

Early supermassive black hole direct collapse with dark matter

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One of the exciting mysteries uncovered by the James Webb Space Telescope is the discovery of very high redshift supermassive black holes (SMBH). Such early formation of SMBH challenges conventional formation mechanisms—one possible explanation is that these black holes formed from the direct collapse of massive dust clouds. However, it has long been understood that the onset of cooling from molecular hydrogen causes the cloud to fragment and prevent SMBH formation. But if the dust cloud had additional sources of heating, this molecular hydrogen cooling can be avoided. We show here that additional heating from a dark sector—in the form of evaporating black holes or decaying particles—can suppress the molecular hydrogen cooling and allow for the successful direct collapse of dust clouds to SMBH at arbitrarily early times.

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