Understanding the high-energy emision of pulsars with synchro-curvature radiation models

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SYNCHRO-CURVATURE MODEL

We consider synchro-curvature radiation[1] as the mechanism in action in pulsars' magnetospheres producing the **high-energy emission** of these objects.

Our **effective radiative model** in a nutshell:

- **Dynamics** of an ensemble of charged particles in **peculiar regions** of the magnetosphere:

$$\frac{d\vec{p}}{dt} = ZeE_{\parallel}\hat{b} - (P_{sc}/v)\hat{p}$$

- **Effective parametrization** of the acceleration region:

$$B = B_{\star}\left(\frac{R_{\star}}{x}\right)^{b} \qquad r_c = R_{lc}\left(\frac{x}{R_{lc}}\right)^{\eta}$$

- Single-particle **power spectra**. Introduced in [1] and reformulated in [2]:

$$\frac{dP_{sc}}{dE} = \frac{\sqrt{3}(Ze)^2\Gamma y}{4\pi\hbar r_{eff}}\left[(1+z)F(y) - (1-z)K_{2/3}(y)\right]$$

- Complexity of the real scenario contained in an **effective particle distribution**:

$$\frac{dN}{dx} = N_0 \frac{e^{-(x-x_{min})/x_0}}{x_0(1-e^{-(x_{max}-x_{min})/x_0})}$$

Total spectrum: $\frac{dP_{tot}}{dE} = \int_{x_{in}}^{x_{out}} \frac{dP_{sc}}{dE}\frac{dN}{dx}dx$

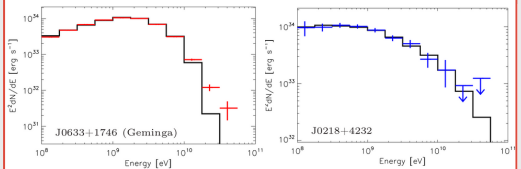
Ultimately defined by three free model parameters ($E_{||}$, x_0, b) and a normalization N_0.

1 Synchro-curvature radiation is a mixture of synchrotron and curvature radiations, reducing to each one in specific conditions.

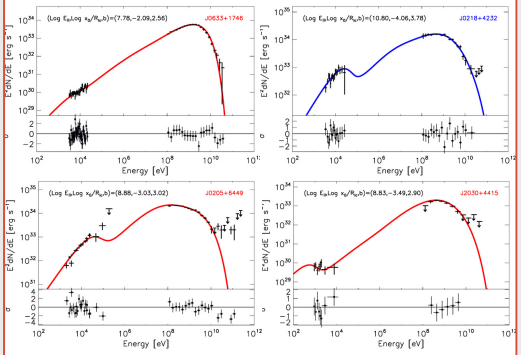
SPECTRAL FITTING

The **effective approach** considered allows to systematically **fit the Spectral Energy Distribution** of those populations of pulsars emitting high-energy radiation.

The entire γ-ray pulsar population is **succesfully fitted** by our model [3]:



The model is able to **reproduce X-ray data** too [4]. A majority of high-energy pulsars[2] are well fitted by our model [5]:

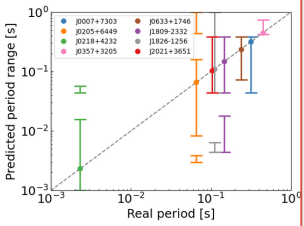


2 High-energy pulsars are γ-ray pulsars which have been detected to emit non-thermal X-ray radiation. This population consist on about 40 objects.

SPIN PERIOD INFERENCE

Can we **infer the period** of a pulsar from its **Spectral Energy Distribution**?

We have developed a method which can **define a range of plausible periods** only from a pulsar's SED [6].



This methodology can **improve the blind searches** on Fermi **pulsar candidates** possessing X-ray counterparts.

FUTURE PROSPECTS

- Continue the study of γ-ray pulsars' light-curves started in [7].
- Relax some current assumptions of the model, in order to make it more realistic.

REFERENCES

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[7] Viganò D., & Torres D. F. 2019, MNRAS, 490, 1437