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Primordial Black Holes from Long-Range Scalar Forces and Scalar Radiative Cooling

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Primordial black holes (PBHs) are a natural consequence of long-range scalar forces in the early Universe. These forces can lead to the formation of halos of heavy particles, Q-balls or oscillons even during the radiation dominated era. This same force removes energy and angular momentum from virialized systems via scalar radiation, leading to the subsequent formation of black holes. We will discuss two scenarios which result in the formation of PBHs. First, we consider heavy fermions interacting via a light scalar mediator. This scenario relates the mass of the dark-sector particles to the masses and abundance of dark matter PBHs in a way that can explain why dark matter and ordinary matter have similar mass densities. Second, we consider interactions among SUSY Q-balls. The mass and abundance of PBHs in this scenario are naturally explained by the SUSY breaking scale. Lastly, we will comment on the expected PBH spins from this formation mechanism in comparison to other earlier models.

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