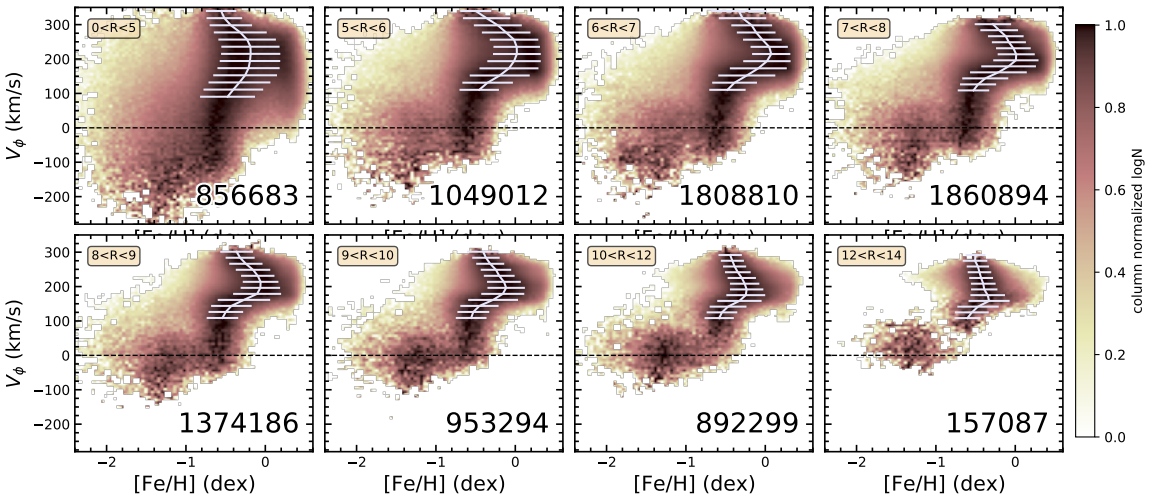

Figure 1. Column normalized number density of stars at various radial bins indicated by the text at the top left corner. The white curves at each panels is the mean value of the fitted Gaussian distribution to the metallicity distribution of stars at small V_ϕ bins as a function V_ϕ, and those horizontal white lines indicates the 1σ metallcitity dispersion at the corresponding V_ϕ bin. See texts for more information. The number at the bottom right corner denotes the number of stars at that radius bin.

