



# - RAY ASTRONOMY 2019

*Current Challenges and New Frontiers in the Next Decade*

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## Diffuse X-ray emission around an ultraluminous X-ray pulsar

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Ultraluminous X-ray sources (ULXs) are extragalactic X-ray emitters located off-center of their host galaxy and with a luminosity in excess of a few  $10^{39}$  erg/s, if emitted isotropically. The discovery of periodic modulation revealed that in some ULXs the accreting compact object is a neutron star (NS), indicating luminosities substantially above their Eddington limit. The most extreme object in this respect is NGC 5907 ULX-1 (ULX1), with a peak luminosity that exceeds by 500 times its Eddington limit. During a Chandra observation to probe a low state of ULX1, we detected diffuse X-ray emission at the position of ULX1. We interpret this extended structure as an expanding nebula powered by the wind of ULX1. Its diameter of  $\sim 200$  pc, characteristic energy of  $\sim 2$  keV, and luminosity of  $\sim 5 \times 10^{38}$  erg/s imply a mechanical power of  $\sim 2 \times 10^{41}$  erg/s and an age  $\sim 6 \times 10^4$  yr. This proves that a genuinely super-Eddington regime can be sustained for time scales much longer than the spin-up time of the NS powering the system. Since the mechanical power from a single ULX nebula can rival the injection rate of cosmic rays of an entire galaxy, ULX nebulae could be important cosmic ray accelerators.

### Topic

Compact and diffuse sources in galaxies and in the Galactic Center

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