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【94】The Evolution of Supermassive Population III Stars

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Supermassive primordial stars forming in atomically-cooled halos at redshifts 15-20 are currently thought to be the progenitors of the earliest quasars in the Universe. In this picture, the star evolves under rapid accretion (0.1-1 M_{sun}/yr) until the general relativistic instability triggers its collapse to a black hole at masses of ˜10⁵ M_{sun}. However, the ability of the accretion flow to sustain such high rates depends crucially on the photospheric properties of the accreting star, because its ionising radiation could reduce or even halt accretion.
We present new models of supermassive Population III protostars accreting at high rates, including general relativistic corrections to the internal structure. We estimate the mass at which the collapse occurs, which gives the upper mass limit of stars that ever formed in the Universe.
We confirm that for high enough rates the stars evolve as red, cool supergiants with surface temperatures below 10⁴ K towards masses above 10⁵ M_{sun}. Compared to previous studies, our results extend the range of masses and accretion rates at which the ionising feedback remains weak, reinforcing the case for direct collapse as the origin of the first quasars.

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