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Orbital angular momentum of photons, plasmons and neutrinos in a plasma J.T. MENDONCA, Instituto Superior Tecnico, Lisboa, Portugal, BO THIDÉ, Swedish Institute of Space Physics, Uppsala, Sweden, H. THEN, S. ALI, Instituto Superior Tecnico, Lisboa, Portugal — We study the exchange of angular momentum between electromagnetic and electrostatic waves in a plasma, due to the stimulated Raman and Brillouin backscatering processes [1]. Angular momentum states for plasmon and phonon fields are introduced for the first time. We demonstrate that these states can be excited by nonlinear wave mixing, associated with the scattering processes. This could be relevant for plasma diagnostics, both in laboratory and in space. Nonlinearly coupled paraxial equations and instability growth rates are derived. The characteristic features of the plasmon modes with finite angular momentum are also discussed. The potential problem is solved and the angular momentum is explicitly calculated [2]. Finally, it is shown that an electron-neutrino beam, propagating in a background plasma, can be decomposed into orbital momentum states, similar to that of photon states. Coupling between different neutrino states, in the presence of a plasma vortex, is considered. We show that plasma vorticity can be transfered to the neutrino beam, which is relevant to the understanding of the neutrino sources in astrophysics. [1] J.T. Mendonca et al., PRL 102, 185005 (2009). [2] S. Ali and J.T. Mendonca, PoP (2009) submitted. [3] J.T. Mendonca and B. Thide, Europhys. Lett. 84, 41001 (2008).

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