# ABSTRACT

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## The formation of seed black holes in the cosmic dark ages

The supermassive black holes observed at z~6 are usually assumed to originate either from the remnants of the first stars, or from intermediate mass black holes with up to $\sim 10^5$ solar masses. To form massive intermediate mass black holes, the gas in primordial galaxies needs to collapse without fragmenting. Hydrodynamical studies show that fragmentation is suppressed if the effective equation of state is steeper than isothermal, thus if cooling is inefficient. In primordial galaxies, cooling by molecular hydrogen is suppressed in the presence of photodissociating background radiation, while cooling in the Lyman Alpha line is suppressed due to the large column densities. I present results from a one-zone model which examines these effects in detail and shows that additional cooling channels exist, in particular a variety of hydrogen lines, but also chemical cooling channels, which still yield a decrease in temperature during collapse. Fragmentation can thus not be excluded on thermodynamical grounds. Numerical simulations however indicate the presence of strong supersonic turbulence in such galaxies, which may lead to the rapid amplification of seed magnetic fields by the small-scale dynamo. While these magnetic fields should not affect the collapse phase significantly, they may help to efficiently transport the angular momentum after the formation of a disk, and thus suppress fragmentation and binaries. This results in larger masses for the seeds of the first supermassive black holes.