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The Rotation of SuperMassive Stars

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Supermassive stars (SMSs), with masses $> 10^5$ $M_\odot$, have been proposed as the possible progenitors of the most extreme supermassive black holes observed at redshifts $z > 6 - 7$. In this scenario ('direct collapse'), a SMS accrete at rates > 0.1 $M_\odot$ yr^{-1} until it collapses to a black hole via the general-relativistic (GR) instability. Rotation plays a crucial role in the formation of such supermassive black hole seeds. The centrifugal barrier appears as particularly strong in this extreme case of star formation. Moreover, rotation impacts sensitively the stability of SMSs against GR, as well as the subsequent collapse. In particular, it might allow for gravitational wave emission and ultra-long gamma-ray bursts at black hole formation, which represents currently the main observational signatures proposed in the literature for the existence of such objects. I will present the latest models of SMSs accounting for accretion and rotation, and discuss some of the open questions and future prospects in this research line.

Primary author: HAEMMERLÉ, Lionel (Université de Genève)

Presenter: HAEMMERLÉ, Lionel (Université de Genève)

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