# BLACK HOLE FORMATION FROM A COMPLETE REGULAR PAST FOR COLLISIONLESS MATTER

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Initial data for the spherically symmetric Einstein-Vlasov system is constructed whose past evolution is regular and whose future evolution contains a black hole. This is the first example of initial data with these properties for the Einstein-matter system with a "realistic" matter model. One consequence of the result is that there exists a class of initial data for which the ratio of the Hawking mass $m = m(r)$ and the area radius $r$ is arbitrarily small everywhere, such that a black hole forms in the evolution. This result is in a sense analogous to the result [1] for a scalar field. Another consequence is that there exist black hole initial data such that the solutions exist for all Schwarzschild time $t \in (-\infty, \infty)$.

*Keywords:* formation of black holes, Einstein-Vlasov system, regular past

[1] D. Christodoulou, The formation of black holes and singularities in spherically symmetric gravitational collapse. *Comm. Pure Appl. Math.* **44**, 339-373 (1991).