Pick up ions in the vicinity of the Moon

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Non-solar wind ions were observed by a low energy ion spectrum analyzer PSA/ISA onboard NOZOMI, during its lunar swing-by. Those ions have different velocity distribution from the nominal solar wind ions and their flux was about 1/100 times of the solar wind protons. Such pick up ions in the vicinity of the Moon have not been reported before. Determination of the species and the source of these ions is important to understand the interaction between the Moon and the solar wind. In this study, we investigate the species and the source of these non-solar wind ions from the Moon by the analysis of the three dimensional velocity distribution of these ions.

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These ions were observed only when the interplanetary magnetic field has some special relation with the positions of the Moon and NOZOMI. These ions have a partial ring distribution in the velocity space. These characteristics are very similar to those of the pick up ions which have been found around the unmagnetized object such as Mars or comets.

These pick up ions from the Moon have a different feature from those of the unmagnetized object. They have relatively large initial velocity, which means that the source of the pick up ions from the Moon differs from those of Mars or comets. Considering further that they have almost the same energies as the solar wind ions, the species are not heavy ions like Na+ or Mg+, but light ions such as H+ or He2+.

Direct observations of the pick-up ions near the Moon have not been reported previously. Determination of the species and the source of these ions is important to understand the interaction between the Moon and the solar wind. In this study, we investigate the species and the source of these non-solar wind ions from the Moon by the analysis of the three dimensional velocity distribution of these ions.