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The kinematical evolution of the Galactic disk

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and RAVE collaboration

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Abstract. We present preliminary results from follow-up observations of a carefully selected sample of subgiant stars from RAVE and Geneva-Copenhagen surveys. We find evidence of rapid saturation of the heating mechanism in the disk, with an abrupt increase of the velocity dispersion for stars older than 9 Gyr.

1. SAMPLE DEFINITION AND FOLLOW-UP OBSERVATIONS

Using high resolution spectroscopy data [7] showed the value of subgiants for dating the Galactic disk. We have selected ∼2000 subgiants candidates from the RAVE survey using RAVEs stellar parameters [6, 8]. We have also selected 404 subgiants (no binaries) from the Geneva-Copenhagen survey (GCS) [3] in the Mv $-T_{eff}$ plane. We performed follow-up observations with the Double Beam Spectrograph (DBS) instrument mounted at the ANU 2.3 m telescope in Siding Spring Observatory. We use a long slit of 5″ width and the 300 B grating, giving a spectral resolution of R = $\lambda/\Delta\lambda \sim 400$. The recorded spectra cover the wavelength range from 3200 Å to 6600 Å. Observations consist of a sequence of target exposure, standard stars, calibration lamps, flats and bias. During the observational campaign we used a wide slit of 5″, which assures that 100% of the star light is collected (depending on the *seeing*), while avoid tracking problems. We also placed the slit parallel to the direction of atmosphere dispersion, i.e, aligning the slit at the parallactic angle to avoid recording incorrect intensities as a function of wavelength that could spoil our flux calibration. Standard stars with the same instrumental setup were obtained each night covering a large range of airmass over the night. This allows us to control the atmospheric extinction in the observed spectra. The final spectra present a typical S/N∼130 at 5500 Å and a S/N∼80 for the Ca II H & K region around 3950 Å. A total of 1253 subgiant candidates spectra were obtained.

2. STELLAR PARAMETERS FROM SPECTROPHOTOMETRY

We derived the stellar parameters using a chi-square minimization technique using empirical model atmospheres from the MILES library [4]. The library consist of ∼1000 stars spanning a large range in atmospheric parameters. The spectra cover the range 3525–7500 Å at 2.3 Å (FWHM) spectral resolution. This technique allows us to derive accurate parameters from low resolution spectrophotometry via flux calibrated spectra. For reddening corrections we use the standard value of $R(V) = A(V)/E(B-V) = 3.1$. We redden the model and we use the $E(B-V)$ as a free parameter together with T_{eff}, [M/H] and log g in the χ^2 fitting. Reddening effects are not large for our stars, as the selected RAVE stars are at $|b| \geq 25$ degrees and the GCS stars are in a very local volume with a radius lower than 100 pc.

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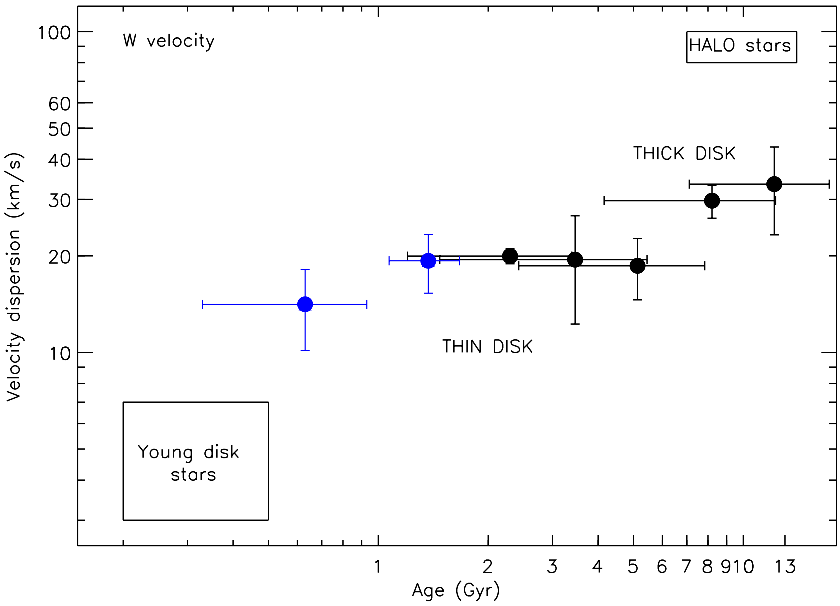

Figure 1. The age-velocity relation for our sample of subgiants (black points) and a sample of young open clusters (blue points) per age bin. We also indicate the position of the thin/thick/halo stars according to their typical W-velocity value and age range.

A typical value in E(B − V) for our stars is ∼0.09. Comparisons between our spectrophotometry estimates and these derived values from high resolution spectroscopy revealed small offsets in both temperature (200 K) and gravity (0.18 dex). The final temperatures, metallicity and gravities showed scatter with respect to high resolution (PASTEL catalogue [5]) of 153 K and 0.2 dex respectively.

3. THE AGE-VELOCITY RELATION IN THE SOLAR VICINITY

Our sample of subgiants, spanning a few kpc from the Galactic plane, is well suited to investigating the age-velocity relation (AVR) of the disk. The W velocity suitable component to investigate the disk heating problem. To derive the ages of stars we use the method developed in [1], adopting a Gaussian probability density for T_{eff}, log g and [m/H] centered at the measured values we determine the probability density distribution for the age. The procedure makes no assumption on the initial mass function, the metallicity distribution, or the star formation rate. We use the isochrones published by [2].

The results (see Fig. 1) suggest that vertical disk heating saturates around 20 km/s and there is an abrupt increase of the velocity dispersion for stars older than 9 Gyr.

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