Title:	The Giant Flare of 1998 August 27 from SGR 1900+14. I. An Interpretive Study of BeppoSAX and Ulysses Observations
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Abstract

The giant flare of 1998 August 27 from SGR 1900+14 was extraordinary in many ways: it was the most intense flux of gamma rays ever detected from a source outside our solar system; it was longer than any previously detected burst from a soft gamma repeater (SGR) in our Galaxy by more than an order of magnitude; and it showed a remarkable four-peaked, periodic pattern in hard X-rays with the same rotation period that was found modulating soft X-rays from the star in quiescence. The event was detected by several gamma-ray experiments in space, including the Ulysses gamma-ray burst detector and the BeppoSAX Gamma-Ray Burst Monitor. These instruments operate in different energy ranges, and comparisons of their measurements reveal complex patterns of spectral evolution as the intensity varies. In this paper, we present a joint analysis of the BeppoSAX and Ulysses data and discuss some implications of these results for the SGRs. We also present newly analyzed Venera/SIGNE and ISEE-3 data on the 1979 March 5 giant flare from an SGR in the Large Magellanic Cloud (SGR 0526-66) and compare them with the August 27 event. Our results are consistent with the hypothesis that giant flares are due to catastrophic magnetic instabilities in highly magnetized neutron stars, or ``magnetars.'' In particular, observations indicate that the initial hard spike involved a relativistic outflow of pairs and hard gamma rays, plausibly triggered by a large propagating fracture in the crust of a neutron star with a field exceeding 10^{14} G. Later stages in the light curve are accurately fitted by a model for emission from the envelope of a magnetically confined pair-photon fireball, anchored to the surface of the rotating star, which contracts as it emits X-rays and then evaporates completely in a finite time. The complex four-peaked shape of the light curve likely provides the most direct evidence known for a multipolar geometry in the magnetic field of a neutron star.

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