ICTS | INTERNATIONAL CENTRE for THEORETICAL SCIENCES

TATA INSTITUTE OF FUNDAMENTAL RESEARCH

ICTS Astrophysics & Relativity Seminar

Title : LIGO-Virgo-KAGRA Searches for Continuous Gravitational Waves from Scorpius X-1

Speaker : Prof. John T. Whelan (Rochester Institute of Technology and University of Warwick)

Date : Wednesday , 05 August 2026

Time : 3:30 PM (IST)

Abstract : Since 2015, the Advanced LIGO gravitational wave detectors have been conducting observing runs, joined in 2017 by Virgo and in 2020 by KAGRA. In the four three observing runs (O1 through O4), these detectors have so far observed nearly 400 transient gravitational wave signals from the inspiral and merger of binaries of black holes and/or neutron stars.

In addition to the transient signals already detected from compact binaries, the LVK conduct searches for other types of gravitational waves, including long-lived nearly periodic signals from rapidly spinning neutron stars. The methods used to coherently or semi-coherently integrate these signals over the course of an observing run depend on the knowledge of the source parameters. These can range from known pulsars with ephemerides which completely specify their sky position, rotation frequency and frequency evolution, to undiscovered neutron stars about which nothing is known. An intermediate situation is a directed search gravitational waves from a neutron star in a known sky location, for which the spin frequency and other parameters are unknown or uncertain.

After presenting an overview of the field, I will focus on semi-coherent directed methods to search for gravitational waves from low-mass X-ray binaries, notably Scorpius X-1, one of the most promising candidates for detection of periodic gravitational waves with advanced detectors. Its large X-ray flux is indicative of accretion of matter from its companion star. This accretion may provide the asymmetry needed to generate gravitational waves, and if the spinup torque due to accretion is balanced by loss of angular momentum in gravitational waves, one can estimate the strength of the resulting GW signal, which is potentially detectable with advanced detector sensitivities. I will summarize results to date, including the recently released upper limits from the first part of the LIGO-Virgo-KAGRA O4 run, which for the first time constrain the GW strength below this torque balance prediction for GW frequencies between 50 and 200 Hz.

Venue : Feynman Lecture Hall
Zoom Meeting:https://icts-res-in.zoom.us/j/99579097619?pwd=0dajCuPRbyvjTdvzDpY66OXELgNixv.1
Meeting ID: 995 7909 7619
Passcode: 862688