The phase space density of pickup ions on Mars

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We calculated the phase space densities of pickup ions at several points near Martian bow shock using a test particle model.

In results; 1, Using the charactristics of large gyro radii of pickup ions, we can know the distribiution of oxygen corona from the phase space density of pickup ions. 2, Because of the increase of production rate of pickup ions at downstream of Martian bow shock through electron impact ionization of oxygen corona, the phase space densities of pickup ions near bow shock become large and mass-loading of the solar wind becomes significant. And since these phase space densities are non-gyrotropic, the mass-loaded solar wind also changes the direction of its velocity. This means the mass-loading can affect the formation of the bow shock.

Mars is expected to possess an extended oxygen corona. Since intrinsic magnetic field does not exist on Mars, the oxygen corona is exposed to the solar wind and many ions produced in the oxygen corona are 'picked up' by the solar wind.

We calculated the phase space densities of these pickup ions at several points near Martian bow shock using a test particle model.

In results;

1,Because the gyro radii of pickup ions are large compared to the planetary scale and pickup ions gyrating near Mars do not experience one cycle of gyro motion, we can backtrace and locate where they are produced or ionized if we know their velocities. So we can know the distribiution of oxygen corona from the phase space density of pickup ions.

2,Enhancements of electron temperature and density at downstream of the Martian bow shock cause the increase of production rate of pickup ions through electron impact ionization process. This leads to the large value of the phase space densities of pickup ions near bow shock, where mass-loading of the solar wind becomes significant. And because these phase space densities are non-gyrotropic, the mass-loaded solar wind does not only change its speed but the direction of its velocity. This means the mass-loading can affect the formation of the bow shock.