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Direct formation of supermassive black holes; from mergers of protogalaxies to global relativistic collapse

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We present the latest developments of the merger-driven scenario for supermassive black hole formation originally developed in Mayer et al. (2010,
Nature, 466. 1082). We show how including realistic radiation physics in mergers of protogalaxies driven from cosmological initial conditions strengthens the proposal that supermassive nuclear clouds may form in only a few 10ˆ8 yr in the nucleus of the remnant, as a result of supersonic turbulence hampering fragmentation and normal star formation even in the presence of metal-enriched gas. The billion solar mass clouds can lead to a supermassive star, which can rapidly produce a massive black hole seed (M_BH > 10ˆ5 Mo), or can undergo a "dark collapse" all the way into a supermassive black hole via the relativistic radial instability depending on the residual angular momentum (Mayer et al. 2015, ApJ, in press).
Both scenarios explain naturally the rapid emergence of high-z QSOs at z > 6. Finally, unprecedented 3D computations joining for the first time galaxy formation simulations in a cosmological context with relativistic hydro calculations of supermassive cloud collapse, including even the effect of nuclear burning in metal-enriched gas, will be presented and the preliminary results discussed in light of the "dark collapse" scenario.

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