A FEROS survey of hot subdwarf stars

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Abstract: We have initiated a small survey of twenty hot subdwarfs using the Fiber-fed Extended Range Optical Spectrograph (FEROS) and the 2.2-m telescope at La Silla. The sample includes apparently single objects as well as hot subdwarfs paired with a bright, unresolved companion extracted from our *GALEX* catalogue of hot subdwarf stars (Vennes et al., 2011; Németh et al., 2012). As expected (Kawka et al., 2015; Kupfer et al., 2015), the fraction of radial velocity variables is close to 50%, and, among these, we identified a long-period (62 d) sdO plus G III binary. This particular system should evolve into a close subdwarf plus white dwarf pair during the common envelope phase that follows the second ascent of the giant branch. Newly discovered systems also include short period binaries with periods ranging from 3.5 hours to 5 days and comprised of a hot subdwarf primary and a late-type companion seen in reflection, or a white dwarf companion. We present a preliminary model atmosphere analysis and a summary of results for representative objects in our sample.

High-dispersion spectroscopy: metallicity

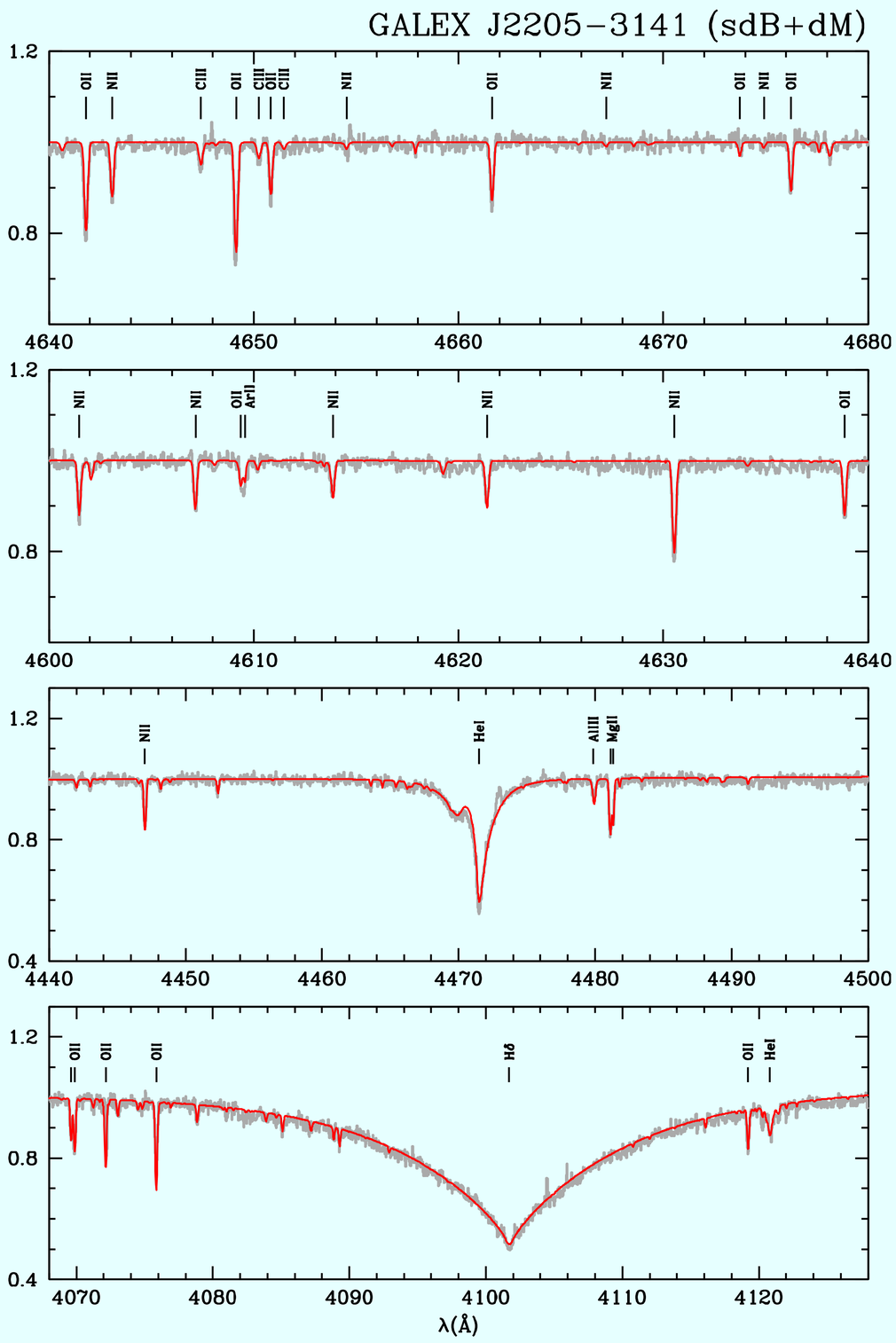

Figure 1: High-dispersion spectra of the hot subdwarf J2205-3141 obtained with FEROS and best-fit non-LTE model (Tlusty/Synspec). The object is in a short period (8.2 hr) binary with a late-type companion showing a strong reflection effect (Kawka et al., 2015). The hot subdwarf exhibits near-solar abundance for most elements and a remarkable excess of nitrogen and argon with respect to oxygen.

