Soft Gamma Repeaters

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Four Soft Gamma Repeaters (SGRs) have now been identified with certainty. In the active phase, SGRs produce short (duration $\sim$0.1–1 s), soft (peak energy $E_p \simeq$15–40 keV) bursts. But rarely, an SGR emits a giant flare — a short giant radiation pulse followed by a weaker tail, which pulsates with the period of neutron star rotation of $\sim$5–8 s. Such giant flares were detected from three of four known SGRs: on March 5, 1979 from SGR 0526-66 [1], on August 27, 1998 from SGR 1900+14 [2–4] and on December 27, 2004 from SGR 1806-20 ([5, 6] and references therein). The SGR 1627-41 produced a huge burst on June 18, 1998. It was weaker than the others and had no pulsating tail [7]. The last two giant flares were detected by the same joint Russian-U.S. Konus-Wind experiment on board the GGS-Wind spacecraft.

The enormous intensity of the initial pulse of the December 27 event proved to be far above the saturation level of the γ-ray detectors, which resulted in loosing the most valuable data on the time structure and energy spectrum of the pulse. At the time of the December 27 outburst, Coronas-F, a Russian spacecraft with a γ-ray spectrometer aboard, was occulted by the Earth and could not see the outburst. It succeeded, however, in observing a weak reflected signal due to Compton scattering of γ-rays by the Moon [6]. The detection of a weakened back-scattered initial pulse combined with direct observations by the Konus γ-ray spectrometer on the Wind spacecraft enabled us to reliably reconstruct the intensity, time history, and energy spectra of the outburst.

We give a short overview of observational properties of SGRs, and present our data on SGR 1806-20 activity before and after the giant flare, as well as the detailed temporal and spectral analysis of the giant flare itself. We compare the three giant flares to one another and discuss the relation of giant flares to short γ-ray bursts.

References

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