Landau Damping and Particle Trapping in Quantum Plasmas

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Landau damping is an essential process of wave-particle interactions in classical and quantum plasmas. It is basically a linear process, which is limited by particle trapping in the nonlinear regime. In this talk, we review the physical meaning of these two concepts and how they are modified by electron quantization. We focus our discussion on electron plasma waves, but extend these concepts to the case of twisted plasma waves, or waves with orbital angular momentum. We include in our analysis the case of photon trapping and photon Landau damping, two processes that are relevant for particle acceleration by laser wakefields. The strong similarity between these photon processes and quantum electron phenomena will be stressed. Finally, a global picture of classical and quantum regimes in laboratory and astrophysical plasmas, and the prospects for new experimental observations, will be given.

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