

Fallback rates in partial tidal disruptions of white dwarfs by intermediate mass black holes

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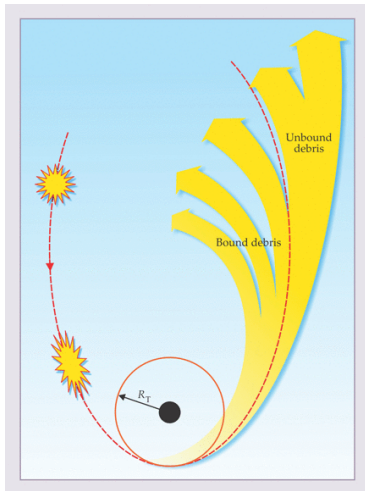
Tidal Disruption Events (TDEs)

Tidal radius (R_T):

$R_T = \left(\frac{M_{\text{BH}}}{M_\star} \right)^{1/3} R_\star$, where M_{BH} is the black hole mass, and M_\star , R_\star are the mass and radius of the star, respectively.

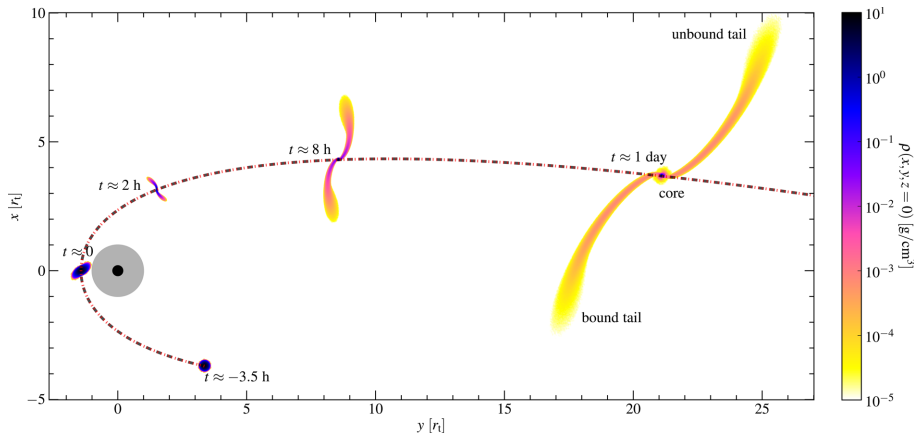
Impact parameter (β): $\beta = \frac{R_T}{R_p}$, where R_p is the pericenter distance of the orbit.

Typically, $\beta \geq 1$ denotes full disruption, and $\beta < 1$ indicates partial disruption.



Credit: S. Gezari, Physics Today.

Tidal Disruption Events (TDEs)



Credit: E. Gafton, E. Tejeda, J. Guillochon, et al., 2015.

WD Tidal Disruption by IMBH

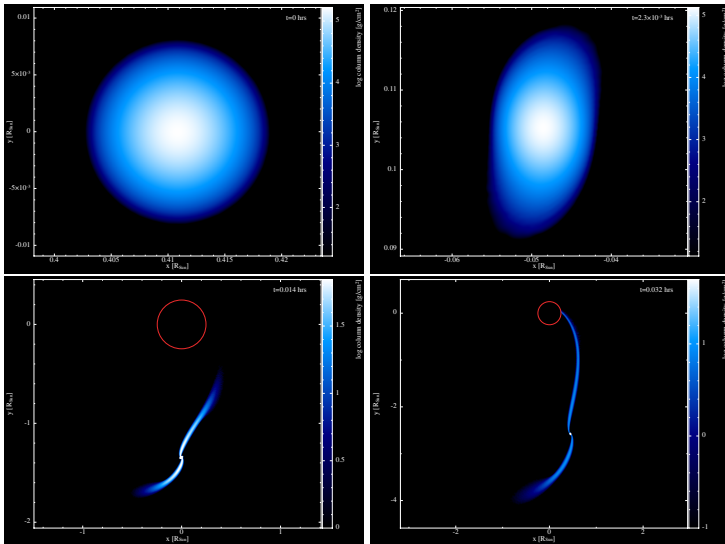
Simulation Code: We developed a smooth particle hydrodynamics code for simulating Tidal Disruption Events (TDEs).

