Setting up GW Searches for Sco X-1 Based on a Neutron Star Spin Evolution Study

Yuanhao Zhang[1,2], Badri Krishnan[1,2], Maria Alessandra Papa[1,2,3]

[1]Max-Planck-Institut für Gravitationsphysik (Albert-Einstein-Institut), D-30167 Hannover, Germany
[2]Leibniz Universität Hannover, 30167 Hannover, Germany
[3]Department of Physics, University of Wisconsin, Milwaukee, WI 53201, USA

The low-mass X-ray binary Scorpius X-1 (Sco X-1) is considered a promising source of continuous gravitational waves for ground-based gravitational-wave (GW) detectors. To optimally set up a GW search, one needs to consider prior information on the signal parameters. Since Sco X-1 is not detected as a pulsar, its spinning frequency and spin-down rate are unknown. The spin evolution of this object, and hence the current values of frequency and frequency derivatives, depend on poorly constrained values for the magnetic field of Sco X-1, its quadrupolar deformation and the equation of state as well as its formation and mass accretion history. We consider a simple spin evolution model with broad values of the system parameters, evolve the spin frequency to today and predict the detectability of the associated GW signals. We apply the simulation results to set up the GW search plan by maximizing the detection probability at limited computing cost. We will present the spin simulation study and discuss about the optimization method.