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Radial Force Balance in Plasma Hole and Role of Centrifugal Force SHINJI YOSHIMURA, National Institute for Fusion Science, MITSUO KONO, Chuo University, MASAYOSHI TANAKA, Kyushu University — A large-scale monopole vortex has been observed in a cylindrical magnetized plasma produced in the HYPER-I device at National Institute for Fusion Science, Japan. It is spontaneously formed with a deep density hole in its core and is referred to as *plasma hole* from the impression of the end-view image taken by a CCD camera. The flow-velocity field of the plasma hole exhibits two characteristic features: a supersonic azimuthal rotation caused by a strong radial electric field and an inward radial flow. Since the latter is not driven in axisymmetric collisionless invicid plasma, it implies finite viscosity of the plasma. It is revealed that quasi-neutrality breaking ($\delta n/n \sim 10^{-3}$), which is the source of strong electric field, occurs in the hole region. To develop a deeper understanding on the structure of the flow-velocity field, we have analyzed the radial force balance including the nonlinear terms, i.e. the dynamic pressure due to radial flow and the centrifugal force. It is found that the centrifugal force dominates the radial electric field in the hole region, giving rise to a rigid rotor equilibrium which is similar to the fast rotation mode realized in pure electron plasmas.

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