R009-09
B 会場 ：11/24　PM2 （15:30-18:15）
15:30〜15:45

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Kelvin-Helmholtz instability at Mars: Properties of plasma boundaries with a large density gradient

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Momentum and mass transport mechanisms at a velocity-sheared boundary between the shocked solar wind and the ionosphere are important processes that affect the ion escape from Mars. Kelvin − Helmholtz instability (KHI) is a promising mechanism to facilitate transport. Although previous studies have suggested KHI occurrence both around the ionopause (e.g., Gurnett et al., 2010) and magnetic pileup boundary (e.g., Poh et al., 2021), theory predicts that compressibility prevents KHI excitation at boundaries with large density gradients because of previously considered boundary structures where density varies with velocity. Based on the observations of a large density gradient boundary by MAVEN at Mars, where we can observe an extreme case, we show that it is the entropy that varies with the velocity in the real velocity-sheared boundary. The entropy-based boundary structure places the velocity shear in a lower-density region than the traditional density-based structure and weakens the compressibility effect (Seki et al., 2024). This new boundary structure thus enables KHI excitation even at large density gradient boundaries around the ionopause of unmagnetized planets. The result suggests the ubiquitous occurrence of KHI in the plasma universe and emphasizes its important role in planetary cold plasma escape from unmagnetized planets. In the presentation, role of KHI in the ion escape and its dependence of the density ratio across the boundary will be also discussed.

References:
Gurnett et al., Icarus, 206, 83-94, https://doi.org/10.1016/j.icarus.2009.02.019, 2010.
Poh et al., J. Geophys. Res., 126, https://doi.org/10.1029/2021JA029224, 2019.
Seki et al., Front. Astron. Space Sci., 11, https://doi.org/10.3389/fspas.2024.1394817, 2024.