB site at http://crd.yerphi.am/Meteorology#weather_at_yerevan_img. Sixteen different key meteorological parameters are measured in 7 locations at various geographical coordinates and altitudes in Armenia: Mt. Aragats (at 3200m, 2000m, and 1460m), Sevan (1900m), Dilijan (1400m), Yerevan (1000 m), and most recently in Shushi (1800m).

The network measurements and displays include important geophysical parameters such as the strength of the near-earth-surface electric field, the level of ionizing radiation, cosmic ray particles in some of the locations, alerts, and forewarnings of possible violent space and terrestrial storms with other natural hazardous geophysical phenomena.

HIGH ENERGY PARTICLE SOURCES AND POWERFUL ULTRA-HIGH FREQUENCY RADIATION



Detection of Runaway Relativistic Electron Avalanche Cascades initiated in the thunderstorm atmosphere

The project proposal “*Comprehensive Research of High-Energy Particles Sources and Powerful Ultra-High Frequency Radiation*” by Russian and Armenian scientists was among the winners of the Russian Science Foundation sponsored competition. The goal was to select the best proposal for funding.

This project brings together three research teams: the Space Research Institute, Moscow Institute of Applied Physics of the Russian Academy of Sciences, and the CRD. All have extensive experience in solving complex problems in high-energy and atmospheric physics.

The research will study enigmatic Terrestrial Gamma Flashes detected by orbiting gamma ray observatories, recently discovered Thunderstorm Ground Enhancements, and super bursts of high-frequency radiation sources in the atmosphere. The sources and generating mechanisms of these phenomena are not yet fully understood, though many research groups are investigating them.

The Russian and Armenian researchers plan to use the existing unique infrastructure of networks of particle detectors, electric and magnetic fields sensors, and automated weather stations at the Mt. Aragats high altitude research center to conduct their experiments.

The data from Aragats will be correlated with data from intense bursts of high-frequency radiation during thunderstorms gathered by the “Chibis-M” satellite to better understand these mysterious phenomena. Experiments will also provide a benchmark for the development of realistic theoretical models of lightning initiation, transition phases, and their differentiation.

This project combines experimental data obtained from terrestrial and satellite experiments, theoretical studies of powerful natural sources of high-energy particles, and ultrahigh frequency radiation in the atmosphere to provide a unique perspective on the subject.

IAEAPROVIDES SUPPORTS THE NEW ELECTRONIC LIBRARY AT YERPHI



YerPhI IT department head, Z. Akopov, and director, A. Chilingarian, at the IAEA headquarters in Vienna

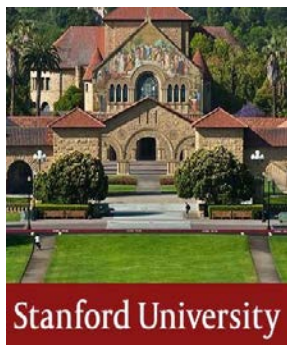
On January 13, 2017, Prof. Chilingarian and Dr. Zaven Akopov met with the International Atomic Energy Agency’s (IAEA) director of planning, information and knowledge management department, Wei Huang, and Deputy Director General and head of the nuclear energy department, Michail Chudakov. They discussed the establishment of an electronic library for the Yerevan Physics Institute. The project moved forward thanks to the strong support of both IAEA leaders.

The IAEA gathers nuclear data, information, and knowledge resources for peaceful uses of nuclear energy and makes it available to its member states, advancing research and development to help countries achieve the United Nations’ sustainable development goals. “*The project has not only allowed YerPhI to acquire and use the scientific information, but has also introduced modern technologies to support the operation of Armenia’s research facilities,*” said Zaven Akopov, Armenia’s International Nuclear Information System (INIS) coordinator at the IAEA.

The installation of the digital repository servers in YerPhI’s IT department provides international access to YerPhI’s scientific preprints and other scientific achievements. Additionally it enables the development of special databases of scientific data collected during experiments in high-energy physics worldwide, where Armenian physicists play leading roles. YerPhI’s scientific papers are among the highest referenced papers per capita in scientific journals. The system also provides a repository for the uniquely valuable data collected by the instruments of YerPhI’s Cosmic Ray Division research stations on Mt. Aragats, in Yerevan, and other regions of Armenia and the world.

For more information please visit <https://www.iaea.org/newscenter/news/armenias-physics-research-legacy-saved-through-pixels>

PROF. CHILINGARIAN AT MIT, STANFORD AND UC SANTA CRUZ



Some of many international ties with CRD

OBSERVATIONS AND INTERPRETATION OF BEHIND THE LIMB SOLAR FLARES



Prof. Vahe Petrossian, of Stanford Physics Department, delivering a seminar for CRD staff and students.

YerPhi Director and head of its Cosmic Ray division, Prof. Ashot Chilingarian, is the recipient of the Armenian Engineers and Scientists of America (AESAs) Victor Hambardzumian Award for his global scientific achievements, bestowed on him at AESA's annual banquet on November 11, 2017

Taking advantage of the opportunity to be in California, Prof. Chilingarian was invited Prof. Vahe Petrossian of Stanford University and Prof. David Smith of University of California Santa Cruz to conduct seminars for their students at their Physics Departments. This is in reciprocity of Prof. Chilingarian's invitation of these two and other distinguished professors to deliver lectures for the students and staff of the Yerevan Physics Institute, while they attended scientific conferences in Armenia which were organized by the CRD.

Prof. Chilingarian's topic was "High Energy Physics in the Atmosphere (HEPA), and Lightning Initiation". CRD has been a pioneer in the study of particle acceleration in thunderstorms and lightning initiation since the year 2008. In addition to having many practical applications, new discoveries are being made about particle acceleration in the charged atmosphere and lightning initiation, a topic of fundamental interest to physicists.

