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Numerical simulation of shielding to the relativistic solar cosmic rays by using the dipole magnetic shield

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The solar wind, which is composed of electrons and protons, blows out from the sun into interplanetary space. The high energetic components in the solar wind are so called solar cosmic rays, which energy sometimes approach 108ev. Humankind, who lives in the Earth, had been protected from the harmful cosmic rays by the atmosphere and magnetic field of the Earth. After the middle of 20th century, we widened our sphere of influence to the cosmic space, which is outside the atmosphere and geospace. As a result, we and our civilization are now directly exposed to danger of the cosmic rays. Recently, the experimental and simulation studies were carried out to discuss the usage of magnetic field to shield satellite from cosmic rays effect. However, models and parameters used in the past studies are non-realistic.

In the present study, we numerically discuss the magnetic shield using dipole magnetic field for relativistic solar cosmic rays. The numerical results show that the magnetic dipole moment with the maximum amount of cosmic rays going in the magnetic shield increases with increasing the kinetic energy of particles, while the maximum amount of cosmic rays going in the magnetic shield itself decreases.

Keywords: magnetic shield, solar cosmic ray