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The trichotomy of PBH initial conditions

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We show that the threshold to form a black hole, in an asymptotically flat and radiation dominated Friedman-Robertson-Walker (FRW) Universe, is not solely (mainly) determined by the behaviour of the compaction function at its maximum, as earlier thought, but also by the three-dimensional curvature at smaller (but super-horizon) scales, which we call “the core”. We find three classes of initial conditions characterized by an open (O), closed (C), or flat (F) FRW core surrounded by a shell with higher three-dimensional curvature. In the C case, the core helps the collapse so that the black hole formation threshold is there the lowest among all cases. Type-II black holes might only be generated by Type-O or F (each of those with different thresholds, with O being the highest) or by a Type-C with an effective F core.

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