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The origin of supermassive black holes at high redshift

Almost every galaxy hosts a supermassive black hole at its center, and the mass of the black hole is correlated with the velocity dispersion of the galaxy, pointing to a co-evolution that has been a focus of research. Interestingly, supermassive black holes are detected even at redshifts greater than 6 when the Universe was very young and it is a mystery how a black hole could have grown to that high a mass in the short amount of time after the formation of galaxies began. We investigate the formation of SMBH considering an accretion flow into a dark matter halo and find that the flow is not possible without the presence of a seed black hole. We calculate the mass accretion rate for the trans-sonic flow and find that it is proportional to the square of the halo mass for a cold isothermal flow. The calculated Eddington ratio is also mildly supersonic for a brief period of time, that too when the black hole mass is not sufficient to drive outflows and stop accretion. Our findings explain the existence of SMBH at redshift above 6 recently detected by JWST and also detected in earlier quasar surveys with SDSS.

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