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The role of collisions and scattering in differential confinement

IAN OCHS, NATHANIEL FISCH, Princeton Univ, RENAUD GUEROULT, Laboratoire Plasma et Conversion d'Énergie, STEWART ZWEBEN, Princeton Plasma Physics Laboratory — Much of plasma physics is concerned with the overall confinement of all species present. However, in certain applications, it is desirable to confine some species while allowing others to escape, or to have different species escape to different regions. In this study, we examine one class of differential confinement system, the plasma mass filter, and evaluate the regimes of feasible operation given realistic confounding effects such as collisions with neutrals and ions, turbulence, and radiative losses. In schemes that rely on Larmor motion, we find that the low-temperature requirement imposed by line radiation necessitates a large (~ 1 T) magnetic field at the densities required for high throughput, since the Coulomb collision frequency scales as $T^{-3/2}$. There are, however, a variety of ways that may be contemplated to achieve separation effects.

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