

Astrophysics of Cosmic Rays

Papers are invited for a special topical issue of *Advances in Space Research* (ASR) entitled **“Astrophysics of Cosmic Rays”**

Cosmic rays (CRs) are the only pieces of matter available to us that come from large Galactic and extragalactic distances. Nowadays they are complemented by the samples of solid interstellar grains returned to Earth by spacecraft. The spectra of CR species, composition, and direction at the highest energies provide invaluable information about their origin and propagation history. The bulk of Galactic CRs is associated with the most energetic events such as supernova explosions, but some fraction may also come from pulsars and interstellar shocks, and perhaps from more exotic and less studied processes. The origin of extragalactic CRs is still a mystery with speculations ranging from nuclei of active galaxies to gamma-ray bursts and primordial shocks. Last decade was generous on discoveries in astrophysics of CRs, thanks to new experimental techniques and technological breakthroughs integrated into the instruments launched to the top of the atmosphere and into space. Among them PAMELA, Fermi-LAT, AMS-02, CALET, DAMPE, NUCLEON, and ISS-CREAM. Ground-based gamma-ray telescopes, such as H.E.S.S., MAGIC, and VERITAS, and water Cherenkov detectors HAWC and LHAASO, proved to be able to probe CR fluxes in distant locations. Besides, we witnessed the birth of gravitational wave astronomy (LIGO and Virgo) and the first astrophysical neutrinos detected by IceCube. Meanwhile, instruments designed and built using the technology of 1970s, Voyager 1, 2 spacecraft, are also continuing to surprise us by beaming unique information from interstellar space. Orbiting near the L1 Lagrange point since 1997, ACE/CRIS is benefiting from the long exposure time discovering rare clues to the origin of the local Galaxy (e.g., the detection of a handful of Fe60 nuclei) yet providing information on variations of CRs during several solar cycles. The proposed issue aims to gather new results that highlight recent discoveries in multi-messenger astrophysics and new measurements of spectra of CR species and their isotopic composition. Reports on direct measurements of gamma-ray emission from a number of particle accelerators and from interstellar space, new CR results at very-high and ultra-high energies, as well as new controversies and alternative theoretical models are cordially invited. This issue encourages presentations of new experimental approaches and theoretical analyses directed towards answering questions related to the origins of cosmic messengers.

The following topics are appropriate for this issue:

Cosmic Rays

Isotopic and elemental composition

Cosmic ray spectra

Gamma rays

Photon emissions at all wavelengths

Neutrino emission

Gravitational waves and their electromagnetic counterparts

Experimental measurements

Theoretical models and interpretations

Sources of cosmic rays

Acceleration of particles in astrophysical sources

Propagation of cosmic rays in Galactic and extragalactic space

Properties of interstellar and intergalactic medium

New physics relevant to astrophysics of cosmic rays in broad sense

Manuscripts must be submitted electronically to <https://www.editorialmanager.com/AISR>. To ensure that all manuscripts are correctly identified for inclusion into the special issue, authors must select **“Special Issue: Astrophysics of CRs”** when they reach the “Article Type” step in the submission process. Submitted papers must be written in English and should include full affiliation postal addresses for all authors. The general format for submission of papers can be found on the ASR Elsevier web site at

http://www.elsevier.com/wps/find/journaldescription.cws_home/644/authorinstructions.

Only full-length papers will be considered for publication, subject to peer review by a minimum of two reviewers. There are no page limits although the length of the paper should be appropriate for the material being presented. While the deadline for submissions is **31 August 2021**, papers will be published electronically as soon as they are accepted. The printed issue will be assembled within a reasonable time with late papers being printed in regular issues of ASR. All articles will be typeset at no cost to the author; there is a charge for printing color figures although there is no charge for color figures on the electronic version.

Dr. Igor V. Moskalenko (imos@stanford.edu) and **Dr. Eun-Suk Seo** (seo@umd.edu) are the Guest Editors for this special issue. Questions can be directed to Dr. Moskalenko or Dr. Seo, or to the Co-Editor for ASR Special Issues, Dr. Peggy Ann Shea (sssrc@msn.com).