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Energization and dawn-dusk asymmetries of the escaping pickup ions at unmagnetized planets

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We discuss the energization and hemispheric asymmetries of pickup ions from unmagnetized planets. Atmospheric ions are energized when a planet interacts with an incident plasma flow such as the solar wind. Especially, atmospheres of planets without an intrinsic magnetic moment are directly influenced by the plasma interaction causing an induced magnetosphere to form. The convection electric field of the upstream flow provides a large scale energy source for the ions in the upper atmosphere. The motion and the energization of the pickup ions are controlled by the electric and magnetic fields of an induced magnetosphere. As an example case, we consider the solar wind induced ion escape from Venus in a global HYB-Venus hybrid simulation. Venus is located in the inner Solar System in a region where the flow-aligned component (Bx) typically dominates the interplanetary magnetic field (IMF). The flow-aligned component of the upstream magnetic field does not contribute to the convection electric field, but it results in asymmetric pickup ion properties between magnetic dawn and dusk hemispheres around the planet. The relative magnitude of Bx over the total magnitude of the IMF and, thus, the magnetic dawn-dusk asymmetries of unmagnetized planets decrease when moving away from the Sun or a central star in exoplanetary systems in general.