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Rediscovering our Galaxy
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The CORAVEL Radial Velocity Data Base

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Abstract. From 1977 to 1999, thousands of accurate radial velocities in both hemispheres were made on a large variety of programmes with the two CORAVEL scanners. The data base of $\sim 350\,000$ individual observations will now be made available to complement the Gaia data.

Keywords. techniques: radial velocities, stars: kinematics, Galaxy: kinematics and dynamics

1. Introduction

The classic technique to measure stellar radial velocities line by line on a spectrogram was long known to be very inefficient. Griffin (1967) then built a dedicated cross-correlation spectrometer and demonstrated in practice the great gains in efficiency and precision of this method. Michel Mayor immediately realised its potential for his own fields – the evolution of the Galactic disk and the properties of Solar-type binaries.

2. The CORAVELs

Mayor introduced five related technical innovations: (1): An échelle grating enables an increase in spectral resolution, efficiency, and thus more precise velocities; (2): a cross-dispersed échelle format allows not only to focus a larger wavelength range on the single detector – a low-noise photomultiplier – but a given velocity produces the same linear shift in all orders; (3): a (hardware) mask of the same format matching $\sim 1\,500$ selected spectral lines in Arcturus should be etched in a metal film on glass; (4): the resulting compact instrument should fit a modest-size telescope ($\sim$ 1 m), and (5): would use modern pulse-counting techniques and on-line computer control.

Realised in collaboration between the observatories of Marseille and Genève (Baranne, Mayor & Poncet 1979), the instrument was named CORAVEL and was built from 1977 in two copies. Both hemispheres between could then be covered by the Swiss 1-m telescope at Observatoire de Haute-Provence and the Danish 1.5-m on La Silla, in cooperation with ESO. Typical velocities errors were ~ 0.3 km s^{-1}, ample for Galactic research and sufficient for studies of most Solar-type binary stars.

3. Dynamical Evolution of the Galaxy

The principal study based on CORAVEL radial velocities was the Geneva-Copenhagen Survey of the Solar Neighbourhood (Nordström *et al.* 2004, Holmberg, Nordström & Andersen 2009 – GCS I-III). The GCS presented isochrone ages, chemical compositions,

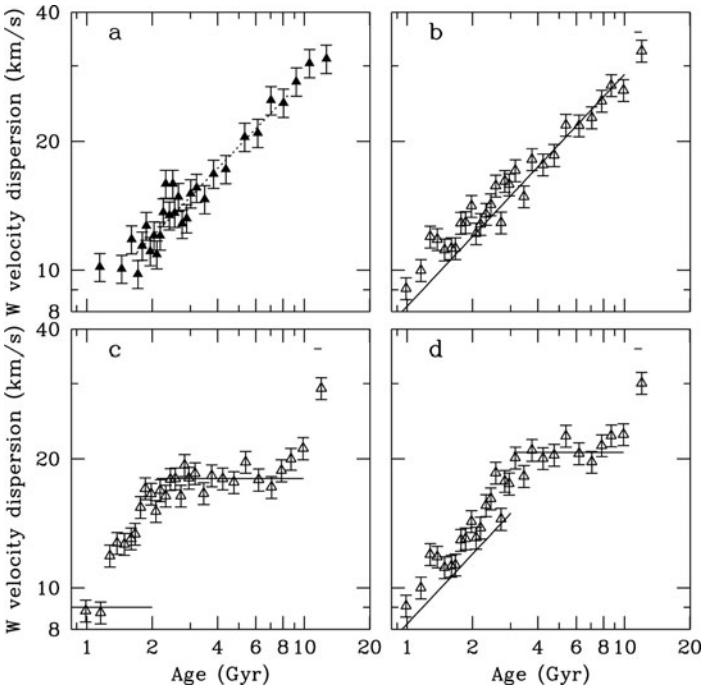

Figure 1. Observed age-velocity relation (*a*) and three model simulations *(b-d)*, illustrating different potential heating mechanisms (from GCS III; further detail in the paper).

distances, velocity vectors, and Galactic orbits for $\sim 15\,000$ Solar-type stars in the Solar neighbourhood – fundamental data for testing all models of Galactic evolution.

4. Velocity zero-point

Careful attention was paid to establishing the velocity zero-point to ~ 0.1 km s^{-1}. This was finally accomplished through the use of a modern fibre-fed, bench mounted and temperature-controlled échelle spectrograph with a low-noise CCD detector (Udry, Mayor & Queloz 1999). Because the two velocity systems will thus be consistent, combining the CORAVEL and Gaia data will provide a baseline of ~ 40 years for radial-velocity coverage of many long-period, low-amplitude variable targets. Making the CORAVEL data base available will thus provide public access to a treasure trove of earlier radial velocities, including many previously unpublished observations.

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