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Low-energy ions: More common than we thought around Earth, Mars and Titan

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Ions with energies less than tens of eV originate from the Terrestrial ionosphere and from several planets and moons in the solar system. The low energy indicates the origin of the plasma but also severely complicates detection of the positive ions onboard sunlit spacecraft at higher altitudes, which often become positively charged to several tens of Volts. We use the Cluster spacecraft and a recently developed technique based on the detection of the wake behind a charged spacecraft in a supersonic ion flow. Recent results from this technique show that low-energy ions typically dominate the density in large regions of the Terrestrial magnetosphere, both on the dayside, in the polar regions, and on the nightside. We compare with recent observations around Mars and the moon Titan and conclude that cold plasma is common also around other celestial bodies. The loss of this low-energy plasma to the solar wind is one of the primary pathways for atmospheric escape from planets in our solar system. Earth, Mars and Titan all lose of the order of 10^{25} to 10^{26} ions/s.