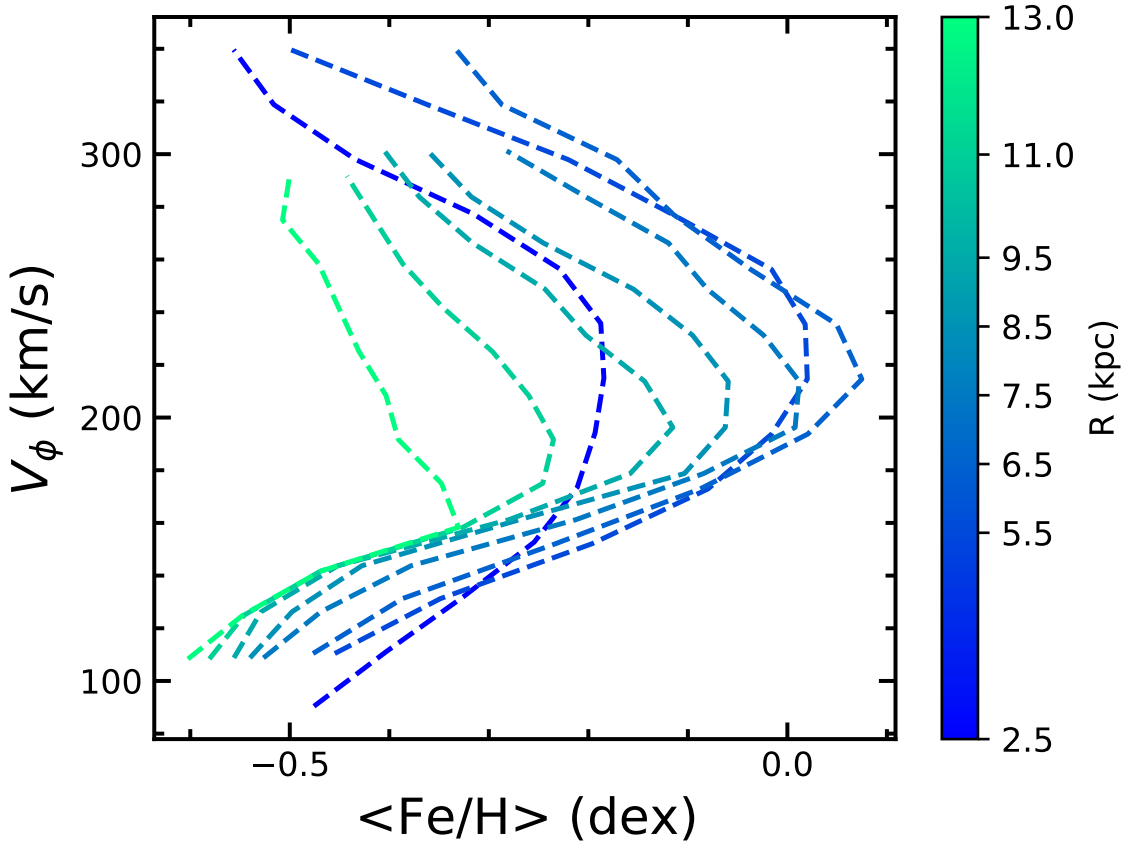

Figure 2. All the white curves in Figure 1 plotted in one panel, the color of those curves indicates the radius bin they belong to.

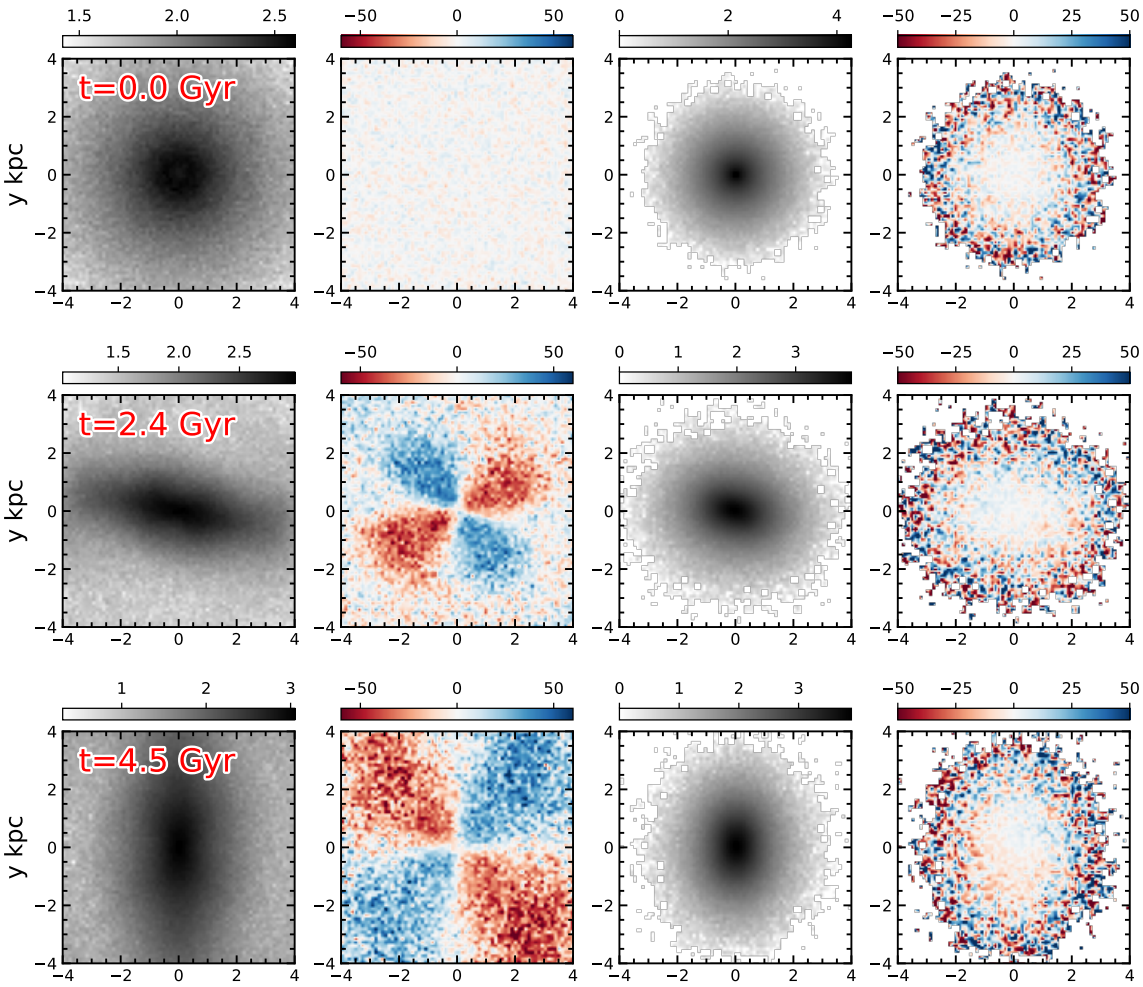

Figure 3. .

