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Progress towards the determination of an empirical flux equation for asymmetry-induced transport

D.L. EGGLESTON, C.T. SMITH, Occidental College — In previous work on asymmetry-induced transport, it was found useful to employ the hypothesis that the asymmetry frequency $\omega$ and the plasma rotation frequency $\omega_R$ always enter the physics in the combination $\omega - l\omega_R$, where $l$ is the azimuthal mode number of the asymmetry. Flux data points satisfying the condition $\omega - l\omega_R = 0$ were shown to satisfy the equation $\Gamma_{\text{sel}} = -\left(B_0/B\right)^{1.33}D_0[\nabla n_0 + f_0]$, where $B$ is the magnetic field, $\nabla n_0$ is the radial density gradient, and $B_0$, $D_0$, and $f_0$ are empirical constants. The general flux equation was then constrained to be of the form $\Gamma(\epsilon) = -\left(B_0/B\right)^{1.33}D(\epsilon)[\nabla n_0 + f(\epsilon)]$, where $\epsilon = \omega - l\omega_R$ and $D(\epsilon)$ and $f(\epsilon)$ are unknown functions. We now examine data points adjacent to the $\epsilon = 0$ points and compare them to a first order expansion of $\Gamma(\epsilon)$. We find that a plot of $d(\Gamma - \Gamma_{\text{sel}})/d\epsilon$ vs $r$ changes sign at about the same radius as $\nabla n_0 + f_0$, and show that this implies $dD/d\epsilon(0) \neq 0$. This, plus the requirement that $D(\epsilon = 0) = D_0$, restricts the form of $D(\epsilon)$. In particular, it excludes a dependence on $\epsilon$ of the form found in resonant particle transport theory, i.e., $D(\epsilon) \propto \exp(-C\epsilon^2)$, with $C$ a parameter.

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