APR10-2009-020044

Abstract for an Invited Paper
for the APR10 Meeting of
the American Physical Society

Gyrokinetics in astrophysics – from tokamaks to galaxies

WILLIAM DORLAND, University of Maryland

Gyrokinetic is a first principles theory for the dynamics and thermodynamics of magnetized, ionized gas. It has been developed over the last three decades, primarily in the magnetic confinement fusion community, where it is widely used to interpret observations and to design experimental devices and operational scenarios. Gyrokinetic simulations of instabilities and turbulence in hot, rarefied plasma have been tested carefully in these laboratory settings. Recently, gyrokinetic ideas and codes have been successfully used to explain long-standing and otherwise puzzling observations of turbulent fluctuations in the solar wind. While magnetohydrodynamics remains the appropriate theory for *dynamics* in larger, truly astrophysical plasmas (such as galaxy cluster plasmas), the appropriate framework for the study of many interesting thermodynamic processes in astrophysics (such as turbulent heating and transport) is gyrokinetics. Example applications will be shown.