N18a Determining $T_{\rm eff}$ and [Fe/H] with line-depth ratios using infrared YJ-band spectra

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The effective temperature ($T_{\rm eff}$) and metallicity ([Fe/H]) are fundamental parameters of a star. Ratios of carefully selected line-depths (LDR) can be used to determine $T_{\rm eff}$, but most previous works were done with optical spectra. Recently, 11 line pairs in the H-band (1.51–1.70 μm) and 81 line pairs in the YJ-band (0.97–1.32 μm) were found to give tight LDR–$T_{\rm eff}$ relations, as reported by Fukue et al. (2015) and Taniguchi et al. (2018) for solar-metal giants.

The metallicity and surface gravity of a star can also affect the line depths and LDRs, and thus the effects of these parameters need to be understood and taken into account. We detected the metallicity and gravity effects in YJ-band using the spectra of dwarfs, giants and supergiants taken by the high-resolution spectrograph WINERED. As reported in Jian et al. (2019), the metallicity effect presents when at least one of the line is saturated. The difference between the ionization potentials of the elements considered in each line pair and the corresponding difference in the depths can, at least partly, explain the dependency of the LDR on the gravity. Finally, to make full use of the information included in the LDRs, we have developed a Bayesian approach to determine $T_{\rm eff}$ and [Fe/H] simultaneously. These two parameters can be estimated with high precision, 20 K and 0.05 dex, within $-0.6 <$ [Fe/H] < 0.4 for early-G to mid-K dwarfs and K giants.