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Thermodynamics of a Black Hole with Moon SAMUEL GRALLA, ALEXANDRE LE TIEC, Univ of Maryland–College Park — For a rotating black hole perturbed by a particle on the "corotating" circular orbit (angular velocity equal to that of the event horizon), the black hole remains in equilibrium in the sense that the perturbed event horizon is a Killing horizon of the helical Killing field. The associated surface gravity is constant over the horizon and should correspond to the physical Hawking temperature. We calculate the perturbation in surface gravity/temperature, finding it negative: the moon has a cooling effect on the black hole. We also compute the surface area/entropy, and find no change from the background Kerr value.

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