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Observed Foreshock Ions which are Actually Behind the Martian Bow Shock

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The Mars Express (MEx) Analyzer of Space Plasmas and Energetic Atoms (ASPERA-3) experiment contains ion and electron instruments for conducting plasma measurements. On January 23, 2012, during in-bound travel of MEx in the southern hemisphere of Mars traveling from its dawn side toward periapsis at dusk, the plasma instruments measured foreshock-like ion beams extending from outside the bow shock and into the magnetosphere, continuing to a distance of about a proton gyroradius from the bow shock. These ion beams were mostly protons, were observed to have energies greater than solar wind protons, and were not gyrating, in agreement with reflections of the solar wind proton beam. Furthermore, in the foreshock region, the ion energy gradually decreased toward the magnetosheath, in agreement with an acceleration by an outward-directed electric field in the bow shock. The observations also suggest that this electric field exists even inside the magnetosheath, within the distance of a proton gyroradius from the bow shock.