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Publication Date:

2003

Permanent Link:

<https://doi.org/10.3929/ethz-a-004585094> →

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Feedback Effects from Growth of Supermassive Black Holes

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Abstract Accreting black holes probably release as much (or more) energy in kinetic form (via jets and accretion disk winds) as they do in the form of radiation. The total energy liberated during growth of a supermassive black hole is more than enough to unbind all the gas in the surrounding galaxy and seriously affect the energetics of the nearby intracluster medium. But the impact of this energy is sensitive to the way in which it is deposited. Are the effects concentrated and violent, or more distributed and gentle?

Recent studies of black hole feedback in clusters of galaxies seem to be favoring gentle and widespread heating. X-ray observations suggest that such feedback compensates for radiative cooling (quenching so-called "cooling flows") and may account for the excess entropy inferred in cluster cores. I will discuss the evidence for gentle ("effervescent") heating and recent attempts to model it, as well as its potential for regulating galaxy and/or black hole formation.