

HIGH RESOLUTION OPTICAL SPECTROSCOPY OF A B-TYPE ABUNDANCE STANDARD CANDIDATE IN Ori OB1 — HD 35039¹

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We present LTE analysis of high resolution optical spectra for the B-type abundance standard candidate HD 35039 (HR 1765, 22 Ori) with an ambiguous binary nature. The spectra were obtained with the 3.9-m Anglo-Australian Telescope (AAT) and the UCLES spectrograph. The standard 1D LTE analysis with line-blanketed LTE model atmospheres and spectral synthesis provided fundamental atmospheric parameters of $T_{\text{eff}} = 22.000 \pm 1300$ K, $\log g = 3.5 \pm 0.3$, $\xi = 6.0 \pm 3.0$ km s⁻¹, $v \sin i = 5.0 \pm 1.0$ km s⁻¹, $[\text{Fe}/\text{H}] = -0.3$ dex, and the photospheric abundances of eleven elements. The FEROS spectrum of the star from the public spectra archive were also obtained and used to test the model parameters of the star: Hydrogen Paschen lines (P₁₂, P₁₃, and P₁₄) provided a good fit for the reported model parameters. We have also acquired high resolution HIDES and HERMES spectra of the star. The error margins in the reported model parameters as well as their degeneracies were tested by the Bayesian inference method. We detect for the first time the P III 4059, 4222, and 4246 Å lines and determine the phosphorus abundance, $\log \epsilon(P) = 4.95 \pm 0.3$ dex (i.e. $[\text{P}/\text{H}] = -0.15$ dex), from line synthesis. The obtained argon abundance, $\log \epsilon(\text{Ar}) = 6.55 \pm 0.19$ dex, agrees well with the literature measurements. For the remaining elements, abundances determined in this study for HD 35039 are lower than the average abundances of B dwarfs of well studied OB associations as well as the mean abundances of a sample of early B-type stars in the solar neighbourhood, by up to 0.3 dex. In the FEROS, HIDES, and HERMES spectra, we observe the emission in the high-excitation lines of Si II and Al II. We find a variable radial velocity, with a peak-to-peak amplitude of about 10 km s⁻¹.

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