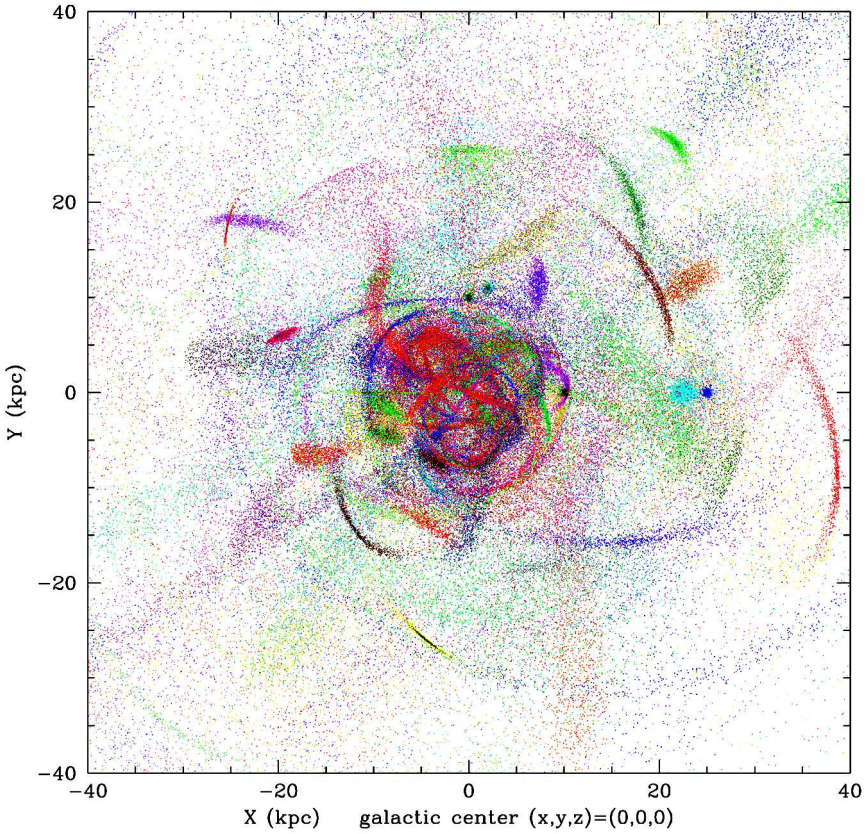

Simulation of a galactic halo formed by accretion of 50 dwarf galaxies over a period of 10 Gyr. Each colour represents an accreted satellite galaxy. Gaia's data will allow astronomers to identify and characterise the accretion events that have taken place in the halo of the Milky Way. Image courtesy of A. Helmi and the 'Spaghetti Project Survey' team.

The primary objective of the Gaia's Radial Velocity Spectrometer (RVS) instrument is the acquisition of radial velocities. These line-of-sight velocities complement the proper-motion measurements provided by the astrometric instrument. Together, these data provide the means to decipher the kinematical state and dynamical history of our Galaxy.

The RVS will provide the radial velocities of about 100-150 million stars up to 17-th magnitude with precisions ranging from 15 km s^{-1} at the faint end to 1 km s^{-1} or better at the bright end. Gaia's data will radically improve our understanding of the Milky Way. It will allow us to probe the gravitational potential and the distribution of dark matter throughout the Galaxy, to map the spiral structure of the Galactic disc, to disentangle, characterise, and constrain the origin and evolution of the stellar populations of the Galaxy, to recover the history of the halo accretion events, and to test the paradigm of the hierarchical formation of galaxies.

The RVS will collect, on average, ∼40 (transit) spectra per star over the 5 years of the mission. The associated multi-epoch radial-velocity information will be ideally suited for identification and characterisation of double and multiple systems. In particular, Gaia will provide masses and radii accurate to a few per cent for thousands of eclipsing binaries. The RVS will also monitor the radial motions of the outer layers of pulsating stars. It will provide pulsation curves for RR Lyrae stars, Cepheids and Miras up to ∼14-th magnitude. Radial velocities will also be used to correct the astrometric data of nearby, fast-moving stars for the effects of 'perspective acceleration'.

The RVS wavelength range, 847–874 nm, is a rich domain. It will not only provide radial velocities, but also many stellar and interstellar diagnostics. The RVS data will effectively complement the astrometric and photometric observations of Gaia's targets, improving object classification. RVS data will also contribute to the derivation of stellar atmosphere parameters, in particular effective temperature, surface gravity, and overall metal abundances. Individual abundances of key chemical elements, e.g. Ca, Mg and Si, will be derived for millions of stars up to ∼12-th magnitude, bringing major improvement in our knowledge of the chemical history and the enrichment processes of the Galaxy. Information on many facets of stellar physics will be extracted from the spectroscopic observations, for example, stellar rotation, chromospheric activity, and mass loss. Finally, from the 862-nm Diffuse Interstellar Band (DIB), RVS data will allow astronomers to derive a 3-dimensional map of interstellar reddening.