Pinpointing GW sources to delve into the fabric of spacetime via Astrometric Gravitational Wave Antenna

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Abstract

A new concept for a GW antenna (AstroGraWAnt) stems from an all-differential general relativistic formulation of the astrometric observable, i.e. the angular separation of a pair of celestial objects. For, close pairs of point-like sources act as natural antenna "arms" to record the very tiny variations in their angular separations induced by passing gravitational waves. This novel astrometric GW detection, truly complementary to the extant approaches, provides a powerful tool to infer GW strength and pinpoint direction to GW sources with unprecedented precision. The astrophysical scenarios in the reach of AstroGraWant comprises GW's associated with a range of populations of binaries made of all possible combinations of degenerate stars and stellar BHs (including signals predicted by theory but yet to be confirmed) within the Milky Way. In addition, probing frequency from microHz to deciHz is complementary, with sufficient overlaps for cross verification, to those already covered other facilities. With observations over the years also GWs of cosmological origin can be probed. Furthermore, the differential methodology can be extended to the detection of astrometric lensing-like effects related to a wide range of masses (i.e., esoplanets, brown dwarfs, stellar BHs) or exotic objects interposed between the observer and the target.

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