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Phenomenology: Characterizing Burst with Linear Memory Events with LIGO-Virgo-KAGRA and Pulsar Timing Array Observatories

Close hyperbolic encounters of black holes (BHs) generate certain Burst With Memory (BWM) events in the frequency windows of the operational, planned, and proposed gravitational wave (GW) observatories. We provide details of our HyperbolicTD & GW_hyp packages that should allow both LIGO-Virgo-KAGRA (LVK) and Pulsar Timing Array (PTA) consortia to search for such BWM events in their respective datasets. Further, we present detailed explorations of the detectable parameter space of such events, relevant to these collaborations.

Preliminary investigations reveal that optimally placed BWM events should be visible to megaparsec distances for the existing ground-based observatories. In contrast, maturing PTA datasets should be able to provide constraints on the occurrences of hyperbolic encounters between supermassive BHs to gigaparsec distances. Some preliminary findings from our ongoing injection studies using simulated LVK and PTA datasets will be provided.

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