Contribution ID: **21** Type: **Research Talk**

Estimation of orbital inclination angle for compact binary mergers through Bayesian Inference

Tuesday 25 April 2023 17:15 (15 minutes)

The detection of Gravitational Waves (GWs) allows the study of massive binary systems that may or may not have any electromagnetic (EM) emission. The joint detection of GW˜170817 and the Gamma Ray Burst (GRB) GRB˜170817A, marked the beginning of GW multi-messenger astronomy. It presented the potential to reveal new insights into the emission mechanisms of GRBs as well as a more accurate picture of what happens during such mergers as more information is available than with each messenger alone. In particular this event confirmed that binary neutron star (BNS) mergers are progenitors for at least some short GRBs (sGRB). An estimated joint detection rate of 0.3 - 1.7 per year between the LIGO Hanford, LIGO Livingston and Virgo (HLV) GW network at design sensitivity, and the Fermi Gamma-ray Burst Monitor (GBM) was predicted. However, to date the GW˜170817/GRB˜170817A joint detection has been the only event of its kind so far. In the LIGO's 3rd observing run, BNS merger, GW˜190425, and Black Hole Neutron star (BHNS) events, GW˜200115_042309 and GW˜191219_163120 were detected with no EM counterpart. This study aims to find a reason why there hasn't been any more GW-GRB joint detections and possibly provide corrections to the current predicted joint detection rates. In this study, we make the hypothesis that these GW events with no EM counterpart were orientated such that the Earth was not within the viewing angle of the GRB (assuming all BNS and BHNS mergers produces a GRB).In this study we make use of the current Bayesian inference techniques to estimate the inclination angle of these systems to determine the orientation with respect to Earth. This analysis is performed with Bilby, which is a python based user-friendly parameter estimation infrastructure. Using the data obtained from this study we hope to potentially improve the current estimated joint detection rates.

Presenter: Mr MAZWI, Luyanda (University of Johannesburg)

Session Classification: Research Talk 8: QIT/ML/Neutrinos/Astrophysics/Cosmology

Track Classification: Cosmology