GHOST SV Observation Evaluation Form

Title: Monitoring Raman O VI feature in M 1-21

Program ID: GS-2023A-SV-103

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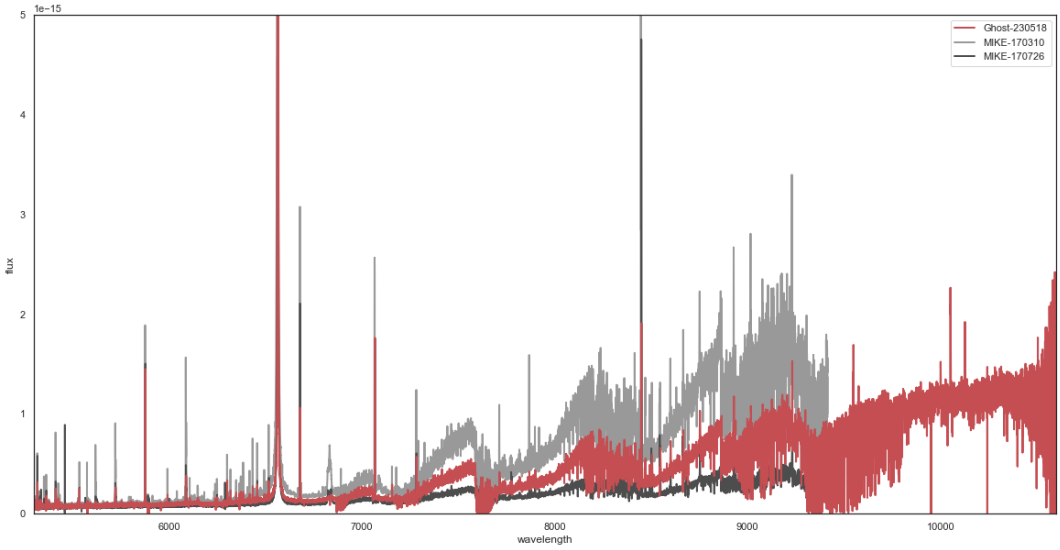
Description of the primary goals and the main findings

Since we detected a significant change in the Raman O VI profile of the symbiotic star M 1-21 from our previous observations with MIKE/Magellan-Clay in 2017, the primary goal of this GHOST observation was to monitor these profile changes.

The GHOST SV observation was performed on May 18th, with the weather conditions recorded as CC50/IQ85-ANY. The average seeing was 1.37”(Blue)/1.19”(Red), respectively. We obtained three datasets, each with an exposure time of 180s, and the stacked spectrum is presented in Figures 1 and 2.

The GHOST data indicates that the spectrum of M 1-21 has evolved over the past five years. While Raman O VI has disappeared, O III 5007 has become stronger. This suggests that M 1-21 has undergone a change in the temperature of the emission region. It is also worth noting that there have been variations in the O III 5007 line profile, displaying multiple emission and absorption components. By conducting a detailed profile analysis of O III lines along with other strong emission lines (such as Balmer lines), we will be able to identify these components and further investigate the structure of symbiotic stars.



