

Radiation from an accelerated charge in Magnetic and Electric Fields

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This bachelor's thesis studies the electromagnetic radiation emitted by accelerated charged particles in electric and magnetic fields. By applying the Liénard-Wiechert retarded potentials, the characteristics of the radiation are analyzed in both non-relativistic and ultra-relativistic limits. It is demonstrated that in the non-relativistic case, in dipole approximation, the angular distribution of radiation is symmetric and precisely described by Larmor's formula; however, as the particle velocity approaches the speed of light, relativistic aberration causes the energy to focus into a narrow cone along the tangential direction of the particle's motion. Illustrative plots and figures are constructed. Furthermore, the angular and spectral properties of synchrotron radiation, along with the physical principles underlying the formation of the critical frequency, are discussed. Both non-relativistic and relativistic regimes are examined, and the parameters for which spectral analysis reveals a sharp asymmetry in the radiation are determined.

