

Cosmic cable

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An extended rigid cable in a general relativistic spacetime was variously considered by Penrose, Geroch, Bekenstein, and Gibbons, within the period 1969–1972. This hypothetical scenario tests the concept of mining energy from a black hole (e.g. Brown 2013) or an expanding universe (e.g. Davies 1984). However there are limits to such processes of course. Recent authors apply the cable scenario to quantum fields or thermodynamics of black holes. My study is purely classical, investigating the relativistic mechanics following from the effects of gravity, that is spacetime curvature. One interesting novel effect is the “redshift” of tension transmitted along the cable, as first shown correctly by Unruh & Wald (1982) and Redmount (1984). The cable situation is useful for relativity pedagogy, particularly for spacetime splittings or threading / foliations, as applied to mechanics. In contrast, some authors take a “Newtonian”-like approach to mechanics by using a single familiar spacetime foliation — cosmic time in cosmology, or the static foliation in Schwarzschild spacetime — with mistaken conclusions.

Selected references:

- Brown, A., 2013. Tensile strength and the mining of black holes, *Physical Review Letters*
- Davies, P., 1984. Mining the universe, *Physical Review D*
- Harrison, E., 1995. Mining energy in an expanding universe, *The Astrophysical Journal*
- Unruh, W. and Wald, R., 1982. Acceleration radiation and the generalized second law of thermodynamics, *Physical Review D*