

Dynamics of Plasma Phase-Space Hole

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The phase-space hole is one of nonlinear solutions in collisionless plasmas. It is rather difficult to observe phase-space holes, because of collisions with neutral gas in laboratory plasmas. Recently, they are observed in broad areas of space plasma.

The dynamics of phase-space holes are revealed by phase-space observation using a Faraday cup. Phase-space holes are excited by a local electric field, which induces local fast charged particles. The local fast particles exceeding the acoustic wave speed form phase-space holes. They are excited also by a two-stream instability, a magnetoacoustic shock wave, and an application of electric field in a plasma of nonuniform density.

The existing region of phase-space holes is understood by using a diagram of phase velocity vs. wave number.