Electromagnetic and Gravitational Radiation from Particles in Intense Electromagnetic Fields

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Accelerated charges emit electromagnetic radiation, and the consequent energy-momentum loss alters their trajectory. This phenomenon is known as radiation reaction, and the Landau-Lifshitz (LL) equation is the classical equation of motion of the electron, which takes into account self-consistently radiation-reaction effects in the electron trajectory. By using the analytical solution of the LL equation in an arbitrary plane wave, we compute the analytical expression of the classical emission spectrum via nonlinear Thomson scattering, including radiation-reaction effects. Both the angularly-resolved and the angularly-integrated spectra are reported, which represent the exact classical expressions of the spectra in the sense that neglected contributions are smaller than quantum effects. Also, we have obtained a phase-dependent expression of the electron dressed mass, which includes radiation-reaction effects. Finally, the corresponding spectra within the locally constant field approximation have been derived. In addition to electromagnetic radiation, an accelerated particle emits gravitational waves. Not just the charge itself but also the electromagnetic field generated by it and the background field are sources of gravitational radiation. This fact makes the problem of calculating the gravitational spectrum produced during a nonlinear Thomson scattering non-trivial, and here we present some results in this direction.