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(U*) Efficiency of Black Hole Heat Engines and Universality

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One of the more exciting things to emerge from black hole thermodynamics is that black holes can form the working material for heat engines. I explore the connection between the critical behaviour of black holes and their efficiency as heat engines over a range of dimensions and for a variety of theories of gravity.

I first show that their efficiency as heat engines near the critical point can be written in general dimensions in terms of the variables characterizing the geometry of the cycle and the critical exponents. Engines near the critical point approach the Carnot efficiency, with the rate of approach determined by the universality class of the black hole. I will specifically consider a broad range of charged black holes, Lovelock black holes, and black holes with isolated critical points. I will then discuss work in progress exploring this formalism for black holes whose specific heat at constant volume is nonzero, applying it to examples such as rotating black holes and STU black holes.

Author: DIMARCO, Maria (University of Waterloo)

Co-authors: JESS, Sierra (University of Waterloo); HENNIGAR, Robie; MANN, Robert (University of Waterloo)

Presenter: DIMARCO, Maria (University of Waterloo)

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