Focus: We investigate scenarios involving the partial disruption of a white dwarf (WD) by an intermediate mass black hole (IMBH).

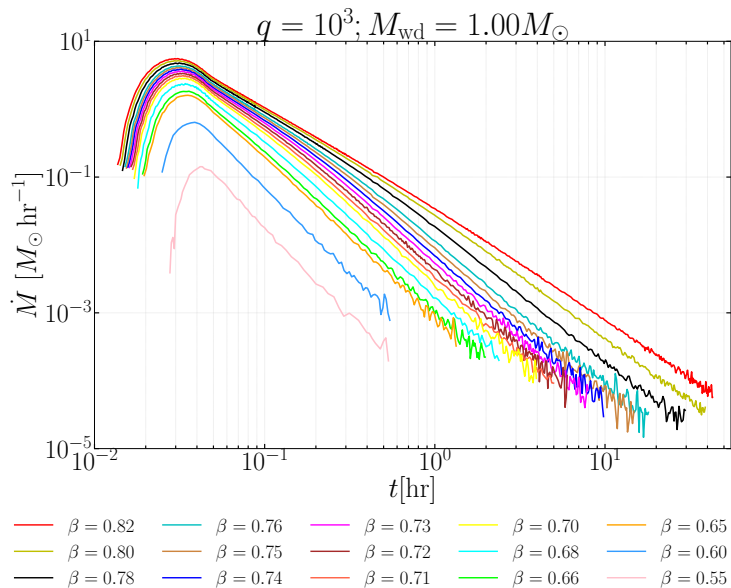
Model Parameters: IMBH modeled as a Schwarzschild black hole with $M_{\text{BH}} = 10^3 M_{\odot}$, WD with $M_{\text{wd}} = 1 M_{\odot}$, $R_{\text{wd}} = 0.0082 R_{\odot}$, with a degenerate equation of state.

Observable: Studying the Fallback rate as a key observable for TDEs, representing the rate at which the bound material returns to the black hole.

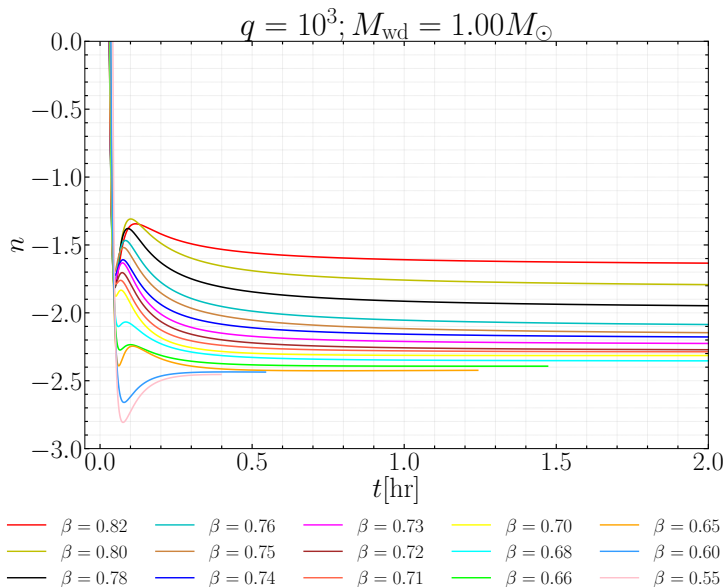
Fallback Process



Fallback Rate



Variation of Power-law Index for the Fallback Rate



Conclusion

Numerical studies play a crucial role in revealing new phenomena associated with IMBHs, due to their relatively unexplored nature.

The late-time slope observed in various partial interactions with IMBHs deviates from the well-known result of $-9/4$ associated with supermassive black holes.

Our study suggests that the observational implications could be substantial; any deviations in the light curves from the expected $-9/4$ scaling may serve as a promising indicator for the presence of IMBHs.