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Diamagnetic Effect in a Partially-Ionized High-Beta Plasma¹ AMNON FRUCHTMAN, H.I.T. - Holon Institute of Technology, SHUNJIRO SHINOHARA, Tokyo University of Agriculture and Technology — Balance between magnetic pressure and plasma pressure is expected in fully ionized plasmas confined by a magnetic field. The magnetic force on the plasma is due to a current carried by the plasma which is diamagnetic. The magnetic field inside the plasma is then lowered by that current. In a partially-ionized plasma, however, the plasma pressure is balanced not only by the magnetic field pressure but also by neutral-gas pressure. In that case the diamagnetic effect of the plasma, even if high beta, is expected to be lower. We calculate the steady-state of a cylindrical low temperature magnetized partially-ionized plasma (such as rf plasma source). We solve for the radial dependencies of the plasma density, the neutral density, and the magnetic field profile. Neutral pressure gradient is established by neutral depletion under the plasma pressure. We demonstrate how neutral depletion affects the diamagnetic effect of a high beta plasma.

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