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The structure of the Milky Way stellar disk*

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ABSTRACT

We used the LAMOST DR5 OB stars sample to obtain the scaleheight and probability density function of stellar disk of the Milky Way.In our model, the distribution of stars perpendicular to the plane of the Galaxy is given by two exponential disks (thin disk plus thick disk).Also, based on star counts, we derive the scaleheights of the thin disk to be 0.175kpc and of the thick disk to be 1.28kpc, respectively, with a local density of 80% of the thin disk.

Keywords: Galactic:disk – Galactic:structure – stars:OB-type

1. INTRODUCTION

The stellar density profile is of importance in unveiling the nature of the Galaxy. Either the photometric survey data, which are supposed to be complete to some extent, or the spectroscopic survey data, which can provide more accurate stellar parameters but obviously do not completely cover the sky due to the lower efficiency of the sampling, can be used to count the stars in three-dimensional space. Although star count modeling has been studied for a long time, not until recently does it give reliable measurements of the Galactic disks based on modern surveys fitted the star counts of various spectral types of stars from the LAMOST spectroscopic survey data with two exponential disks.

2. DATA

we use OB stars observed in the LAMOST survey to probe the structure of the thin disc and thick disc.We select the OB stars from the LAMOST DR5 catalogue, which contains about 9.01 million stellar spectra. We select those OB stars with K ¡ 14.3 mag.Note that most of the LAMOST OB stars are within this range, so such a cut will not induce a substantial selection effect in the samples.

3. STAR COUNT MODEL

At a given R bin, the vertical stellar density profile is composed of two components: the thin and thick discs. We adopt the exp model for the thin and thick discs . For the thin disc component, the vertical density profile at given R can be written as

$$v_{thin}(Z \mid R) = v_0(R)[1 - f(R)]e^{-Z \backslash h_1(R)} \tag{1}$$

where 0(R) is the total stellar density at Z = 0, f(R) are the fractions of thick disc at Z = 0, and h1(R) is the scaleheight of the thin disc.All these parameters are functions of R without any pre-defifined analytical form. For the thick disc, this becomes

$$v_{thick}(Z \mid R) = v_0(R)f(R)e^{-Z \backslash h_2(R)} \tag{2}$$

Similarly to the thin disc, the scaleheight of the thick disc, hz2(R), is also a function of R without pre-defifined form.

3.1. *RESULTS*

We separate the OB samples into R bins centred at R = 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0 and 15.0kpc. The width of bins is 0.5 kpc.The principles regarding the separation of the bins along R are as follows. First, we expect the bin size to be as small as possible, to obtain better resolution in R. Secondly, we need to keep as many stars as possible in each bin so that we can have good coverage in the Z direction.

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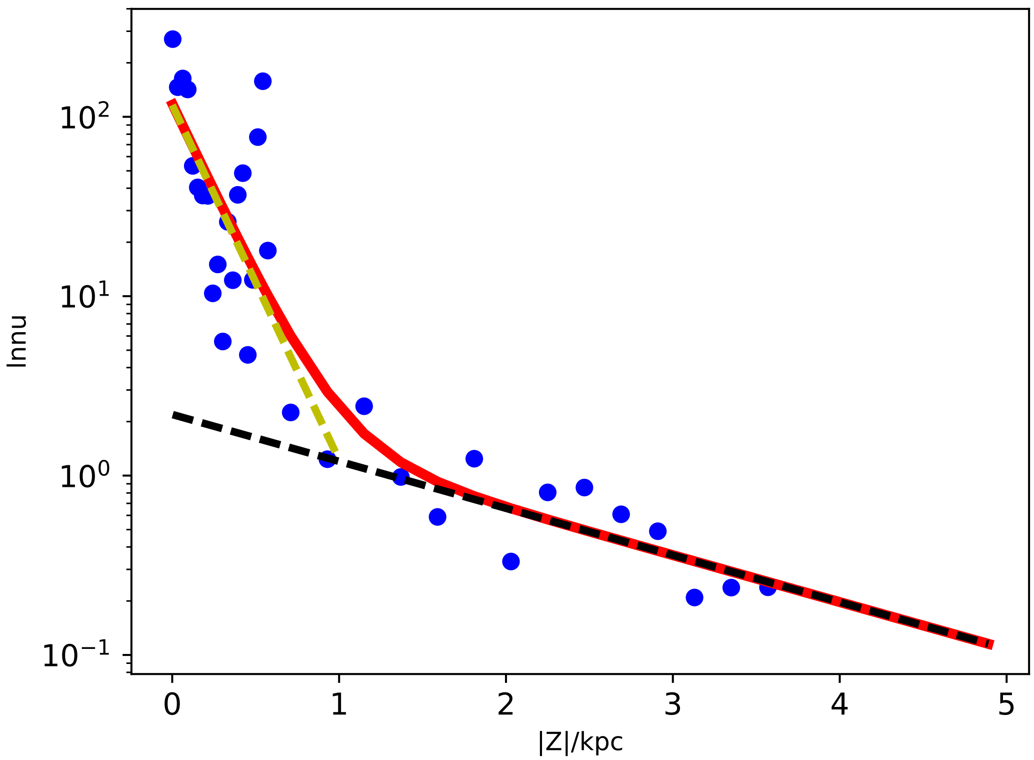

Figure 1. Fitting the data points R=7kpc to R=8kpc area with the curve-fit.