A multifluid MHD study on three-dimensional Kelvin-Helmholtz instability at Mars

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Due to the absence of intrinsic global magnetic fields, the Martian ionosphere interacts directly with the solar wind to form an induced magnetosphere. Under the strong flow shear between solar wind and ionosphere, the Kelvin-Helmholtz instability (KHI) can occur near the magnetospheric boundary layer of Mars. Although the KHI at Mars has been reported by observations and simulations, the three-dimensional (3D) configuration of this instability and its effect on ion escape are still unsettled. In this study, using a newly-developed multi-fluid MHD model, the 3D and global characteristics of Martian KHI near the boundary layer are analyzed. The influence of the Hall effect, which indicates the relative motion between ions and electrons, on the KHI is especially investigated by comparing the temporal evolution of KHI for cases with and without the Hall term. We will also focus on the ion escape processes caused by the KHI. Furthermore, these simulated results will be compared with the MAVEN observations of KHI.

Keywords: Mars, Kelvin-Helmholtz instability, Multifluid MHD, Hall effect

