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## **Dark matter around primordial black holes**

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Massive primordial black holes may have formed in the early universe, accounting for a small fraction of dark matter. Most of dark matter, however, may be composed of elementary particles or black holes with smaller masses. These objects could form dense spikes around the large black holes during the radiation-dominated phase of the universe's evolution. Dark matter particles can annihilate in the spikes. In this study, we discuss the structure and properties of the spikes, considering their transformation due to annihilation. In the hybrid scenario involving black holes of various masses, small black holes can scatter and merge in the central regions around larger black holes.

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