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Gaia RVS instrument for the study of stellar populations

Minia Manteiga[1], Diego Ordóñez, Carlos Dafonte, Bernardino Arcay[2], and Ana Ulla[3]

[1] Dept. Ciencias de la Navegación y de la Tierra. Univ. da Coruña
[2] Dept. de Tecnologías de la Inf. y Com. Univ. da Coruña
[3] Dept. de Física Aplicada. Univ. de Vigo

Abstract

Gaia spacecraft will be launched by Spring 2012 and will measure astrometry with unprecedented accuracy for a significant 1% of the objects in the Milky Way. Additionally, two spectrophotometers will determine the SEDs of the objects in the region of 0.3 to 1 microns, and a radial velocity spectrograph (RVS) will provide spectra in the near IR CaII triplet region with an expected SNR between 100 and 20 for F-G-K stars with visual magnitude between 8 and 15. We have been testing several analysis techniques in order to be prepared to extract all possible astrophysical information from RVS stellar spectra. A combination of data processing in transformed domains (Fourier analysis and Wavelet multilevel decomposition) and connectionist systems (Artificial Neural Networks) have proven to be a good approach to derive the fundamental stellar parameters, $T_{\rm eff}$, $\log g$, [Fe/H], and [α/Fe], on the basis of RVS synthetic spectra blurred with noise at different SNR. Signal processing techniques allowed us to estimate and categorize the SNR, which in turn is found to be essential since the optimal algorithm for parameterization is highly dependent on SNR. In the case of low SNR (5–25) spectra, it is found that the wavelet transform provides a competitive approach for parameterization. The derivation of the stellar parameters is performed by the use of ANNs trained with the error backpropagation algorithm. The accuracy in the derivation of parameters is presented for typical galaxy populations.