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Fluid modeling of a high power positive column: Competitive effects of magnetic field and neutral depletion LAURENT LIARD, JEAN-LUC RAIMBAULT, PASCAL CHABERT, Laboratoire de Physique des Plasmas, Ecole Polytechnique, France, PLASMAS FROIDS TEAM — Transport phenomena in low temperature plasmas only need charged particles dynamics to be considered when the ionization fraction is small. However, recent reactor discharges such as ICP's and helicon allow high ionization rate, which changes drastically the transport dynamics. Recently, several authors included neutral dynamics in classical low-temperature discharge models and showed that, when electronic (ne kB Te) and neutral (nn kB Tn) pressure are on the same range, neutrals are pushed away from the discharge centre, resulting in neutral depletion effects. In this paper, we add to the neutral depletion model an axial magnetic field. Exact numerical solutions of the fluid model are found, but we also derive an approximate analytical solution. Densities spatial profiles, electronic temperature and edge-to-center ratio are presented as a function the magnetic field amplitude. On one hand, the presence of the magnetic field confines the plasma and so limits the diffusion of charged species to the wall. This goes against the neutral depletion effect. But on the other hand, the electronic density in a helicon discharge is strongly dependant of the magnitude of the magnetic field, which in turns tends to increase the depletion effect at fixed power.

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