

Observation of the Second LIGO/Virgo Event Connected with a Binary Neutron Star Merger S190425z in the Gamma-Ray Range

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Abstract—The results of observations of the gravitational-wave (GW) event S190425z recorded by the LIGO/Virgo detectors with the anti-coincidence shield (ACS) of the SPI gamma-ray spectrometer onboard the INTEGRAL observatory are presented. With a high probability ($>99\%$) it was associated with a neutron star (NS) merger in a close binary system. This is only the second event of such a type in the history of gravitational-wave observations (after GW170817). A weak gamma-ray burst, GRB 190425, consisting of two pulses ~ 0.5 and ~ 5.9 s after the NS merger in the event S190425z with an a priori significance of 3.5 and 4.4σ (taken together 5.5σ) was detected by SPI-ACS. Analysis of the SPI-ACS count rate history recorded on these days (a total of ~ 125 ks of observations) has shown that the rate of random occurrence of two close spikes with the characteristics of GRB 190425 does not exceed $6.4 \times 10^{-5} \text{ s}^{-1}$ (i.e., such events occur by chance, on average, every ~ 4.3 hours). Note that the time profile of GRB 190425 has much in common with the profile of GRB 170817A accompanying the event GW170817, that both NS mergers were the nearest ($\lesssim 150$ Mpc) of all the events recorded by the LIGO/Virgo detectors, and that no significant excesses of the gamma-ray flux above the background were detected in any of ~ 30 black hole merger events recorded to date by these detectors. No bursts of hard radiation were detected in the field of view of the SPI and IBIS/ISGR1 gamma-ray telescopes onboard INTEGRAL. This, along with the absence of detection of gamma-ray emission from GRB 190425 by the GBM gamma-ray burst monitor of the Fermi observatory suggesting its occultation by the Earth, allows the localization region for the source of this GW event to be reduced significantly. The parameters E_{iso} and E_p for GRB 190425 are estimated and compared with those for GRB 170817A.

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