Particle Transport Phenomena in the DIII–D Tokamak

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ABSTRACT

Many theoretical models show a direct connection between energy transport and particle transport. For a complete understanding of transport processes both energy and particle transport must be understood. In this paper we present a discussion of how energy and particle transport should be related in terms of the relative importance of the diagonal and off diagonal terms in the equation for the fluxes. A model for particle transport is discussed and it is shown that this model can describe measured density profiles in the DIII–D tokamak under a wide range of DIII–D parameters. This model is obtained from a Langranian formulation of the kinetic equation and utilizes the assumption that transport takes place while approximately conserving the first and second adiabatic invariants. The measured results utilize the improved diagnostic capability of DIII–D with an improved capability of measuring current density profiles and particle density profiles. This model is then extended to include energy transport. It is experimentally observed that the particle diffusivity and the thermal diffusivity do not differ greatly and have roughly the same radial dependence. This is discussed and compared with the model. A brief discussion of the effect of internal transport barriers is included.