Close binaries I: radial velocity and orbital period

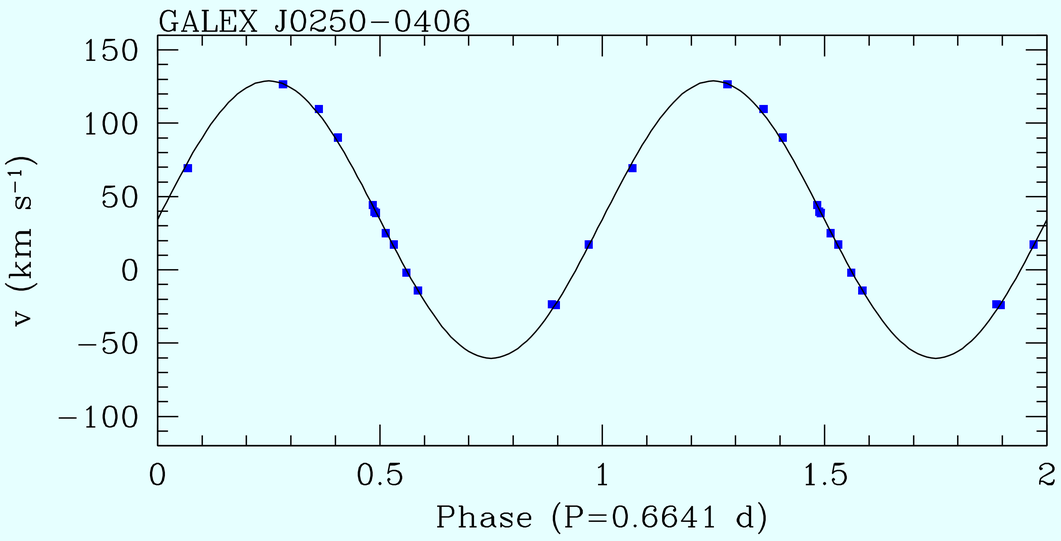

Figure 2: Radial velocity measurements of the sdB star folded on the orbital period ($P = 15.9$ hr). The hot subdwarf in this newly identified system also exhibits a nitrogen excess. A NSVS ligh-curve does not show variability when folded on the orbital period, but the large subdwarf velocity amplitude implies a minimum mass of $0.33\,M_\odot$ for the companion which suggests the likely presence of a normal white dwarf companion ($0.6\,M_\odot$).

Close binaries II: radial velocity and orbital period

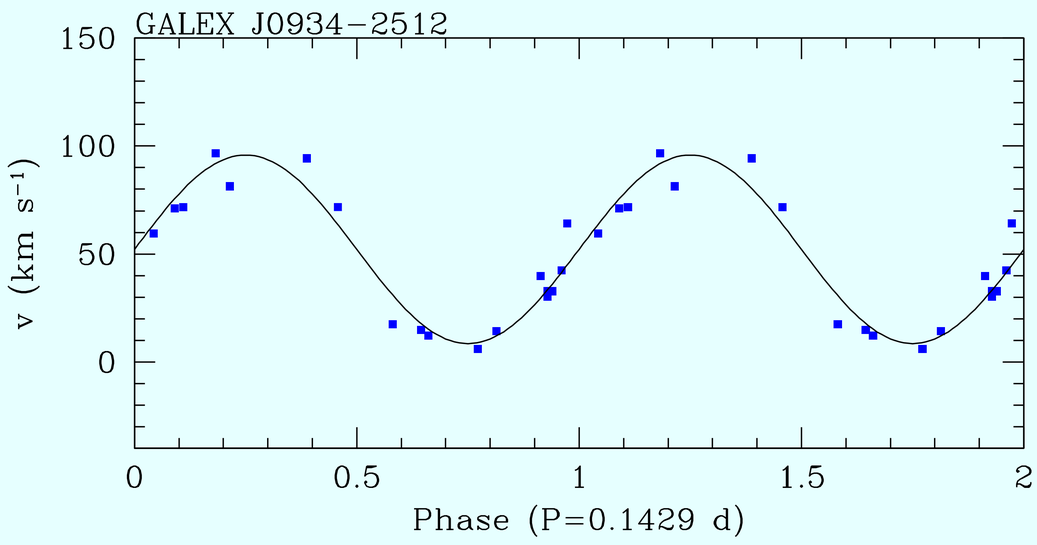

Figure 3: Radial velocity measurements of the sdO star folded on the orbital period ($P = 3.43$ hr). A SuperWASP light-curve does not show variability when folded on this period, but the mass function implies a minimum mass of $0.07\,M_\odot$ for the companion. This system is probably seen at a low inclination.

