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Hydrodynamic circularization in stellar tidal disruption events ROSEANNE CHENG, HOTAKA SHIOKAWA, JULIAN KROLIK, Johns Hopkins University, TSVI PIRAN, Hebrew University of Jerusalem, SCOTT NOBLE, University of Tulsa — In the tidal disruption of a star by a black hole, the process by which debris forms a disk and generates flares and/or jets is not well-understood. We investigate this process using a new numerical tool to simulate the circularization of debris from the disrupted star. A post-Newtonian hydrodynamic simulation (FNC) of the star itself as it is torn apart is combined with a fully general relativistic hydrodynamics simulation (Harm3d) of the subsequent motion of the stellar debris as it orbits the black hole. The characteristic length scale at which the tidal streams merge to form an accretion flow is much larger than classical expectation. Furthermore, the time for accumulation of mass into the flow is significantly longer than the characteristic orbital period of most tightly-bound tidal streams. We discuss how these results can be applied to recently observed tidal disruption candidates.

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