T04a Spontaneous reduction of the heat conductivity by a temperature gradient driven instability in electron-ion plasmas

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We have shown that there exists low-frequency growing modes driven by a global temperature gradient in electron and ion plasmas, by linear perturbation analysis within the frame work of plasma Kinetic theory. The driving force of the instability is the local deviation of the distribution function from the Maxwell-Boltzmann due to global temperature gradient.

Application to the intracluster medium shows that scattering of the particles due to waves excited by the instability is possible to reduce mean free paths of electron and ion down to five to seven order of magnitude than the mean free paths due to Coulomb collisions. This may give the answer to the fundamental question why hot and cool gas can co-exist in spite of strong thermal conduction in the intracluster medium. Our results suggest that the realization of the global thermal equilibrium is postponed by the local instability which is induced for quicker realization of local thermal equilibrium state in plasmas. The instability provides a new mechanism to create and grow cosmic magnetic fields without any seed magnetic field.