

Neoclassical Physics

Let

$$\vec{B} = I(\psi) \vec{\nabla} \zeta + \vec{\nabla} \zeta \times \vec{\nabla} \psi. \quad (1)$$

where $\vec{b} = \vec{B}/B$. Expect $n_a = n_a(\psi)$, $p_a = p_a(\psi)$, and $T_a = T_a(\psi)$.

Let

$$\vec{u}_0^a = \vec{V}_a, \quad (2)$$

$$\vec{u}_1^a = -\frac{2}{5} \frac{\vec{q}_a}{p_a}, \quad (3)$$

and

$$u_{\theta j}^a = \frac{\vec{u}_j^a \cdot \vec{\nabla} \theta}{\vec{B} \cdot \vec{\nabla} \theta}. \quad (4)$$

Let

$$(u_\theta^a) = \begin{pmatrix} \langle u_{\theta 0}^a B^2 \rangle \\ \langle u_{\theta 1}^a B^2 \rangle \end{pmatrix}, \quad (5)$$

$$(V_*^a) = \begin{pmatrix} V_{*0}^a \\ V_{*1}^a \end{pmatrix}, \quad (6)$$

where

$$V_{*0}^a(\psi) = -\frac{I T_a}{e_a} \frac{d \ln p_a}{d\psi}, \quad (7)$$

$$V_{*1}^a(\psi) = \frac{I T_a}{e_a} \frac{d \ln T_a}{d\psi}. \quad (8)$$

Let

$$(u_\theta^i) = -[L^{ii}](V_*^i) - [L^{iI}](V_*^I). \quad (9)$$

Require elements of $[L^{ii}](\psi)$ and $[L^{iI}](\psi)$ matrices. Here, i denotes the majority ion species, whereas I denotes the impurity ion species.