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Foreshocks of the terrestrial planets: Simulations of kinetic effects

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Planetary foreshocks and magnetosheaths are regions which include many small-scale kinetic processes. Therefore, terrestrial planets Mercury, Venus, Earth and Mars provide interesting laboratories to investigate how the kinetic effects depend on the properties of the solar wind and on the properties of the planet.

The kinetic effects can be investigated with a 3D hybrid model where ions are modelled as particles accelerated by the Lorentz force. Recent studies based on our parallel hybrid model have shown that the simulation has an adequate spatial resolution to investigate, in detail, the ion 3D velocity distributions and the properties of the ULF waves at the foreshocks of Mercury, Venus and Mars.

In this presentation, we focus on the simulated 3D ion velocity distributions at various sites around terrestrial planetary bodies and discuss their role near the planets, especially at the foreshocks. We also introduce methods to automatically analyze basic properties of the ion velocity distributions in the simulation.