PARTICLE PHYSICS SEMINAR SERIES

Dark radiation and superheavy dark matter from black hole domination

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If even a relatively small number of black holes were created in the early universe, they will constitute an increasingly large fraction of the total energy density as space expands. It is thus well-motivated to consider scenarios in which the early universe included an era in which primordial black holes dominated the total energy density. Within this context, we consider Hawking radiation as a mechanism to produce both dark radiation and dark matter. If the early universe included a black hole dominated era, we find that Hawking radiation will produce dark radiation at a level $\Delta N_{eff} \sim 0.03-0.2$ for each light and decoupled species of spin 0, 1/2, or 1. This range is well suited to relax the tension between late and early-time Hubble determinations, and is within the reach of upcoming CMB experiments. The dark matter could also originate as Hawking radiation in a black hole dominated early universe, although such dark matter candidates must be very heavy ($m_{DM} > 1011$ GeV) if they are to avoid exceeding the measured abundance.

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