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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 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 and the area radius is arbitrarily small everywhere, such that a black hole forms in the evolution. Another consequence is that there exist black hole initial data such that the solutions exist for all Schwarzschild time.