A multicomponent model for the optical to γ-ray emission from the Crab Pulsar

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ABSTRACT: We present a multicomponent model to explain the features of the pulsed emission and spectrum of the Crab Pulsar, on the basis of X and γ-ray observations performed with BeppoSAX, INTEGRAL and CGRO. This model explains the evolution of the pulse shape and of the phase-resolved spectra, ranging from the optical/UV to the GeV energy band, on the assumption that the observed emission is due to more components.
The first component, C_O, is assumed to have the pulsed double-peaked profile observed at the optical frequencies, while the second component, C_X, is dominant in the inter-peak and second peak phase regions. The spectra of these components are modeled with log-parabolic laws.
Moreover, to explain the properties of the pulsed emission in the MeV-GeV band, we introduce two more components, $C_{O\gamma}$ and $C_{X\gamma}$, with phase distributions similar to those of C_O and C_X and log-parabolic spectra with the same curvature but different peak energies. This multicomponent model is able to reproduce both the broadband phase-resolved spectral behavior and the changes of the pulse shape with energy.
We also propose some possible physical interpretations in which C_O and C_X are emitted by secondary pairs via synchrotron mechanism while $C_{O\gamma}$ and $C_{X\gamma}$ can originate either from Compton scattered or primary curvature photons.