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Searching for Gravitational Waves from Scorpius X-1

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The low-mass X-ray binary Scorpius X-1 (Sco X-1) is a promising source of continuous gravitational waves for ground-based detectors. We use an improved method to search for signals with nearly constant frequency from Sco X-1 in the range of 40-180 Hz in LIGO O2 public data. Thanks to the efficiency of the search pipeline we can use a long coherence time and significantly improve the sensitivity. Our search has been able to probe gravitational wave amplitudes that could balance the accretion torque at the neutron star radius, for an inclination angle 44 ± 6 derived from radio observations, and assuming that the spin axis is perpendicular to the orbital plane. Our results are more constraining if the neutron star is magnetized, where the accretion torque is longer than the neutron star radius. This allows us to exclude certain mass-radius combinations and to place upper limits on the strength of the star's magnetic field with a different probe than ever used before. We will present our results and the physical interpretation of the neutron star. In this talk, we will also discuss a spin evolution model of the neutron star in Sco X-1 and use it to predict the spin parameters, the detectability of the associated gravitational-wave signal and inspirations for gravitational-wave search setup.

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