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Star formation history and dynamical evolution of the solar neighbourhood

Andreas Just and Kseniia Sysoliatina

Zentrum für Astronomie der Universität Heidelberg, Astronomisches Rechen-Institut, Mönchhofstr. 12-14, 69120 Heidelberg
email: `just@ari.uni-heidelberg.de`

Abstract. We used our detailed analytic local disc model to compare predictions in number counts, colour distribuitons and kinematics with a data set extracted from a combination of TGAS and RAVE catalogues. We find generally a very good agreement with some deviations close to the Galactic plane.

Keywords. Galaxy: disk, Galaxy: kinematics and dynamics, Galaxy: evolution, Galaxy: solar neighbourhood

1. The local disc model

In a series of papers (Just & Jahreiß 2010; Just, Gao, Vidrih 2011; Rybizki & Just 2015) we have published a self-consistent vertical disc model of the thin and thick disc in the solar cylinder. The model is based on a series of isothermal stellar subpopulations with a time resolution of 25 Myr. Their properties are described by four analytic input functions, namely the star formation history (SFR), the IMF, the age-velocity dispersion relation (AVR), and the age-metallicity relation (AMR). Based on this model density, age and velocity distributions of all stellar types can be predicted.

2. TGAS-RAVE data

We combine the TGAS catalogue (Gaia collaboration 2016) with the RAVE catalogue (Kunder *et al.* 2017) resulting in 6-D phase space coordinates for the sky region, where the RAVE and the TGAS completeness functions are available. Out of this sample we select thin disc stars ([Fe/H]>-0.6, [Mg/Fe]<0.2) in the solar cylinder ($D_{xy} < 300\,\mathrm{pc}$) with relative parallax errors smaller than 30%. Our final sample contains 26,000 stars. For this area of the sky we derive theoretical stellar populations along each line of sight and apply the 3-D extinciton map of Green *et al.* 2015. Then we apply the parallax errors of Gaia and the completeness functions of RAVE and Gaia to the sample. Finally, we determine colour distributions, vertical number profiles and velocity distribution functions and compared it to the observed data (see Fig. 1).

We find that the model is overall consistent with the TGAS-RAVE sample in number densities, colour and velocity distributions. Below $\sim 100\,\mathrm{pc}$ our model predicts too many stars and a dynamically too cool core, because the young and dynamically cold populations have a thickness, which is slightly too large. In the Hess diagrams we see that the red clump in the data is much more smeared out in colour.

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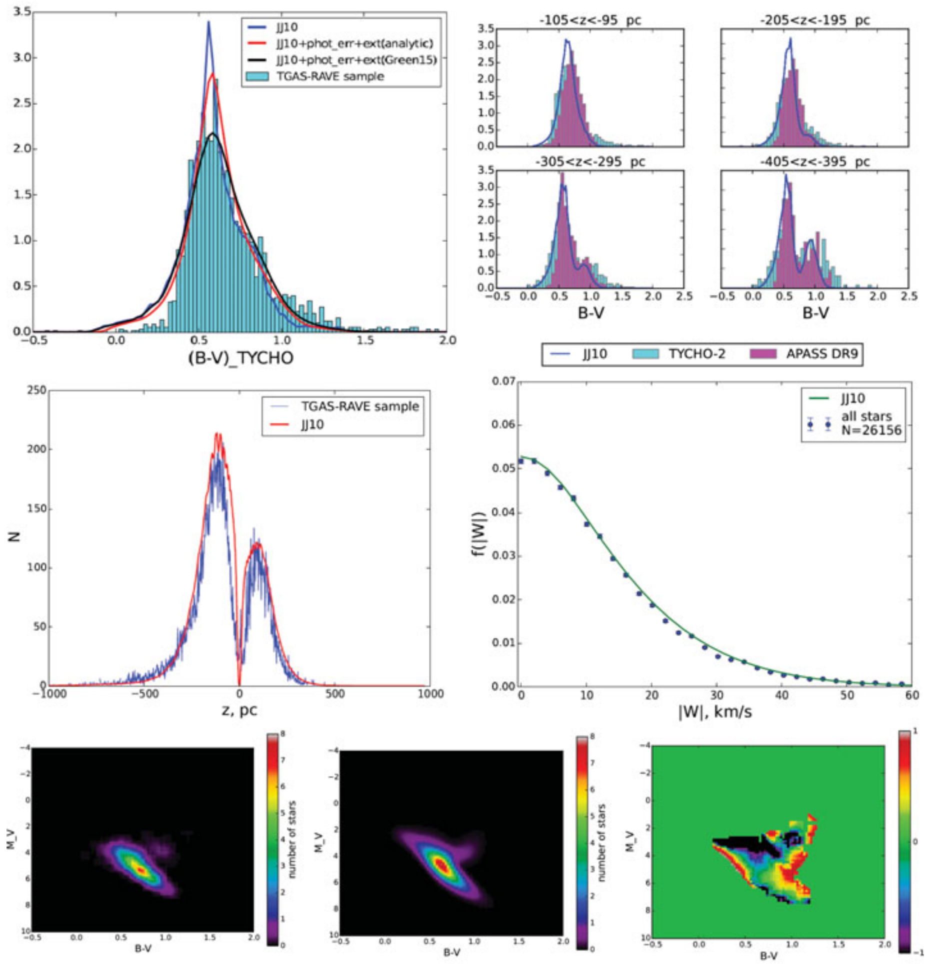

Figure 1. Top row: Impact of extinction on the total colour distribution (left); predicted and observed colour distributions at different z-slices (right). Second row: Number of stars as function of z (left); velocity distribution function of the full sample (right). Bottom row: Hess diagrams of data (left), model (middle) and their relative difference (right).

use of data from the European Space Agency (ESA) mission Gaia, processed by the Gaia Data Processing and Analysis Consortium (DPAC). Funding for the DPAC has been provided by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement.

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