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Accretion Disk Formation in Tidal Disruption Event

The tidal disruption of a star by a nearby black hole can trigger transient electromagnetic signals in multiple wavebands, making it a well-recognized class of transient events. Understanding the origin of detected emissions from such tidal disruption events (TDEs) is particularly interesting.

In this work, we discuss the potential radiative emissions from TDEs during the formation of the accretion disk. We follow the dynamic process before the peak fallback rate with 3D radiation-hydrodynamic simulations. We found that for higher mass black holes, the stream-stream collision can drive strong, optically thick outflows, creating a reprocessing layer in the pre-peak time. When the outflow subsides, dissipation initiates gas circularization and accretion disk formation. The photosphere of such pre-peak TDE systems is likely to be anisotropic, either assembled by the optically thick outflow or early circularization gas.

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