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Physics and Structure of the Galactic disc(s)

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Abstract. The combination of classical models of chemical evolution with radial mixing and dynamics of the Galactic disc has opened alternative methods of understanding the detailed structure of the solar neighbourhood. I will show how radial mixing alters the views on chemical evolution as demonstrated by Schönrich & Binney (2009). I will explain how the model gives rise to a very natural division of the Galactic disc into a thick and a thin component, which can be examined in the light of detailed observational studies combining information on kinematics, chemistry and stellar ages.

Keywords. Galaxy: structure, Galaxy: evolution, Galaxy: abundances, Galaxy: kinematics and dynamics

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Since the result of Sellwood & Binney (2002) it was known that from a theoretical point of view radial mixing must play a crucial role in the evolution of galactic discs. Schönrich & Binney (2009a) showed that by including radial mixing a chemical evolution model with only two free parameters gives a perfect fit to the full metallicity distribution provided by the Geneva-Copenhagen Survey (Nordström *et al.* 2004, Holmberg *et al.* 2007). In addition, no such fit is possible in a physically sound model without radial mixing. Without any further adaption the model provides - by the intrusion of stars from different galacto-centric radii into the solar neighbourhood - a natural explanation for the difference between theoretical predictions and observations of the time dependence of stellar velocity dispersions and especially for all the detailed links between chemistry and kinematics that were observed by Haywood (2008). It is predicted (cf. Schönrich & Binney 2009b) that no kinematic selection on a single disc component can be clean. The model further naturally gives rise to a thick disc created by mixing alone and not requiring any hiatus in star formation, matching all its properties to the observed precision. These are especially the abundance "gap" between high and low alpha element enrichment, the vertical density distribution as measured from the SDSS data by Jurić *et al.* (2008) and the detailed properties in age, metallicity and velocity space of the thin and thick disc under a kinematic selection as performed by Bensby *et al.* (2005). On these grounds there is no more convincing evidence for a hiatus of star formation in the past of the Galactic disc.

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