Trapping and guiding bodies by gravitational waves endowed with angular momentum

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It has been established theoretically and experimentally confirmed that electromagnetic waves endowed with angular momentum (for example, Bessel beams) can trap charged particles in the vicinity of the beam center. It can be shown that trapping of bodies by waves can be extended from electromagnetism to gravity. It means that gravitational waves endowed with angular momentum may accumulate near its axis all kinds of cosmic debris. The trapping mechanism in both cases can be traced to the Coriolis force associated with the local rotation of the space metric. In contrast to the electromagnetic case, the trapping in the gravitational case is universal; it does not depend on the mass of the body. The presentation of the trapping mechanism is based on the simplest model of a gravitational wave carrying angular momentum which is the Bessel beam. In this case the deviation equation for trapped geodesics can be solved analytically. On the other hand it can be shown, that Bessel beam in the vicinity of its axis has similar properties (such as the spatial distribution of angular momentum density) to properties of the gravitational radiation emitted by a binary system in the neighborhood of the direction perpendicular to the orbital plane at intermediate distances from the source. Trapping of bodies in the vicinity of the wave center could be related to the formation of jets in some specific circumstances.

The talk is based on "Trapping and Guiding Bodies by Gravitational Waves Endowed with Angular Momentum" (arXiv:1810.02219).

References

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