

Cosmic Strings and Spinning Black Holes

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A large cosmic string loop captured by a much smaller black hole oscillates on a nearly periodic orbit. The orbit slowly evolves due to energy and angular momentum exchange between the loop and the black hole. For a non-rotating black hole, the loop gradually loses its energy due to the friction of the moving string against the horizon. But for a spinning black hole, the loop energy can greatly increase by extracting the rotational energy of the black hole. The loop evolution is mathematically equivalent to the continuous deformation of a curve in 3D, described by a simple equation. We explore possible asymptotic states of this evolution and show that they are strong emitters of gravitational waves. Finally, we find that string loops are very likely to be captured by supermassive black holes at galactic centers for a wide range of string parameters.

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