GHOST SV Observation Evaluation Form

Title: Chemically Peculiar EMP near-circular planar MW star

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Description of the primary goals and the main findings

The early accretion history of the MW *disk* will be revealed by high-resolution spectroscopy of individual stars, even in the era of Gaia and stellar spectroscopic surveys. The targets are rare and expected to be extremely metal poor ([Fe/H] < -3), on near-circular planar orbits, and likely to have a chemical fingerprint that reveals their origins – i.e., properties of the early universe as held in the secrets of the accreted proto-galactic fragments. We requested a standard resolution single-object mode spectrum of Pristine_183.6849+04.8619 (G=14.8), which had previously been observed at CFHT and found to have a disk-like orbit. The GHOST spectrum is needed to provide access to unique spectral features at blue wavelengths and with high SNR to determine carbon and heavy elements (Eu, Sr, Ba) to test its origins and the nucleosynthetic history of its natal gas/ host galaxy.

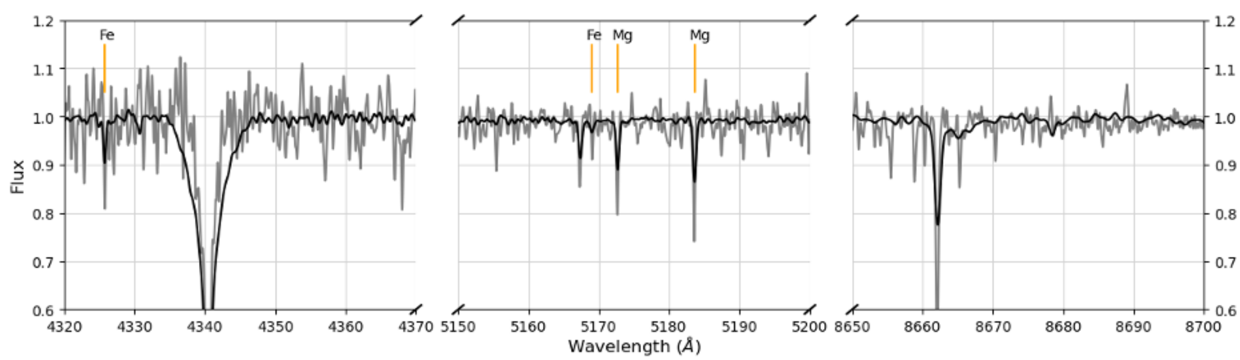

Figure 1: A sample of the Gemini/GHOST spectrum (black, 3x 1800s single-mode standard resolution) is compared with that taken with CFHT/ESPaDOnS (2x 2400s; Venn et al. 2020). The SNR for the GHOST spectrum was requested to be greater than 50 near the Eu II 4129 A (it is 53). A few features are noted (including the H-gamma Balmer line at 4340 and one of the Ca II triplet lines at 8662 A).

A model atmosphere analysis for the GHOST spectrum of P1836849 confirms it is extremely metal poor, with [Fe/H] = -3.27 +/- 0.09 from 41 lines of Fe I and 3 lines of Fe II, assuming

1DLTE.   Our preliminary 1DLTE chemical abundance results for 10 elements (and 2 significant upper limits) are compared to the only 3 elements that were available in the CFHT/ ESPaDoNS spectrum. The 1DLTE abundances hint at the odd-even effect typical of nucleosynthesis in metal-poor core collapse supernovae, emphasizing the low level of chemical evolution in this system, and with few contributions to heavy elements (Sr, Ba) from later AGB stars. The high Ti II abundance is unusual, and likely linked to enrichment from at least one hypernova. A more thorough investigation of the chemistry and orbital properties of P1836849 is in preparation by Anya Dovgal and Kim Venn.

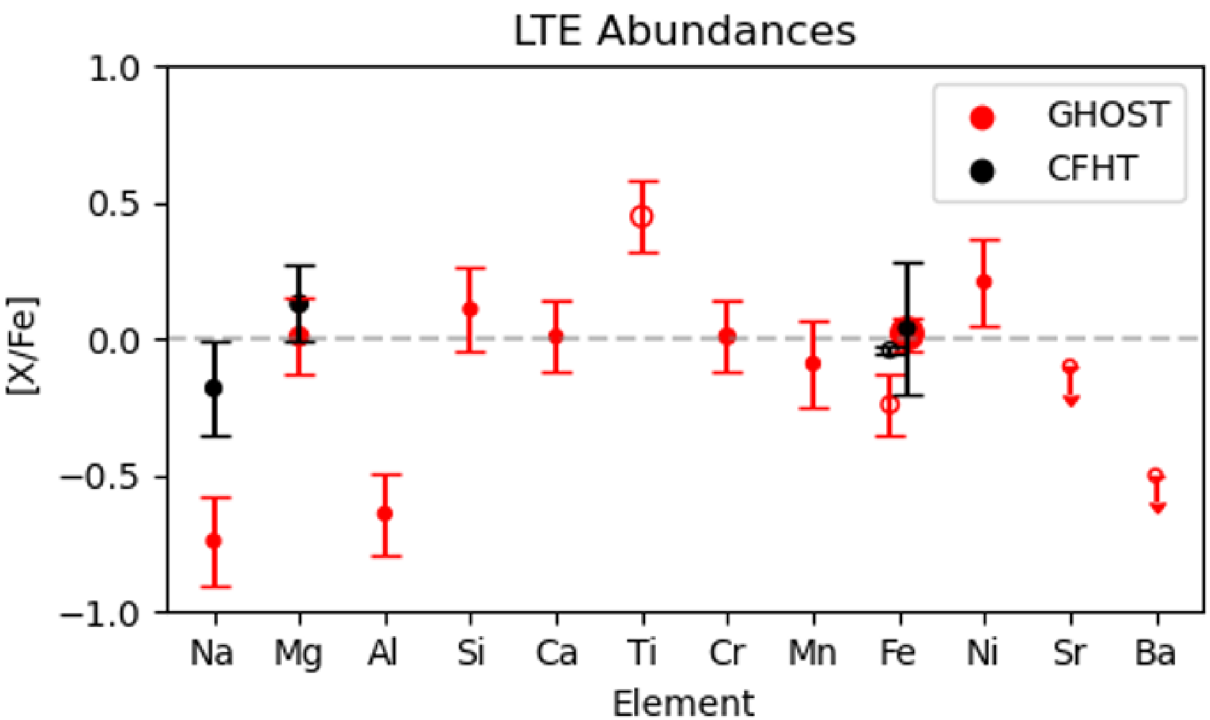

Figure 2: A comparison of the 1DLTE element abundances from the analysis of the CFHT/ ESPaDoNS spectrum (black, Venn et al. 2020) and the Gemini/ GHOST spectrum (red). Filled circles include neutral element species, and open circles for singly ionized species.

Additional comments on GHOST performance:

We tested the single target mode in standard resolution, the quality of the data reduction pipeline, sky subtraction, flat & wavelength solution – particularly at the extreme blue end. Part of this spectrum overlaps with a previously analysed CFHT/ESPaDOnS spectrum (>5000 A) from Venn et al. (2020); see Figure 1.

Suggestions for improvements:

The new GHOSTDR had a few non-trivial issues in selecting the right calibration files, but once those were correctly selected, the reduced science spectrum is exquisite.

Any additional comments about GHOST SV

It was extremely helpful to have the Gemini spectroscopy experts involved in and running this GHOST SV. This helped so much in debugging the data reduction pipeline and its interface with the Gemini archive and dragons environment. Many thanks to the SV team!