evolution including orbital expansion/contraction, orbital perturbation and disruption by third body encounters, RD-LMXB lifetimes, statistics of LMXB vs. MSPs, post-accretion vaporization and possible complete evaporation of low-mass companion stars. We discuss in detail the 'accretion binary' 4U 1820-30, and the 'post-accretion binary' PSR 1744-24A whose evolution may have been strongly influenced by both primary's radiation and star encounters. According to current models of star formation and evolution any pulsar in a globular cluster must be the result of binary evolution. We discuss how the pulsars discovered in globular clusters can provide information about the binary production mechanism. Current and future observations may contribute in discriminating between the core tidal capture model and models for which the number of binaries does not depend on core star densities.

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Session 80: Galactic Structure
Oral Session, 2:00–3:30 pm
Philadelphia North

80.01

Direct Detection of the Bar in the Milky Way

D.N. Spergel (PU) and L. Blits (U.Md.)

We show that the bar at the center of the Milky Way, long postulated from a number of different studies, is unambiguously detected in the data from the 2.4 μm observations of the Galactic center made by Matsumoto *et al.* and reported in 1983. The bar is oriented such that the side closest to the Sun lies in the first Galactic quadrant. We show also that the data imply that the bar is tilted with respect to the Galactic plane, consistent with the work of Liszt and Burton, who first proposed a tilted bar to explain the kinematics of the HI and CO at the Galactic center. We also show that the small extinction that is observed at latitudes greater than 3°at 2.4 μm, is insufficient to account for the asymmetries observed in the distribution of the infrared emission.

We also discuss the observations of a larger segment of the Galactic plane by Hayakawa *et al.*[1], as well as the distribution of OH/IR stars identified by te Lintel Hekkert[2], and show that the vertical distribution of both componenets is consistent with their origin in a thick disk. The stars giving rise to this emission is also found in a non-axisymmetric distribution consistent with the triaxial potential argued by Blitz and Spergel[3] to be the origin of the asymmetries in the HI distribution in the outer Galaxy. We demonstrate how emission from the Blitz and Spergel model with an embedded bar can quantitatively account for the observed distributions through a projection of the model emission onto the plane of the sky.

There seems to be little question now that the Milky Way is a barred spiral galaxy, not unlike several shown in Hubble Atlas and the Revised Shapley-Ames catalogue, with a triaxial bulge or thick disk that has observable consequences out to the edge of the disk. Confirmation of our picture will be possible with data from the COBE satellite.

References

[1]Hayakawa,S., T. Matsamuto, H. Muarkami, K.Uyama, J.A. Thomas and T. Yamagami, 1981 *Astron. and Astrophys.*, 100, 116.
[2] te Lintel Hekkert, P., "The Evolution of OH/IR Stars and Their Dynamical Properties", Ph.D. Thesis, Leiden University.
[3] Blitz, L. and Spergel, D.N. 1991, to appear in *Ap. J.*.

80.02

Rotation of the Galactic Bulge

P. Harding (OCIW)

Studies of disk galaxies similar to our own show that their bulges can be classified into two groups: box/peanut bulges which have boxy isophotes and cylindrical rotation (where the rotation of the bulge remains constant to large distances above the plane) and spheroidal bulges which have more rounded isophotes and a steady decrease in rotation with distance above the plane. The kinematics for both box and spheroidal bulges are intermediate between the disk and halo, with rotational velocities approximately half that of their disk rotation. Does our Galaxy's bulge also rotate with intermediate velocity, and is it a box bulge with cylindrical rotation?

Results from a study of the kinematics of turnoff stars at $l \sim 10°$, $b = -14°$ and $b = -22°$ will be presented. These stars are at a distance of ~2 kpc from the minor axis and ~2 and ~3 kpc above the plane. These main-sequence stars near the turnoff provide a sample uncontaminated by foreground disk stars. Velocities of these stars give information about the rotation of the bulge and allow us to explore the relationship between thick disk and bulge.

80.03D

A Complete, Multicolor Survey of Absolute Proper Motions to B ~ 22.5: Structure and Kinematics at the North Galactic Pole

S.R. Majewski (Observatories of the Carnegie Institute)

Proper motions and multicolor photometry have been determined for a complete sample of stars to B ~ 22.5 in the North Galactic Pole field SA57. The random error of the proper motions is ~0.10 arcsec/century and has been tied to the absolute reference frame of galaxies and QSOs to better than 0.01 arcsec/century. Using our high quality (errors < 0.02 mag) photometry, we have determined uv-excesses and photometric parallaxes for 250 stars in the range 0.3 < B-V < 1.10, U < 21.5. Thus we have been able to probe the chemical and kinematical distributions of F, G and K dwarfs to distances up to 25 kpc above the Galactic plane, allowing for the first time an unbiased view of the thick disk and halo from normal stars in situ.

We find an unexpectedly sharp break in the distribution of uv-excess at z ~ 5.5 kpc. Features in the kinematical distribution are also seen at this distance. This suggests that there is a correspondingly sharp change in the mix of stellar populations at z ~ 5.5 kpc, which we associate with the edge of the thick disk. The halo field stars show no metallicity gradient and a reflex velocity to the LSR of -275+/-16 km/s at all z-distances. The metallicity dispersion for the halo is broader than that of the globular cluster system. Thus it appears that the globular cluster system does not accurately trace the chemical and kinematical properties of the halo field subdwarfs. Our data are consistent with no metallicity gradient for the thick disk, and an asymmetric drift which varies linearly from ~10 km/s locally to 120 km/s at z ~ 5.5 kpc. The most straight forward interpretation of the separability of kinematical and chemical distributions between the thick disk and halo is that the thick disk was not formed as a smooth transitional phase between the creation of the thin disk and halo. Previously found correlations between kinematics and abundance in surveys of high velocity stars are the result of broad and overlapping metallicity dispersions for the thick disk and halo.

80.04

The Abundance Gradient and Distribution in the Galactic Bulge

N. D. Tyson and R. M. Rich (Columbia Univ.)

Using the newly calibrated Washington CCD photometric system (Geisler 1990, priv. comm.) we determine the mean abundance and abundance distribution for K giants in five windows of low extinction along $l = 0°$ to the Galactic bulge. The windows span Galactic latitudes from $b = -2.5°$ to $b = -13°$. Preliminary results suggest that the metal-rich population found for Baade's window at $b = -4°$ (Rich 1988, *AJ* 95,828) extends at least to $b = -6°$, a volume that contains 70 percent of the bulge mass. For the window at $b = -6°$, the abundance distribution of K giants peaks at [Fe/H] ≈ 0.3 and has a long, low abundance tail that extends to [Fe/H] ≈ −1.5. Pending a more detailed analysis of the uncertainties in reddening, these are the same features that characterize the abundance distribution in Baade's window. The closed box, simple model of galactic chemical evolution (where star formation proceeds without gas infall or outflow as the system becomes self-enriched; Searle and Zinn 1978, *ApJ* 225,357) provides an accurate analytic model for the abundance distribution in this $b = -6°$ window, as it does in Baade's window (Rich 1990, *ApJ* 362,604). If the simple model is appropriate for the entire bulge then this may be an important consideration in models of galaxy formation.