Contribution ID: **561** Type: **Talk in the parallel session**

Matter shells modifying gravitational wave signals

Monday 5 July 2021 17:30 (20 minutes)

As detections of mergers of compact bodies begin to flow in, and as we enter an era of precision GW measurements, our understanding of compact bodies, their physics and that of the surrounding astrophysical environment, will continue to grow and at times even be challenged. The need to revise the mass bounds of compact bodies such as BHs and NSs and the possibility of the existence of GW echoes are just some of consequences of the first few years of GW detection. In previous work, using linearised perturbation theory, we made the novel finding that a dust shell will cause a GW to be modified both in magnitude and phase, but without any energy being transferred to or from the dust. We extend our analysis to matter shells surrounding compact body mergers and to intervening matter in cosmology. Instead of only monochromatic GW sources, as we used in our initial investigation, we also consider burst-like GW sources. The thin density shell approach is modified to include thick shells by considering concentric thin shells and integrating. Solutions are then found for these burst-like GW sources using Fourier transforms. In the context of cosmology, apart from the gravitational redshift, the effects are too small to be measurable. We show that GW echoes that are claimed to be present in the LIGO data of certain events, could not have been caused by a matter shell. We do find, however, that matter shells surrounding BBH mergers, BNS mergers, and CCSNe could make modifications of order a few percent to a GW signal. These modifications are expected to be measurable in GW data with current detectors if the event is close enough and at a detectable frequency; or in future detectors with increased frequency range and amplitude sensitivity.

Authors: NAIDOO, M (Rhodes University); BISHOP, Nigel (Rhodes University); Dr VAN DER WALT, Petrus (Rhodes University)

Presenter: NAIDOO, M (Rhodes University)

Session Classification: Numerical Relativity and Gravitational Wave Observations

Track Classification: Gravitational Waves: Numerical Relativity and Gravitational Wave Observations