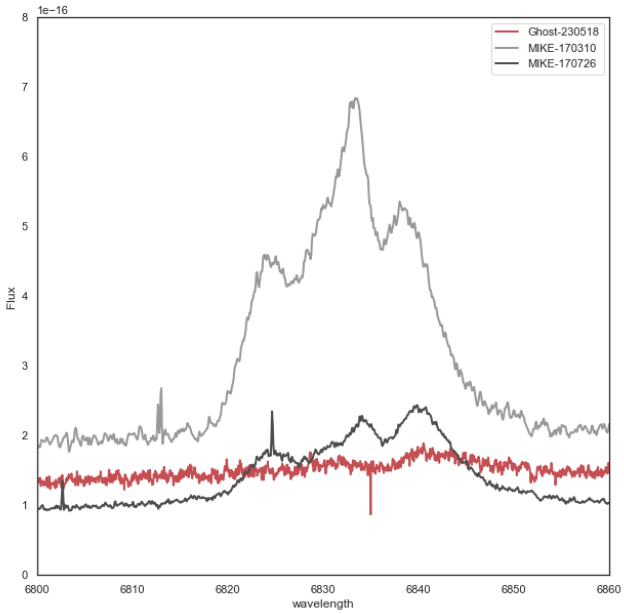
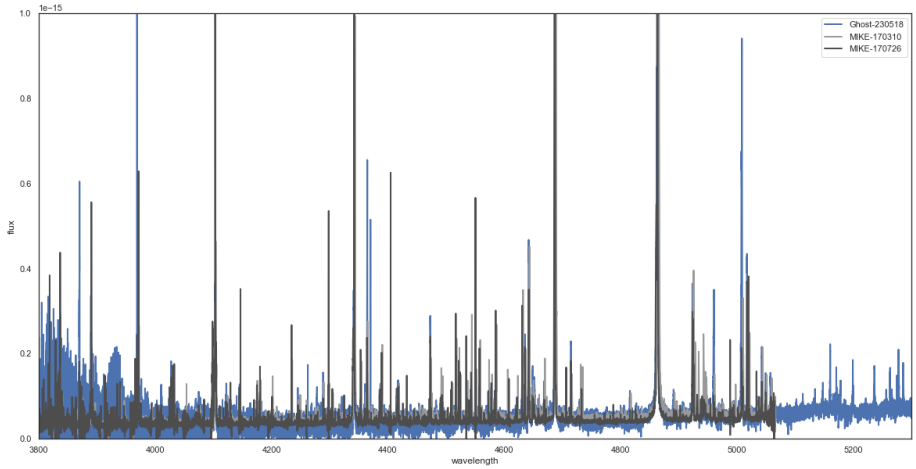


Figure 1. The Red part of spectra of M 1-21. The top panel displays the entire wavelength range, while the bottom panel highlights the Raman O VI 6825 feature. The red line represents the GHOST SV data, while the gray and black lines correspond to the MIKE data.



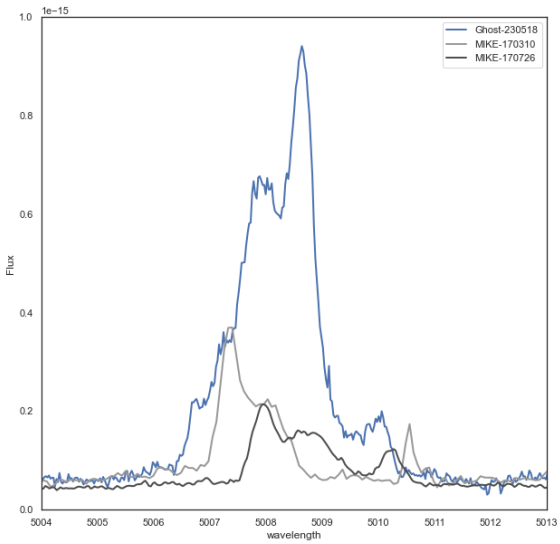


Figure 2. The Blue part of spectra of M 1-21. The top panel displays the entire wavelength range, while the bottom panel zooms in on the O III 5007. The blue line represents the GHOST SV data, while the gray and black lines correspond to the MIKE data.

Additional comments on GHOST performance:

Results of any other GHOST capability tested and comparison with other instruments

Figures 1 and 2 present previous data observed using MIKE with the 6.5m Magellan-Clay telescope in 2017. Both datasets were taken with an exposure of 600 sec under favorable conditions, the seeing was < 0.8”. MIKE with 0.7”x0.5” slit offers a resolving power of ~27,000 (Blue) and ~35,500 (Red).

When comparing the spectra from GHOST and MIKE, it appears that the GHOST data has a lower SNR than the MIKE data, mainly because the GHOST data was obtained under poor seeing conditions, ~ 1.3".

Nevertheless, it’s worth emphasizing that the spectral resolution of GHOST, R~50,000, is clearly reflected in the spectrum. For example, in the case of the O III 5007 line, we can observe more distinct and detailed structures in the GHOST data. Additionally, GHOST covers a broader wavelength range, particularly in the red spectrum, extending > 10500A, providing a more extensive view.

Suggestions for improvements:

Any additional comments about GHOST SV