Prof. Chilingarian and CRD's Bagrat Mailian were also panelists at MIT's "New Perspectives: Lightning, Climate Change, and Other Exciting Scientific Challenges" panel discussion organized by the Cambridge-Yerevan Sister City Association (CYSCA)

Prof. Chilingarian also met with the Armenian students and Diaspora members in Massachusetts and California to forge and strengthen ties between them and their counterparts in Armenia.

Prof. Vahe Petrossian is a highly respected physicist and a professor in the Stanford Physics Department where he led the Astronomy group for many years. He is a close colleague of Prof. Ashot Chilingarian.

Taking advantage of the opportunity, while Prof. Petrossian was in Armenia, Prof Chilingarian invited him to YerPhi to deliver a highly informative lecture for YerPhi staff and students on the exciting topic of solar flares and recent observations with satellite detectors

During the current solar cycle, the Fermi Large Area Telescope (LAT) has detected more than 40 flares of up to a billion electron volt energy, some lasting many hours and contemporaneous with Solar Energetic Particles (SEPs). Three of these flares originated from active regions (AR) of the sun located behind the limb (BTL), meaning on the other side of the sun as viewed from the Earth. They were detected by STEREO (the Solar Terrestrial Relations Observatory).

It was expected that the sun would block the direct light from a BTL flare, but in these three cases, radiation from those flares reached detectors near Earth. This apparent paradox is providing the solar scientists with a unique exploratory tools.

Prof. Petrossian's lecture was received enthusiastically by the YerPhi staff and students.

Yes, I want to promote Armenian science and education by supporting the excellent work of the dedicated scientists, engineers, technicians, & students of the Cosmic Ray Division of Artem Alikhanyan National Laboratory (also known as the Yerevan Physics Institute).

Name _____ Address _____

My contribution is in the amount of \$5000 \$2000 \$1000 \$500 \$200 \$ _____

Please send this cut-out with your check, payable to **AESA-CRD** and mail to the Support Committee of Armenia's Cosmic Ray division at:
AESA-CRD, P.O. Box 655, Menlo Park, CA 94026



MUON FLUX MONITORING IN UNDERGROUND LABORATORY IN ARMENIAN SALT MINES



S. Amirkhanyan, A. Aleksanyan T. Kotanjyan, L. Poghosyan

The Directorate of the CRD and its parent institute, the Yerevan Physics Institute (YerPhi), has a deliberate and systematic plan to educate and employ bright, enthusiastic Armenian scientists to pursue careers in Armenia.

Young scientists, under the tutelage of Dr. Poghosyan, began experiments to detect and measure properties of muons in the underground laboratory in the Avan salt mines at a depth of 70 ft. The salt mine is a natural filter of background radiation coming from the sun and space.

Muons are unstable subatomic particles of the same class as electrons, but 200 times more massive. They make up much of the cosmic radiation reaching the earth's surface. Understanding muons is important, as they are very useful probes for a number of important experiments.

On the fundamental side of science, the careful estimation of the muon flux created by cosmic rays in the atmosphere, which penetrate deep underground, is of crucial importance for neutrino experiments that allow observations of nature at its smallest scale.

The underground laboratory also allows the exploration of how underground muon fluxes correlate with upper air temperature and sudden stratospheric warming.

SUPPORT COMMITTEE CO-FOUNDER, JOSEPH DAGDIGIAN, ON CRD



Joe, and Poppies in Armenia

This past summer I had the opportunity to revisit the CRD and attend the opening of the October 2-6 “*Thunderstorms and Elementary Particle Acceleration*” (TEPA) symposium at CRD’s Nor Ambert research station on Mt. Aragats. Computer models of the electrification of clouds, and electric discharge mechanisms were described together with spectacular short video clips of the birth and progression of lightning strikes.

In addition to the high level scientific conferences, CRD has established a “*Space Education Center*” to offer introductory lectures for young Armenians who are curious about science and scientific careers. I was privileged to attend a lecture by Dr. Johannes Knapp, a researcher at DESY (German Electron Synchrotron Laboratory) who was visiting CRD’s headquarters in Yerevan. His tutorial on cosmic ray physics was targeted towards CRD’s new students and other young Armenian men and women not yet associated with CRD. I was impressed by the number of young people attending. Some of them will likely be future leaders of Armenian science.

At CRD’s Nor Ambert research station I saw the new tractor, financed by the Diaspora, which will be used to safely transport staff to the Aragats research station at 10,000 feet this winter. Winter travel up the narrow road is treacherous.

Visiting the CRD staff and students is like visiting home. CRD students, staff, and the support committee thank you for your generous support.

Visit www.crdfriends.org for more information.

The Support Committee for Armenia’s Cosmic Ray Division (SCACRD) operates under the umbrella of the Armenian Engineers and Scientists of America Inc. (AESA), a 501 (c) 3, tax-exempt (ID 95-3957498), charitable organization dedicated to promoting scientific and engineering excellence in the United States and Armenia. AESA has chapters in California, Michigan, New York/New Jersey, and the greater Metropolitan Washington DC area (www.aesa.org).

In Armenia, SCACRD operates under the umbrella of the Yerevan Physics Institute (YerPhi) named after Artem Alikhanian, a non-profit, non-governmental, independent organization dedicated to the promotion and funding of science and education for peace in Armenia (www.yerphi.am).

AESA’s and YerPhi’s financial integrity are assured by annual audits in accordance with international standards by both the US Internal Revenue Service and the independent company Grant Thornton International respectively.