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Ion acoustic instability, turbulence, anomalous resistivity and enhanced laser light absorption in ICF plasmas

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Hot plasmas with strong temperature gradients in inertial confinement fusion (ICF) experiments are examined for ion acoustic instabilities and kinetic effects produced by electron heat flux. Return current instability (RCI) due to neutralizing current of cold electrons arising in response to large electron heat flux is investigated as a source of the stationary levels of ion acoustic turbulence (IAT). Two mechanisms of anomalous laser light absorption on IAT: due to enhanced anomalous collisionality and mode conversion into Langmuir waves at the critical density are described in terms of effective absorption rates and applied to hohlraum plasmas with $ZT_e/T_i>>1$. The RCI threshold and growth rates are derived in the nonlocal regime of the thermal transport. They are compared with results of Vlasov-Fokker-Planck (VFP) simulations. Quasi-stationary state of the IAT produced by the RCI is achieved in VFP simulations. Nonlinear saturation of the RCI involves the mechanisms of the quasi-linear evolution and induced scattering of ions on IAT. In this talk, these topics will be explored in light of Professor Kaw's enduring research results on anomalous resistivity, enhanced laser light absorption and parametric instabilities in laser produced plasmas [1]. [1] P.K. Kaw, J.M. Dawson, Phys. Fluids **12**, 2586 (1969); P.K. Kaw, E. Valeo, J.M. Dawson Phys. Rev. Lett. **25**, 430 (1970); P.K. Kaw, J. M. Dawson, Phys. Fluids **14**, 792 (1971).