

Observation of interplanetary cosmic ray particles by EIS onboard the NOZOMI spacecraft (II).

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We observed solar energetic particle events that were associated with CME events with the EIS (Electron Ion Spectrometer) onboard the NOZOMI satellite launched in July 1998. In the event on Jun 26 in 1999, it obtained time variation data of high energy proton, electron and heavy ion fluxes. That event was originated in the flare with CME on Jun 23. Steep increase of particle fluxes was observed following the change of B-theta from -90 to +90 on 12:40 (UT) in the satellite time. In addition, the increase of proton fluxes with over 250 keV was larger than that with less than 250 keV. This result shows that the narrow shock regions in the front of CME, in which high energy particles only with over 250 keV could to be accelerated efficiently comparing with less than 250keV, were formed.

We observed solar energetic particle events that were associated with CME events with the EIS (Electron Ion Spectrometer) onboard the NOZOMI spacecraft launched in July 1998. These events are divided into two type groups: I) fluxes are increased, but an index of energy flux power law does not change between before and after the time of particle fluxes increase, II) both fluxes and the index of energy flux power law change and the index is getting hard. Especially event on Jun 26 in 1999, for example of type-I, it obtained time variation data of high-energy proton, electron and heavy ion fluxes. The NOZOMI spacecraft was near the Mars orbit, in the direction of 45-degree west from the Sun-Earth line. That event was thought to be originated in the flare with CME on Jun 22 or 23. In the EIS observation, steep increase of particle fluxes was observed following the change of B-theta from -90 to +90 on 12:40 (UT) in the satellite time. In addition, the increase of proton fluxes with over 250 keV was larger than that with less than 250 keV between 12:50 and 13:00. In the other periods, the index of energy flux power law was almost same as both indexes before and after 12:40 although the fluxes increased. The ACE spacecraft observed neither change of magnetic field nor flux variations of particle originated from the CME. According to the observation results and the relative positions between the sun, the earth (ACE) and NOZOMI, it is thought that the NOZOMI spacecraft were not in the front of an ejector (CME) but in the east side of the ejector. On the other hand, in the event on Nov. 27, the particles were heated in the CEM-Shock region and the energy spectra were hard. The direction of the CME in Nov. was 45-degree east from the Sun-Earth line. Therefore, particles were heated efficiently to high energy because NOZOMI was west from the center of the shock region formed by ejector.