

The Mixed Origin of the Galactic Thick Disk†

W. Y. Cui^{1,2}, C. Liu³, P. de Laverny⁴, A. Recio-Blanco⁴ and G. Van de Ven⁵

¹Department of Physics, Shandong University, Jinan, Shandong 250100, China
email: wycui@bao.ac.cn

²Department of Physics, Hebei Normal University, Shijiazhuang, Hebei 050024, China

³National Astronomical observatories, Chinese Academy of Sciences, Beijing 100012, China

⁴Observatoire de la Côte d'Azur, Dpt. Cassiopée UMR6 202, 06 304 Nice Cedex 4, France

⁵Max-Planck-Institut für Astronomie, Königstuhl 17, D-69117 Heidelberg, Germany

Abstract. We found that the thick disk stars of the Galaxy should form from gas-rich mergers and minor merger or radial migration.

Keywords. Galaxy, abundances, disc, formation, kinematics and dynamics.

1. Introduction

Since the thick disk of the Milky Way has been discovered, many formation scenarios were proposed. However, it is still a debated issue. In this work, we investigate the chemo-orbital properties of 493 disk stars, to study the origin of the thick disk stars. The abundance data were compiled by Venn *et al.* (2004).

2. Results

We follow Liu & van de Ven (2012) to use the circularity L_z/L_c to separate the stars into two groups: the CIRC stars with $L_z/L_c > 0.85$ and the ECC stars with $L_z/L_c < 0.8$.

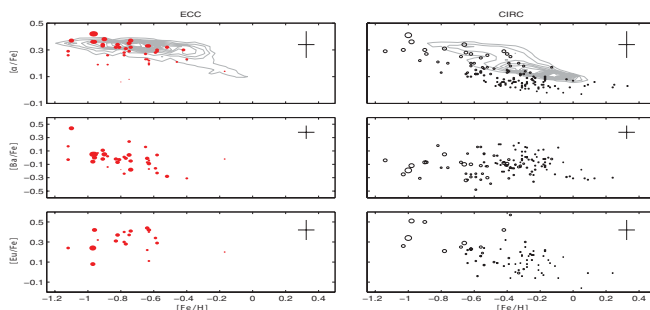


Figure 1. $[X/Fe]$ vs. $[Fe/H]$ for ECC (filled circles) and CIRC stars (unfilled circles).

Different evolution tracks of $[X/Fe]$ vs. $[Fe/H]$ imply different origins of the ECC and CIRC stars (figure 1). The ECC stars are likely originated from gas-rich mergers and the thick disk CIRC stars are likely heated from the old thin disk stars through minor merger or radial migration.

† This work is supported by NSFC 1100302, U1231119, 11273011, CPSF 2013M531587, NSFH A2011205102, CPRC034.