P123a The impact of ionizing radiation on the formation of a supermassive star in the early Universe

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A massive primordial halo near an intensely star forming galaxy may collapse into a supermassive star (SMS) and leave a massive black hole seed of about 10^5 $M_\odot$. To investigate the impact of ionizing radiation on the formation of an SMS from a nearby galaxy, we perform three-dimensional radiation hydrodynamical simulations by selecting a pair of massive dark matter halos forming at $z > 10$. We find that rich structures such as clumps and filaments around the source galaxy shield the cloud from ionizing radiation. In fact, in some cases cloud collapse is accelerated under ionizing radiation. This fact suggests that the ionization of the cloud's surroundings helps its collapse. Only strong radiation at the early stage of structure formation can halt the cloud collapse, but this is much stronger than observationally allowed value. We also explored the effect of ionizing radiation on a sample of 68 halos by employing an analytical model and found that increase in the mean density of the gas between the SMS forming cloud and the source galaxy protects the gas cloud from ionizing radiation as they approach each other. Thus, we conclude that ionizing radiation does not prevent the formation of an SMS in most of the cases.