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Ambipolar and nonambipolar flow across magnetic field[1] AMNON FRUCHTMAN, GENNADY MAKRINICH, H.I.T. - Holon Institute of Technology — The two-dimensional steady-state of plasma confined radially by an axial magnetic field is studied. An analytical solution is found by variable separation for the case that the transport coefficients are constant, without an assumption of ambipolar flow. In two such analytical descriptions, of ambipolar and nonambipolar diffusion, are compared. By ambipolar flow we mean equal ion and electron flow locally. Since the sources of ions and electrons are equal the total ion and electron flows through the boundaries are equal even when the flow is not ambipolar. We then formulate the nonlinear diffusion problem where the nonlinearity results from the dependence of the transport coefficients on the plasma and neutral densities. We solve the nonlinear 1D cross-field transport for the two different cases of ambipolar and nonambipolar diffusion. The nonambipolar diffusion corresponds to electrons crossing field lines at the end walls, in what is called the short-circuit effect. Neutral depletion, recently studied for the unmagnetized case,[2] is included here for the magnetized plasma.

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[2]A. Fruchtman, G. Makrinich, J.-L. Raimbault, L. Liard, J.-M. Rax, and P. Chabert, Phys. Plasmas **15**, 057102 (2008).

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