



Astrophysics > Cosmology and Extragalactic Astrophysics

Probing Intermediate Mass Black Holes With Optical Emission Lines from Tidally Disrupted White Dwarfs

Drew Clausen, Michael Eracleous

(Submitted on 28 Oct 2010)

We calculate the emission line spectrum produced by the debris released when a white dwarf (WD) is tidally disrupted by an intermediate-mass black hole (IMBH; $M \sim 10^2 - 10^5 M_{\text{sun}}$) and we explore the possibility of using the emission lines to identify such events and constrain the properties of the IMBH. To this end, we adopt and adapt the techniques developed by Strubbe & Quataert to study the optical emission lines produced when a main sequence (MS) star is tidally disrupted by a supermassive black hole. WDs are tidally disrupted outside of the event horizon of a $< 10^5 M_{\text{sun}}$ black hole, which makes these tidal disruption events good signposts of IMBHs. We focus on the optical and UV emission lines produced when the accretion flare photoionizes the stream of debris that remains unbound during the disruption. We find that the spectrum is dominated by lines due to ions of C and O, the strongest of which are $\text{[C IV]} \lambda 1549$ at early times and $\text{[O III]} \lambda 5007$ at later times. Furthermore, we model the profile of the emission lines in the $\text{[O III]} \lambda 4959, 5007$ doublet and find that it is highly asymmetric with velocity widths of up to $\sim 2500 \text{ km s}^{-1}$, depending on the properties of the WD-IMBH system and the orientation of the observer. Finally, we compare the models with observations of X-ray flares and optical emission lines in the cores of globular clusters and propose how future observations can test if these features are due to a WD that has been tidally disrupted by an IMBH.

Comments: 19 pages, 9 figures, accepted for publication in The Astrophysical Journal

Subjects: **Cosmology and Extragalactic Astrophysics (astro-ph.CO)**

Cite as: **arXiv:1010.6087v1** [astro-ph.CO]

Submission history

From: Drew Clausen [[view email](#)]

[v1] Thu, 28 Oct 2010 20:25:50 GMT (2060kb)

[Which authors of this paper are endorsers?](#)

Download:

- [PDF](#)
- [PostScript](#)
- [Other formats](#)

Current browse context:

astro-ph.CO

[< prev](#) | [next >](#)

[new](#) | [recent](#) | [1010](#)

Change to browse by:

[astro-ph](#)

References & Citations

- [SLAC-SPIRES HEP](#)
([refers to](#) | [cited by](#))
- [NASA ADS](#)

Bookmark([what is this?](#))



