Report on the outcomes of a Short-Term Scientific Mission[1]

Action number: CA21126

Grantee name: Havva Bostan

Details of the STSM

Title: Searching for Extended Dusty Shells Around Symbiotic Stars Using Python-Based Tools

Start and end date: 03/02/2025 to 18/02/2025

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

(max. 500 words)

The main objective of the mission was to develop efficient Python-based methods for downloading and organizing large amounts of IR imaging data. Before the mission, I had started working on a script using Python tools to achieve this goal, but there were some missing and flawed parts in the initial attempts, which resulted in it not functioning as desired. From the beginning of the mission until the end of the first week, under the supervision of Tiina Liimets and Boris Deshev from University of Tartu, we managed to debug the script and find the right way to download the Spitzer IRAC data. Initially, we created three target lists based on the optical nebular features. These lists included symbiotic stars with optical nebulae, those without optical nebulae, and targets for which there was no information regarding optical nebulae. The initial download process focused on approximately 200 symbiotic stars with unknown optical nebular features (which is the ⅔ of the whole list). Additionally, we developed a framework for subsequent semi-manual analysis, as creating purely automated code proved inappropriate due to the extended and faint features of these types of nebulae. In the second week, we had a visitor to our working group, Maimouna Brigitte from the Astronomical Institute of the Czech Academy of Sciences. We began analyzing the first set of downloaded data, which included around 200 sources. Simultaneously, we modified the data downloading script to gather data also from the WISE mission, which covers the entire sky. This adjustment allowed us to collect data on all symbiotic stars with lower resolution than the Spitzer mission. By the end of the second week, we had successfully downloaded and examined all relevant IRAC and WISE data for symbiotic stars with unknown nebular features. Our strategic plan was executed with optimal efficiency.

1 This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

(max. 500 words)

The primary objective of the mission was to obtain a Python-based workflow for the automated collection and organization of infrared (IR) data from the IRAC database. This objective has been successfully achieved. Additionally, we have developed a method to visualize the data, displaying different wavelengths for each source in separate panels and highlighting the area at the location of each source. This approach accelerates greatly the analysis of this extensive dataset. Looking ahead, our future work plan includes downloading the IRAC and WISE data for our remaining two target lists (the remaining ⅓ of the whole list). After assessing this data, we will conduct analyses of the discovered IR nebulae and prepare our results for publication.