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Circular Orbits and Matter Accumulations at Wormholes

We investigated the existence of timelike circular orbits and photon orbits at the throat of symmetrical wormholes. Our analysis reveals the potential for a broad spectrum of circular orbit solutions located at the throat. We derived expressions for the boundaries of this spectrum with regard to the specific angular momentum in terms of the metric components of the spacetime. The shape of the parameter space is primarily influenced by the presence or absence of an ergoregion encompassing the throat. Additionally, we obtained formulas for assessing the stability of these orbits, again expressed in terms of the metric components. By incorporating the thick accretion disk model, we established a connection between the existence of circular orbits at the throat and the potential formation of matter accumulations around the throat. These findings suggest that certain wormhole spacetimes could feature central bright regions, due to the existence of spherically shaped accretion structures at the throat. Moreover, the presence of infinitely many circular timelike orbits at the throat may indicate possible instabilities of such spacetimes.

Author: GJORGJIESKI, Kristian (Carl von Ossietzky Universität Oldenburg)

Co-authors: KUNZ, Jutta (University of Oldenburg); NEDKOVA, Petya (Sofia University "St. Kliment Ohridski")

Presenter: GJORGJIESKI, Kristian (Carl von Ossietzky Universität Oldenburg)