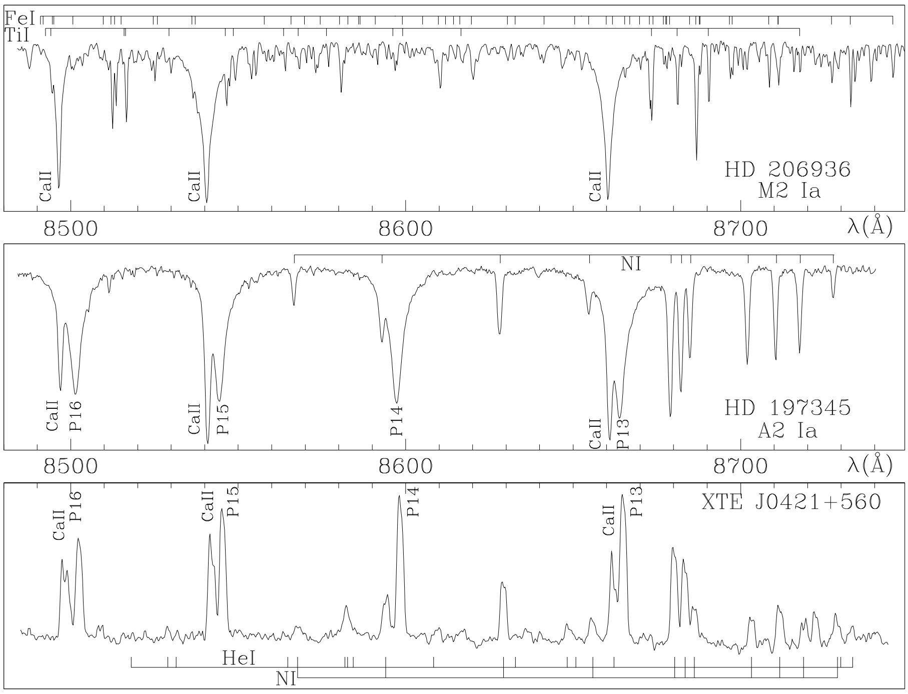

Spectra of the late-type star HD 206936 (top), of the early-type star HD 197345 (middle), and of the X-ray-transient star XTE J0421+560 (bottom), obtained with the echelle spectrograph mounted on the Asiago 1.82-m telescope. The different morphologies of the spectra outline the classification potential of the RVS wavelength range. Figure courtesy of U. Munari.

The Radial Velocity Spectrometer (RVS) is an integral-field spectrograph dispersing the light of the field of view with a resolving power R $\sim$ 11,500. The RVS instrument, like the astrometric and photometric instruments, operates in TDI (time-delayed integration) mode, observing each source about 40 times during the 5 years of the mission. The RVS wavelength range, 847–874 nm, has been selected to coincide with the energy-distribution peaks of G- and K-type stars which are the most abundant RVS targets. For these late-type stars, the RVS wavelength interval displays, besides numerous weak lines mainly due to Fe, Si, and Mg, three strong ionised Calcium lines (at around 849.8, 854.2, and 855.2 nm). The lines in this triplet allow radial velocities to be derived, even at modest signal-to-noise ratios. In early-type stars, RVS spectra may contain weak lines such as Ca II, He I, He II, and N I, although they will generally be dominated by Hydrogen Paschen lines.

Over the 5 years of the mission, the RVS will observe $\sim$5 billion (transit) spectra of the brightest 100–150 million stars on the sky. The on-ground analysis of this spectroscopic data set will be a complex and challenging task, not only because of the data volume but also because the spectroscopic data analysis relies on the multi-epoch photometric and astrometric data. As a consequence, the extraction of radial velocities and astrophysical parameters from Gaia's observations will be performed in a fully automated fashion. Automated methods will also be used to analyse the RVS spectra to extract, for example, chemical-element abundances, rotational velocities, and interstellar reddening.

Radial velocities will be obtained by cross-correlating observed spectra with either a template or a mask. An initial estimate of the source atmospheric parameters derived from the astrometric and photometric data will be used to select the most appropriate template or mask. Iterative improvements of this procedure are foreseen. For stars brighter than $\sim$15-th magnitude, it will be possible to derive radial velocities from spectra obtained during a single field-of-view transit. For fainter stars, down to $\sim$17-th magnitude, accurate summation of the $\sim$40 transit spectra collected during the mission will allow the determination of mean radial velocities.

Atmospheric parameters will be extracted from observed spectra by comparison of the latter to a library of reference-star spectra using, e.g., minimum-distance methods, principal-component analyses, or neural-network approaches. The determination of the source parameters will also rely on the information collected by the other two instruments: astrometric data will constrain surface gravities, while photometric observations will provide information on many astrophysical parameters. Details of the procedures with which to optimally 'combine' Gaia's astrometric, photometric, and spectroscopic data are currently being studied.