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Editorial

Cosmic Ray Variability: Century of Its Observations

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Cosmic ray (CR) discovery in 1912 initiated the experimental and theoretical studies in various fields of physics. The issue call was targeted to variability of CR reflected in low energy CR measurements. To understand the propagation of CR in the heliosphere, the knowledge of the diffusion coefficients is important. A paper by J. J. Quenby et al. indicates the new possibilities of probing the fine structure of CR propagation when using the high count rate CR measurements on satellites (below the atmospheric cutoff) with the detector having a large geometrical factor. Implications for different descriptions of particle behavior studied in the three cases are reported. The method proposed, that is, using local particle conditions to check diffusion coefficients with locally derived plasma parameters, is a new way of validating the ability to model cosmic wave-particle interaction in a collisionless regime. Solar modulation is described using a 2D (radius and colatitude) Monte Carlo approach to solve the transport equation including diffusion, convection, drift, and adiabatic energy loss, in a paper by P. Bobík et al. In addition to earlier papers by the group, the IMF is here modified with latitudinal components and its effect is discussed.

Time variability and related modulation effects have been studied using the ground-based CR measurements in three papers. A. Vecchio et al. using Climax neutron monitor data proposed a new, combined application of the wavelet technique and an empirical mode decomposition. The authors were able to discern the CR variations induced by the solar activity and those possibly related to drift in large scale IMF of heliosphere. H. Mavromichalaki and E. Paouris used for the analysis data from another neutron monitor and CME SOHO catalogue for the period of 23rd and a part of 24th solar cycle. The authors found that the best reproduction of CR intensity is obtained when using sunspot number, IMF, CME-index, and tilt angle of the heliospheric current sheet. For the temporal variability of CR, the paper by J. Pérez-Peraza et al. is using another source of information, namely, records of cosmogenic isotopes ^{10}Be and ^{14}C suitable to check CR variability on longer time scales. Using wavelet as well as ARMA technique, the authors revealed the persistence of ~30-year periodicity in CR flux that is of importance, for example, in a possible connection with climatic phenomena.

Two papers have been related to solar high energy particle emissions. V. Kurt et al. analyzed the high energy gamma and neutron emissions from solar flares as observed by low altitude polar satellite CORONAS-F in 2001–2005 (device SONG). The authors showed that SONG response was consistent with neutral pion-decay gamma ray and neutron emissions from a couple of flares and the onset times of GLEs were compared with the time of high energy photon emissions. The observations of solar neutrons on satellites are an important but not an easy task. One type of such measurements on ISS is described in a paper by Y. Muraki et al. Three years of observations are summarized by the authors. Their analysis shows that solar neutrons were possibly observed in connection with two solar flares, namely, March 7 and June 7 in 2011.

In addition to ground-based measurements, many of the results on CR variability were obtained on balloons and satellites. A review paper by Y. I. Logachev et al. summarizes selected results of CR research obtained over long time period by the Russian satellites and balloons.

We believe the papers collected in this issue constitute a good sample of relevant contemporary problems in the field of cosmic ray variability and could therefore give the readers a broad view of the topics under discussion in this important field of CR research.

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