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A correlation between supermassive black holes and the hot atmospheres of host galaxies

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The masses of central supermassive black holes are known to correlate with the bulge components of their host galaxies, suggesting a coevolution of the two. Here, we report the discovery of a tight correlation between the temperatures of the hot atmospheres permeating brightest cluster/group galaxies (BCGs) and the masses of their central supermassive black holes, making the atmospheric gas temperature the best known proxy for the black hole mass in these systems. The atmospheric gas temperature is set primarily by the underlying gravitational potential and our hydrostatic analysis reveals a linear correlation between the total masses of BCGs and the masses of their central supermassive black holes. In the scenario of a simultaneous growth of the central black holes and their host galaxies through mergers, the observed linear correlation is a natural consequence of the central limit theorem.

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