Abundance pattern in hot subdwarfs: examples

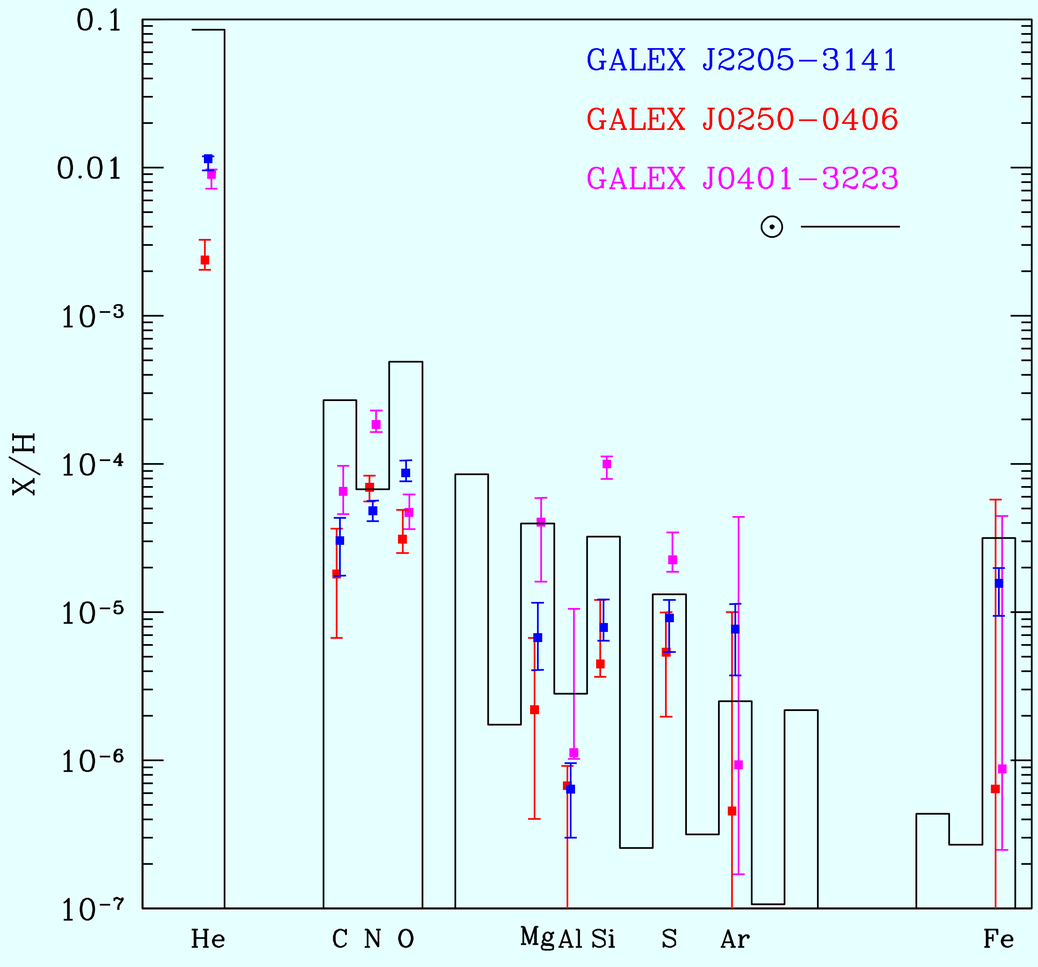

Figure 4: Abundance measurements in three hot hydrogen-rich subdwarfs: J2205-3141 comprised of an sdB primary and a late-type companion, J0250-0405 comprised of an sdB and a likely white dwarf companion, and J0401-3223 which is possibly in a short period system with a very low-mass companion. All three hot subdwarfs exhibit nitrogen excess relative to oxygen and other elements.

Objectives: Our aims are to: (1) extend the present abundance analysis to the full FEROS sample, (2) achieve self-consistent spectral decomposition of the UV-selected subdwarf plus main-sequence binaries based on the FEROS high-dispersion spectra, and (3) identify new radial-velocity variables in the full sample.

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