



## Symposium

# Thunderstorms and Elementary Particle Acceleration (TEPA-2017)

### GENERAL INFORMATION:

**TIME FRAME:** October 2-6 2017

**LOCATION:** Nor Amberd International Conference Centre of the Yerevan Physics Institute, Byurakan, Aragatsotn Province, Armenia.

### SYMPOSIUM WEBSITE:

Will be established soon

### ORGANIZERS:

Cosmic Ray Division of Yerevan Physics Institute, Armenia

Skobeltsyn Institute of Nuclear Physics of Moscow State University, Russia

### INTERNATIONAL ADVISORY COMMITTEE:

- *Ashot Chilingarian, Yerevan Physics Institute, Armenia, co-chair*
- *Lev Dorman, Israel Cosmic Ray Center and Emilio Segre' Observatory, Israel*
- *Joseph Dwyer, Space Science Center (EOS) and Department of Physics University of New Hampshire, USA*
- *Gerald Fishman, NASA-Marshall Space Flight Center, Huntsville, USA*
- *Hartmut Gemmeke, Karlsruhe Institute of Technology, Germany*
- *David Smith, University of California, Berkeley*
- *Johannes Knapp, DESY Zeuthen, Germany*
- *Karel Kudela, Institute of Experimental Physics, Slovakia*
- *Alexandr Lidvanski, Nuclear Physics Institute, Russian Academy of Science, Russian Federation*
- *Jean Lilensten, Institut de Planétologie et d'Astrophysique de Grenoble, France*
- *Evgeny Mareev, Institute of Applied Physics, Nizhny Novgorod, Russian Federation*
- *Razmik Mirzoyan, MPI, Munich, Germany*

- *Yasushi Muraki*, STE laboratory, Nagoya University, Japan
- *Michail Panasyuk*, Moscow State University, Russian Federation, co-chair
- *Vladimir Rakov*, University of Florida
- *Marco Tavani*, INAF and University of Rome "Tor Vergata", Italy
- *Tatsuo Torii*, Japan Atomic Energy Agency, Tsuruga, Japan
- *Harufumi Tsuchiya*, Cosmic Radiation Laboratory, Riken, Japan.
- *Lev Zeleny*, Space Research Institute, Russian Academy of Sciences, Russian Federation

## **BACKGROUND:**

New emerging field of high-energy atmospheric physics (HEAP) is still lacking firmly established concepts and theories. The relationship of lightning and elementary particle fluxes in the thunderclouds is not fully understood to date. HEAP presently includes 2 main physical phenomena: Terrestrial Gamma Flashes (TGFs) - brief burst of gamma radiation (sometimes also electrons and positrons) registered by the orbiting gamma ray observatories in the space and Thunderstorm ground enhancements (TGEs) - the prolonged particle fluxes registered on the ground level. Both TGFs and TGEs are related to the thunderstorms and lightning flashes: TGEs - by directly detecting electric field and lightning occurrences above the detector site; TGFs by making rather complicated synchronization with worldwide lightning detecting networks. The central engine initiated TGE is believed to be the Relativistic Runaway Electron avalanches (RREA) accelerated seed electrons from ambient population of cosmic rays (CR) in the large-scale thundercloud electric field up to 40-50 MeV. Observation of numerous TGEs by the Japanese, Russian, Armenian, Chinese, Slovakian groups prove that RREA is a robust and realistic mechanism for electron acceleration and multiplication leaving no doubts about correctness of the RREA model for the TGE initiation. Models using CERN origin GEANT4 code support *in situ* measurements of electron and gamma ray energy spectra at Aragats. Another model of the gamma glow initiation was used for explaining gamma ray detections by TERA array in Florida. The main idea of the model is thermal electron acceleration in the streamer tips up to energies of ~65 keV; thereafter these electrons runaway and accelerate further by the extreme electric field in the streamer zone in vicinity of negative lightning leader. This 2-stage model includes development of very strong electric fields in very short times. Correspondingly, the model includes compatible theories and models with several parameters which values are very difficult to measure or estimate (for instance the electric field of 260 kV/cm in the lightning leader tip, or- field strength and elongation in the streamer zone where runaway electrons suppose to reach MeV energies). Thus, many questions about thundercloud electrification and discharge mechanisms, lightning initiation, propagation and attachment processes, the global electrical circuit, and transient luminous events do not have a complete and common accepted explanation yet. One of the most important problems “do lightning flashes produce relativistic particles or not?” is still open. TEPA meeting is great opportunity for scientist to meet, discuss, invent new ideas and make new bridges for collaborative works.

