The Galactic disk structure
-- the rings and waves
Herschel's Galaxy model

(~200yrs ago)

6400 light years

1300 light years

Solar system

Tidal Stream in the Plane of the Milky Way
If it’s within 30° of the Galactic plane, it is tentatively assigned to this structure

NORTHERN SKY

SOUTHERN SKY

(~before SDSS)

100,000 ly

20,000 ly

Nuclear bulge

Galactic nucleus

Disk

Globular clusters

Triangulum Stream

Sagittarius Stream

Hercules-Aquila Cloud

Orphan Stream

Virgo Overdensity

SDSS DR8 / Bonaca, Giguere, Geha
RINGS AND RADIAL WAVES IN THE DISK OF THE MILKY WAY

YAN XU\textsuperscript{1,2}, HEIDI JO NEWBERG\textsuperscript{2}, JEFFREY L. CARLIN\textsuperscript{2}, CHAO LIU\textsuperscript{1}, LICAI DENG\textsuperscript{1}, JING LI\textsuperscript{3}, RALPH SCHÖNRICHT\textsuperscript{4}, AND BRIAN YANNY\textsuperscript{5}

\textsuperscript{1}Key Laboratory of Optical Astronomy, National Astronomical Observatories, Chinese Academy of Sciences, Datun Road 20A, Beijing 100012, PR China; xuyan@bao.ac.cn
\textsuperscript{2}Department of Physics, Applied Physics and Astronomy, Rensselaer Polytechnic Institute, Troy, NY 12180, USA
\textsuperscript{3}Shanghai Astronomical Observatory, Chinese Academy of Sciences, 80 Nandan Road, Shanghai 200030, China
\textsuperscript{4}Rudolf Peierls Centre for Theoretical Physics, University of Oxford, 1 Keble Road, OX1 3NP, UK
\textsuperscript{5}Experimental Astrophysics Group, Fermi National Accelerator Laboratory, P.O. Box 500, Batavia, IL 60510, USA

Received 2014 September 30; accepted 2015 January 14; published 2015 March 11

ABSTRACT

We show that in the anticenter region, between Galactic longitudes of $110^\circ < l < 229^\circ$, there is an oscillating asymmetry in the main-sequence star counts on either side of the Galactic plane using data from the Sloan Digital Sky Survey. This asymmetry oscillates from more stars in the north at distances of about 2 kpc from the Sun to more stars in the south at $4-6$ kpc from the Sun to more stars in the north at distances of $8-10$ kpc from the Sun. We also see evidence that there are more stars in the south at distances of $12-16$ kpc from the Sun. The three more distant asymmetries form roughly concentric rings around the Galactic center, opening in the direction of the Milky Way’s spiral arms. The northern ring, 9 kpc from the Sun, is easily identified with the previously discovered Monoceros Ring. Parts of the southern ring at 14 kpc from the Sun (which we call the TriAnd Ring) have previously been identified as related to the Monoceros Ring, and others have been called the Triangulum Andromeda Overdensity. The two nearer oscillations are approximated by a toy model in which the disk plane is offset by the order of 100 pc up and then down at different radii. We also show that the disk is not azimuthally symmetric around the Galactic anticenter and that there could be a correspondence between our observed oscillations and the spiral structure of the Galaxy. Our observations suggest that the TriAnd and Monoceros Rings (which extend to at least 25 kpc from the Galactic center) are primarily the result of disk oscillations.

\textit{Key words}: Galaxy: disk – Galaxy: kinematics and dynamics – Galaxy: structure
Flare in the Galactic stellar outer disc detected in SDSS-SEGUE data

M. López-Corredoira\textsuperscript{1,2} and J. Molgó\textsuperscript{3}

\textsuperscript{1} Instituto de Astrofísica de Canarias, 38205 La Laguna, Tenerife, Spain
e-mail: martinlc@iac.es
\textsuperscript{2} Departamento de Astrofísica, Universidad de La Laguna, 38206 La Laguna, Tenerife, Spain
\textsuperscript{3} GRANTECAN S.A., E-38712, Breña Baja, La Palma, Spain

Received: 24 February 2014
Accepted: 24 May 2014

Abstract

Aims. We explore the outer Galactic disc up to a Galactocentric distance of \( \approx 30 \) kpc to derive its parameters and measure the magnitude of its flare.

Methods. We obtained the 3D density of stars of type F8V-G5V with a colour selection from extinction-corrected photometric data of the Sloan Digital Sky Survey – Sloan Extension for Galactic Understanding and Exploration (SDSS-SEGUE) over 1400 deg\(^2\) in off-plane low Galactic latitude regions and fitted it to a model of flared thin+thick disc.

Results. The best-fit parameters are a thin-disc scale length of 2.0 kpc, a thin-disc scale height at solar Galactocentric distance of 0.24 kpc, a thick-disc scale length of 2.5 kpc, and a thick-disc scale height at solar Galactocentric distance of 0.71 kpc. We derive a flaring in both discs that causes the scale height of the average disc to be multiplied with respect to the solar neighbourhood value by a factor of \( 3.3^{+2.2}_{-1.6} \) at \( R = 15 \) kpc and by a factor of \( 12^{+20}_{-7} \) at \( R = 25 \) kpc.

Conclusions. The flare is quite prominent at large \( R \) and its presence explains the apparent depletion of in-plane stars that are often confused with a cut-off at \( R \geq 15 \) kpc. Indeed, our Galactic disc does not present a truncation or abrupt fall-off there, but the stars are spread in off-plane regions, even at \( z \) of several kpc for \( R \geq 20 \) kpc. Moreover, the smoothness of the observed stellar distribution also suggests that there is a continuous structure and not a combination of a Galactic disc plus some other substructure or extragalactic component: the hypothesis to interpret the Monoceros ring in terms of a tidal stream of a putative accreted dwarf galaxy is not only unnecessary because the observed flare explains the overdensity in the Monoceros ring observed in SDSS fields, but it appears to be inappropriate.
Structure of the Galaxy

- streams
- bar
- warp

Halo SF regions(?)