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(U*) Black Hole Heat Engines and Critical Behaviour

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One of the more exciting things to emerge from black hole thermodynamics in the past 10 years is the understanding that black holes can undergo a broad range of chemical-like phase transitions, including liquid-gas phase transitions, triple points, superfluid transitions, polymer-type transitions, and exhibit critical behaviour. It is even possible to consider black holes as the working material for heat engines. The efficiencies for a variety of black holes can be calculated and compared against each other.

In this talk I will discuss the connection between critical behaviour and the efficiency of black hole heat engines. I first consider the heat capacity of static black holes at constant volume such that Cv=0 Using the near critical expansion of the equation of state, the coefficients appearing in this expansion can be found from an engine cycle placed along a critical point on a PV plot.

I will discuss the importance and applications of the simplifications made, along with how this result allows one to go from the near critical expansion of the equation of state directly to a conclusion about the behaviour of a heat engine near the critical point.

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