MAGNETARS and e-ASTROGAM, by R. Turolla, R. Taverna and S. Zane

Magnetars are ultra-magnetized neutron stars (B ~ 10^{13} – 10^{15} G) which, at variance with ordinary radio-pulsars, are powered by their own magnetic energy. Observationally identified with two peculiar classes of X-ray pulsars, the soft gamma repeaters and the anomalous X-ray pulsars, their persistent emission has been detected from the IR/optical range up to the hard X-rays (~ 200 keV) with the Integral satellite (see Fig. 1, left). Up to now, only upper limits at higher energies (~ 0.1 – 10 MeV) are available, thanks to old CGRO Comptel observations (see Fig. 1, left). The basic picture for the high-energy magnetar emission involves the reprocessing of thermal photons emitted by the star surface through resonant Compton scattering onto charges, moving in a "twisted" magnetosphere. Many crucial details of the model are however still unclear. The distribution of the scattering particles in the velocity space is not completely understood as yet, nor is the geometry of the region where currents flow (the "j-bundle"). Observations in the gamma-ray range, as those e-ASTROGAM will allow, are key in addressing these issues. Fig. 1 (right) and Fig. 2 clearly show how theoretical spectral predictions are substantially different above ~ 0.5 MeV, according to the assumed velocity distribution of the charges, the geometry of the twisted region (either localized or global) and the viewing angle.

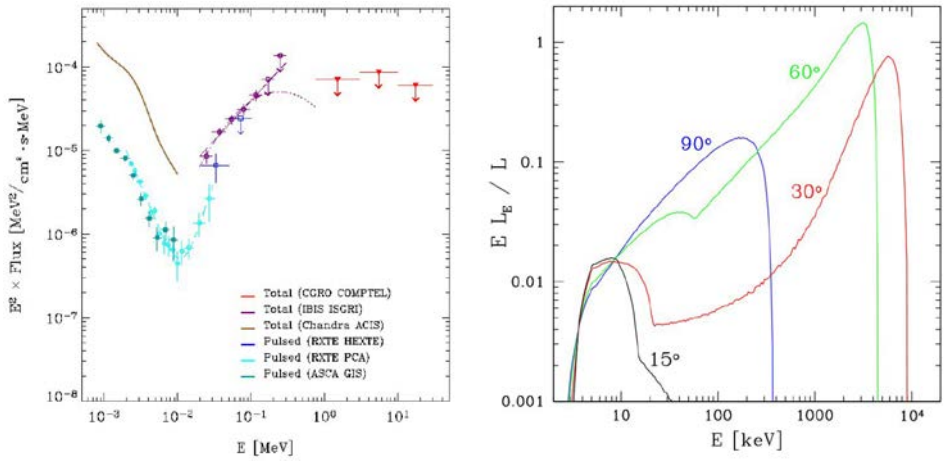

Fig. 1. *Left*. The observed SED of the AXP 4U 0142+614 (Kuiper et al., 2006). *Right*. Model spectra from a localized j-bundle at different viewing angles with respect to the magnetic axis (Belorodorov 2013).

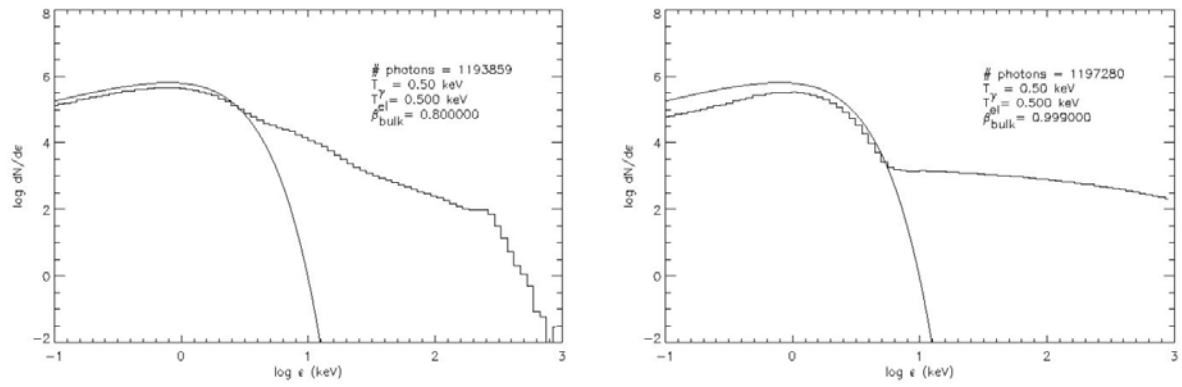

Fig. 2. Montecarlo simulations of spectra emerging from a globally twisted magnetosphere for different values of the bulk electron velocity, β = 0.8, left, and β = 0.999, right (Zane et al. 2011).

References

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