nature portfolio

Peer Review File

A Tidal Disruption Event from an Intermediate-Mass Black Hole Revealed by Comprehensive Multi-wavelength Observations

Corresponding Author: Mr Jialai Wang

This manuscript has been previously reviewed at another journal. This document only contains information relating to versions considered at Nature Communications.

This file contains all reviewer reports in order by version, followed by all author rebuttals in order by version.

Version 0:

Reviewer comments:

Reviewer #1

(Remarks to the Author)
I would like to thank the authors for their responses to my comments. I am happy to recommend the paper for publication.

Reviewer #3

(Remarks to the Author)
This manuscript presents a broadband campaign studying the recent tidal disruption event (TDE) AT 2018cqh. The source has been previously observed showing an X-ray rise of ~550 days, while this work presents new observations showing a prolonged X-ray plateau, in contrast to the usual expected decay. The work also presents a number of independent mass measurements of the central black hole, suggesting a mass of ~1e5 solar masses and therefore is presented as a TDE around an intermediate mass black hole.

The observation of the X-ray plateau phase is a very interesting result in the context of observed TDEs so far, and so is the implication that the TDE occurred around an intermediate mass black hole. Overall, I feel the authors have addressed the previous report well, and the concerns raised have been generally handled appropriately, and therefore I will be able to recommend this work for publication. There is only one point that I would like to raise for the authors to consider.

One of the methods used in this work to estimate the mass of the central black hole is fitting the X-ray spectral shape. Multiple models are used here, however the first of these is using a characteristic black body, resulting in a mass estimate of 1.6e5 Msun. However, this is known to be an unphysical model for this situation, with systematic biases (Mummery A., 2021, MNRAS, 507, L24). The paper does present analysis using more physical disk models, which give masses of 5.1e4 and 6.2e5 Msun, which in the new revision are appropriately marked as estimates only for reference. This additional comment now implies that the first (black body) model is a more reliable method, which I believe was unintended and is likely misleading.

Version 1:

Reviewer comments:

Reviewer #3

(Remarks to the Author)
I thank the authors for making the change to the paper and addressing my concern.

Reviewers' comments:

Reviewer #1 (Remarks to the Author):

I would like to thank the authors for their responses to my comments. I am happy to recommend the paper for publication.

Response: We sincerely thank the reviewer for his/her careful reading of our revised manuscript and are pleased that our revisions met his/her expectations. We truly appreciate his/her time and effort in reviewing our paper.

Reviewer #3 (Remarks to the Author):

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Response: We sincerely thank the reviewer for his/her careful reading of our revised manuscript and for providing helpful comments. We recognize that the additional comment it is currently presented could be misleading. We have deleted this comment and revised the manuscript (see Lines 231-232) to make it clear that the single-temperature blackbody model could introduce potential biases as indicated by Mummery (2021). All changes in the revised manuscript are highlighted in red.

Reviewers' comments:

Reviewer #3 (Remarks to the Author):

I thank the authors for making the change to the paper and addressing my concern.

Response: We sincerely thank the reviewer for his/her careful reading of our revised manuscript and are pleased that our revisions met his/her expectations. We truly appreciate his/her time and effort in reviewing our paper.