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Gravitational wave memory for various black hole and wormhole geometries

Gravitational wave (GW) memory is studied in the context of a certain class of braneworld wormholes. Unlike other wormhole geometries, this novel class of wormholes do not require any exotic matter fields for its traversability. First, we study geodesics in this wormhole spacetime, in
the presence of a GW pulse. The resulting evolution of the geodesic separation shows the presence of displacement and velocity memory effects. Motivated by the same, we study the memory effects at null infinity using the Bondi-Sachs formalism, adapted for braneworld wormhole. Our analysis provides a non-trivial change of the Bondi mass after the passage of a burst of gravitational radiation and hence manifests the memory effect at null infinity. In both of these exercises, the presence of extra dimension and the wormhole nature of the spacetime geometry gets imprinted in the memory effect. Since future GW detectors will be able to probe the memory effect, the present work provides another avenue to search for compact objects other than black holes. In fact GW memory effect can be used to differentiate between black holes and various exotic compact objects (ECOs). Keeping this in mind we have studied memory effect for various spherically symmetric spacetimes of GR and theories beyond GR.

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