P104a 初代星形成におけるバースト的降着と間欠的 UV フィードバック

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The mass accretion process onto growing primordial protostars is very dynamic in general and sometimes displays highly variable accretion rates. As a result of the gravitational fragmentation of a circumstellar disk, fragments migrate inward to initiate burst-like accretion events when accreting onto the star. Here I present our recent 3D radiation-hydrodynamic (RHD) simulations following this dynamic accretion process under the influence of stellar UV feedback. Our calculations, which also solve the stellar evolution simultaneously with the 3D RHD simulations, result in the wide diversity of final stellar masses obtained in our previous 2D simulations. In particular, the formation of very massive (more than 250 Msun) primordial stars should be possible in 3D if disk fragmentation is followed by successive mergers or episodic accretion. Short accretion bursts with more than 0.01 Msun/yr weaken the stellar UV feedback. Unable to thermally readjust on such short timescales, the protostar substantially inflates with rapid accretion, it's atmosphere cools rapidly, it's UV flux drops, and a forming HII region suddenly disappears. This process allows the formation of very massive stars in the early universe, whose observational signature has been recently reported (Aoki et al. 2014). This should also be suggestive for forming even more massive (or supermassive) stars, which will seed supermassive black holes in the early universe.