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Pulsar gamma-ray emission in the radiation reaction regime

Since the era of the Fermi/LAT and atmospheric Cerenkov telescopes, pulsars are known to emit high and very high-energy photons, in the MeV-GeV range and sometimes up to TeV. To date, it is still unclear where and how these photons are produced. Nevertheless gamma-ray photons require particle acceleration to ultra-relativistic speeds. In this talk, we compute single particle trajectories for leptons in an arbitrary strong electromagnetic field in the so-called radiation reaction limit. In this picture, particle velocity only depends on the local electromagnetic field which we assume to follow the vacuum dipole rotator. From this velocity field, we compute the curvature radiation spectrum and light-curves. Sky maps and phase-resolved spectra are then deduced accounting for realistic pulsar periods and magnetic field strengths. Emission sites within the pulsar magnetosphere where most of radiation emanates are then localized. For standard parameters of millisecond and normal pulsars, we show that a break in the spectrum occurs at several GeV in agreement with the Fermi/LAT second pulsar catalogue. A sample of representative phase-resolved spectra and sky-maps are shown. A pair multiplicity of several tenths to several thousands is required to account for the total gamma-ray luminosity. Moreover depending on the geometry, single or double-peaked light-curves are found. Our model shows that minimalist assumptions are already able to reproduce salient features of pulsars emission characteristics.

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