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Energization of pickup ions at terrestrial planets: From planet to planet, from solar cycle to solar cycle

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We discuss the pickup ion escape from the atmospheres of terrestrial planets in the Solar System. When upper atmospheric neutral planetary species are ionized in the solar wind at unmagnetized planets, they get accelerated by the solar wind flow and can escape from the atmosphere. We study in this work the energization of planetary ions in the solar wind at different heliospheric distances corresponding to Mercury, Venus, Earth and Mars. The analysis is based on the interplanetary Pioneer Venus Orbiter and OMNI solar wind datasets between 1978-1988. Using these datasets we derive statistics of the ExB drift velocities and Larmor radii of pickup ions at the terrestrial planets over a solar cycle. We find that the pickup ions are expected to be found on average at lower energies and at velocities more perpendicular to the solar wind flow the closer to the Sun a planet is due to the Parker spiral structure of the interplanetary magnetic field. Further, the energization and dynamics of the pickup ions vary considerably with the solar activity. The Larmor radii of the pickup ions are largest during a solar minimum while the pickup ion energies are highest during the declining phase of a solar cycle.

References: Jarvinen R. and Kallio E., Energization of planetary pickup ions in the Solar System, J. Geophys. Res., accepted article, doi:10.1002/2013JE004534, 2014