



## **IMF direction derived from cycloid-like ion distributions observed by Mars Express**

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The Mars Express (MEX) Ion Mass Analyser (IMA) often observed cycloid distributions (two dimensional partial ring distributions in velocity phase space) of protons upstream the Martian bow shock. Since ions are expected to gyrate around the interplanetary magnetic field (IMF) in velocity phase space when the IMF is relatively uniform on a scale larger than the gyroradius, it is in principle possible to derive the IMF orientation from the observed cycloid distributions. Three different methods in deriving the IMF orientation are compared: (a) intuitive method, (b) the minimum variance direction of the velocity vectors selected manually (manual method), and (c) the minimum variance direction of the velocity vectors selected automatically using simple filters (automatic method). The source population for these ring distributions is most likely newly ionized hydrogen atoms, which are picked up by the solar wind.