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The chemodynamical properties of the Galactic bulge

XIAOJIE LIAO,[1] ZHAOYU LI,[1] IULIA SIMION,[2] AND JUNTAI SHEN[1]

[1] *Department of Astronomy, School of Physics and Astronomy, 800 Dongchuan Road, Shanghai Jiao Tong University, Shanghai 200240, People's Republic of China*
[2] *100 Guilin Rdoad, Shanghai Normal University, Shanghai 200234, People's Republic of China*

ABSTRACT

We present a chemodynamical analysis of a large sample across the whole disk selected from Gaia-XP-spectra-derived dataset. When dividing the sample into a subsequent of annuluses, a universal chemodynamical trend exists from the disk to the bulge in the row normalized density map in the azimuthal velocity V_ϕ and metallicity [M/H] space is found, that is, a V-shaped structure stacked with a vertical band shows up in all radial bins, which are considered to refledt the thin, thick disk and the Splash respectively. The median behaviour of the universal trend exhibits a regulated transition with radius all the way into the inner Galaxy, thus implying a disk origiin for the majority of bulge stars. Further split the bulge population in the V_ϕ and [M/H] plane into 5x5 grids and study the

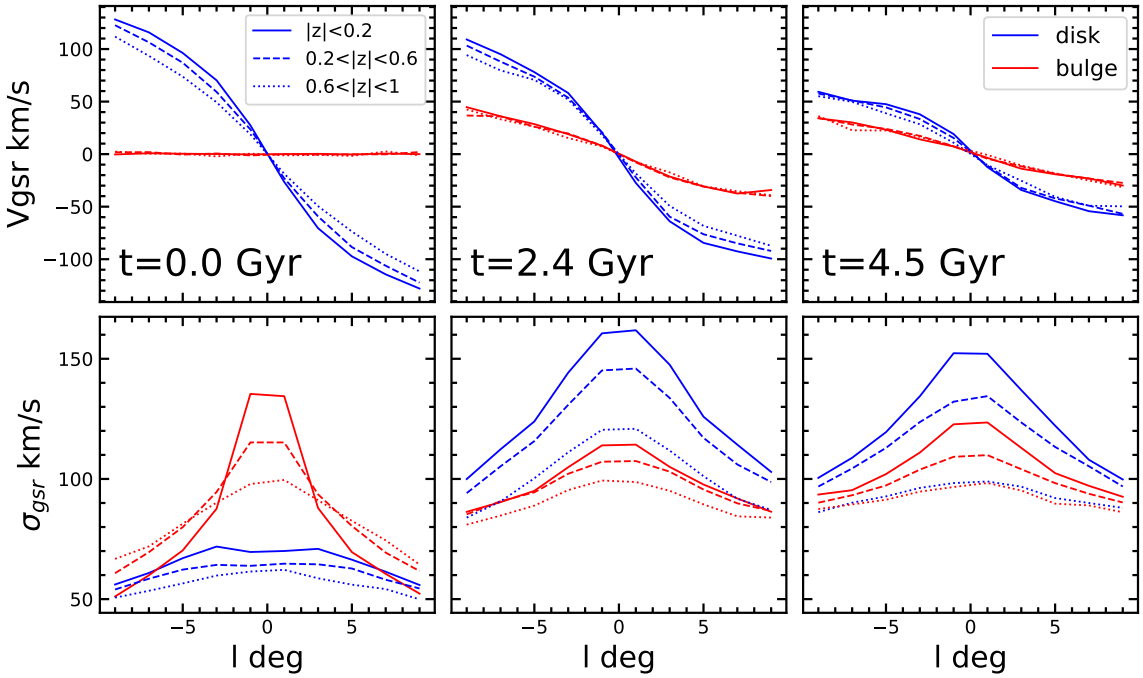

Figure 4. .

kinematical properties of those divided populations, we found a well defined boundary that separates the bulge stars into relatively hot and cold groups, the populations in the cold groups all show the V_R butterfly pattern in the x-y plane and cylindrical rotation that are strong evidence of bar, while all the populations in the hot group does not show butterfly pattern but some of them still exhibit cylindrical rotation, which implies that the cylindrical rotation is not an unique feature of bar that used to be thought as unique in literature. We perform a N-body simulation with an initially non-rotating spherical structured placed, which turns out to be that this non-rotating component would be spun up in a cylindrical way by the later formed bar that is disk-originated, and the spherical structure do not involved in the bar formation since it does not exhibit the V_R butterfly pattern, which explains the phenomenon seen in observation.

Keywords: Galaxy: bulge — Galaxy: Chemistry and kinematics

1. DISSCUSION

APPENDIX

A. APPENDIX INFORMATION