## **STRUCTURE OF THE SYMPOSIUM:**

We anticipate the following sessions:

1. Models of high-energy emissions in thunderclouds;
2. Multivariate observations of thunderstorms from the Earth's surface and from space;
3. Particle fluxes and lightnings – any causal relations?
4. Research of the Thunderstorm ground enhancements (TGEs);
5. Research of the Terrestrial gamma-ray flashes (TGF);

6. Extensive air showers, lightning and RB/RREA process;
7. Atmospheric High-energy phenomena observations by space-born facilities
8. Instrumentation

We plan also discussions on the most intriguing problems of high-energy physics in the atmosphere and on possible directions for the advancement in the collaborative studies.

Topics to be covered during oral and poster sessions:

- *Research of the Thunderstorm ground enhancements (TGEs), measurements of electrons, gamma rays and neutrons by networks of particle detectors located on Earth's surface;*
- *Research of the Terrestrial gamma-ray flashes (TGFs) observed by the orbiting gamma-ray observatories;*
- *Radio emissions produced by atmospheric discharges and particle fluxes;*
- *Lightning initiation and its relation to particle fluxes originated in thundercloud;*
- *Neutron production during thunderstorms;*
- *Ultraviolet and infrared emissions during thunderstorms;*
- *Monitoring of thunderclouds and particle emission from orbit;*
- *Monitoring of the thunderstorms by high speed cameras e;*
- *Methods of the remote sensing of the thundercloud structure and electric field;*
- *X-ray emissions from the lightning;*
- *Abrupt termination of the particle flux by the lightning flash;*
- *Precise electronics for the high-energy atmospheric research;*
- *Relations to the climate and space weather issues;*
- *Possibility of joint observations by space-born and ground-based facilities.*
- *The global electrical circuit.*

#### **ATTENDANCE LIMITATION:**

Due to the size of the venue and other restrictions, the number of participants will be limited to 40. Therefore, participation in the Symposium is by invitation only. Registered personnel need to submit an abstract of presentation to receive an invitation.

#### **ABSTRACT SUBMISSION:**

Abstracts should be submitted electronically on the Symposium website. The deadline for abstract submission is 31 July 2017.

#### **REGISTRATION:**

Registration to **TEPA 2017** should be done online via the Symposium website. We will provide participants with their own account on the Symposium website. These accounts will serve for the submission of abstracts, papers for Symposium proceedings and for providing information about accompanying persons.

Registration fees:

- Regular Attendees [300 Euro]
- Undergraduate and Graduate Students [150 Euro]

The fee covers the cost of transportation from and to airport, coffee breaks, as well as the Reception, the Banquet, and excursions. Payment of the registration fee will be accepted at the Symposium desk upon arrival.

**CONFERENCE DEADLINES:**

- 1 August 2017 Abstract submission deadline
- 1 September 2017 Contributed presentations selected and participants notified
- 15 September 2017 Symposium program in the Conference site

**TRANSPORTATION AND LODGING:**

The organizers will provide transportation from/to the Yerevan Airport “Zvartnots”. Information on the arrival date, time and flight number should be sent to the Local Organizing Committee. During the Symposium, the participants will be accommodated at the hotels in Nor Amberd International Conference Center of Yerevan Physics Institute, located on the slopes of Mount Aragats, near the village of Byurakan, Aragatsotn District, Armenia. The Center has a rich tradition of hosting high-energy physics schools and is well equipped for international forums.

**CORRESPONDENCE:**

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