

Review: Reproducibility of the First Image of a Black Hole in the Galaxy M87 from the Event Horizon Telescope (EHT) Collaboration

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The paper *Reproducibility of the First Image of a Black Hole in the Galaxy M87 from the Event Horizon Telescope (EHT) Collaboration* by Patel et al. aims to reproduce the M87* imaging results presented by the Event Horizon Telescope (EHT) from observations made in 2017, as well as provide documentation and computational environments that allow others to reproduce the results more easily in the future. The paper gives an overview of the procedures used to generate the images, as well as clearly lays out what software and documentation is available by the collaboration and what is missing. The authors are able to qualitatively reproduce the results using scripts provided by the EHT collaboration, and quantitatively reproduce results that are similar to those presented by the collaboration. I recommend publication after addressing the following comments.

Major comments:

* The paper states that a number of data products and code are not available that are in fact publicly available. These are listed below. I do not believe any additional analysis is necessary, but incorrect statements should be corrected.

- Table 1 and the text states that the raw data is unavailable. The raw data for 2017 observations is available through the EHT website:
<https://eventhorizontelescope.org/for-astronomers/data> Additional information can be found here:
<https://eventhorizontelescope.org/blog/public-data-release-event-horizon-telescope-2017-observations>
- The text states that the ALMA intrasite baseline data is unavailable. This data is publicly available by the ALMA archive here:
https://almascience.eso.org/aq/?result_view=observations&observationsProjectCode=2017.1.00841.V
- The text states that documentation was not available to transform the grayscale output of SMILI and DIFMAP into the colored images. In [3] on page 9 it indicates that the EHT uses the ehtplot Python library. Images are plotted using the 'afmhot_10us' colormap.
<https://github.com/liamedeiros/ehtplot>

* It is important that the authors indicate what versions of the software packages were used in their analysis. In [3] the exact versions for SMILI and eht-imaging

were given. Were these versions or the latest snapshot of the libraries used for the paper's analysis? The latest imaging codebases have changed slightly from what was used to produce the M87 images. The authors state "that they had to correct syntax insides in part of the Python code," which indicates that a different version of Python or the libraries was likely used. The versions of these libraries and the Python version should be indicated in the manuscript. This is likely to also account for differences in the χ^2 reported.

- * The paper states "We also find a larger difference between the original and reproduced values for the DIFMAP pipeline: this is consistent with the discussion of the different time avering used in DIFMAP" It is unclear what this statement is referring to. Did the authors use a different time-averaging than was indicated in [3]?

- * The authors state "Members of the EHT Collaboration highlighted in conversations with the authors of this paper how a qualitative comparison of the images is more interpretable". I urge the authors to clarify this statement with the collaboration members that they have consulted. I believe a quantitative analysis is important, but the members were likely highlighting that there is large enough uncertainty in the reconstructed images that the differences that are obtained by using slightly different software versions leads to differences in the images that are still less than the uncertainty quantified in [3] by reconstructing images with different imaging parameters or pipelines.

Minor comments:

- * The paper mentions that the "EHT project uses Very Long Baseline Interferometry (VLBI) to link together eight radio telescopes..." M87 only used 7 of the 8 telescopes participating in 2017, since the South Pole Telescope is not able to see M87. It is also incorrect to say that the EHT has only 8 telescopes, as the EHT has grown since 2017 to include more telescopes.

- * The paper mentions "The EHT data used for the generation of the first M87 black hole images consists of spatiotemporal data of visibility amplitudes collected over five days in 2017". This is incorrect, as M87 was only observed over four days (nights) in 2017.

* To be consistent, in the section on “Image Building” you should also call the SMILI pipeline an M87 Stokes I Imaging Pipeline. Also, the font used for the eht-imaging pipeline changes throughout the manuscript.

* Table 1 does not make it clear that the EHT has provided scripts for each of the three pipelines to reproduce the fiducial images published. Table 1 only mentions that “Code” is available, but it is not clear that scripts that indicate how to use that code are also provided. Please modify this or the description of what “Code” means in the caption.

* The shorthand for Sagittarius A* is Sgr A* rather than Sag A*.

* The referenced EHT papers should start their citation with “Event Horizon Telescope Collaboration” rather than K. Akiyama.

* It might be helpful to readers if the authors included the following references to the ehtim and SMILI github pages:

ehtim: [Chael+ 2018](#)

(<https://ui.adsabs.harvard.edu/abs/2018ApJ...857...23C/abstract>)

SMILI: [Akiyama et al. 2017a, ApJ, 838, 1](#)

(<https://ui.adsabs.harvard.edu/abs/2017ApJ...838....1A/abstract>)

[Akiyama et al. 2017b, AJ, 153, 159](#)

(<https://ui.adsabs.harvard.edu/abs/2017AJ....153..159A/abstract>)