γ-Ray Emission of the Crab Nebula

Long and repeated exposures of the galactic anticenter were accumulated with the γ-ray telescopes on the *Compton Gamma Ray Observatory*. The Crab pulsar and nebula could therefore be measured in great detail above 100 keV. We have compiled a new multi-wavelength spectrum for the unpulsed part of the Crab emission, presumably due to emission from the nebula, from data of *CGRO, GRIS, BeppoSAX,* and from ground based TeV telescopes (Kuiper et al., 2001).

None of the used instruments has the angular resolution to distinguish a DC flux from the pulsar (a point source) from the surrounding nebula. From observations in the soft X-ray and optical range it is however clear that the pulsar is of very low intensity during its off-pulse phase of rotation (typically ~1% of the emission peak value) Figure 1 shows the multi-wavelength spectrum of the nebula.

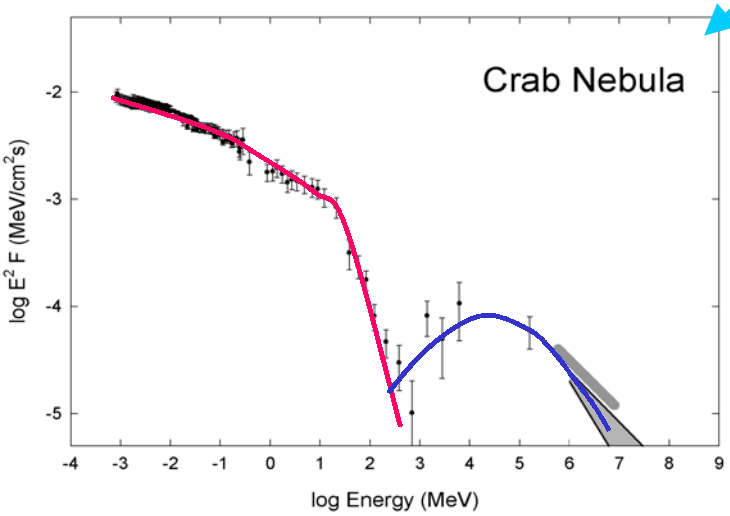

Figure 1: Spectrum of the unpulsed (‚nebular') emission from the Crab source.

As a guide to the eye a line has been drawn through the spectral points. After a careful analysis of systematic effects coming from the uncertain normalisations of different instruments Kuiper et al., 2001 have derived the following fits to sections of the spectrum: from 1-700 keV the spectrum is fitted with a power-law of index -2.14 and interstellar absorption corresponding to $N_H = 3.61(2) \times 10^{21}$ cm^{-2}; the spectrum steepens to a power-law of index 2.227±0.013 in the range 0.75 to 30 MeV steepening even further above 30 MeV; above about 300 MeV a new spectral component (blue line) is observed. The low energy part of the spectrum (red line) is generally explained by synchrotron emission of ultra-relativistic electrons in the nebular magnetic fields.The high-energy component was interpreted by de Jager et al., 1996 as due to inverse Compton scattering of the same electrons with Lorentz factors of 10^{6-7} on ambient photons in the nebula close to the pulsar.

References:

Kuiper L., et al, (2001) A&A, **378**, 918
de Jager et al., 1996, ApJ, **457**, 253

L. Kuiper, W. Hermsen, G. Cusumano, R. Diehl, V. Schönfelder, A. Strong, K. Bennett, M. McConnell, and G. Kanbach