Kinematics and Metallicities of the Milky Way Bulge

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The Giraffe Inner Bulge Survey (GIBS - PI: M. Zoccali) is focussed into study the kinematics and metallicities of the Galactic inner bulge, using red clump (RC) stars. The survey was performed with the ESO Giraffe spectrograph, divided in two setups: The high resolution branch, where ~450 stars were observed with a resolution of R~22500 (HR13) in order to derive kinematics, metallicities and alpha abundances in a strip along the major axis at b≈-4. And the low resolution branch, which include ~6000 stars observed with a resolution of R~6500 (LR8), centered in the Calcium Triplet (CaT) region at 8500 Å. Cross-correlation against synthetic spectra provide accurate radial velocities (≦1 km/s) wich allow us to construct, for the first time, a fully observational kinematical maps for the inner Bulge, which can be used to constrain formation models of the Galaxy. GIBS also provide metallicities for the low resolution spectra derived from a proper CaT metallicity calibration made for bulge RC stars.

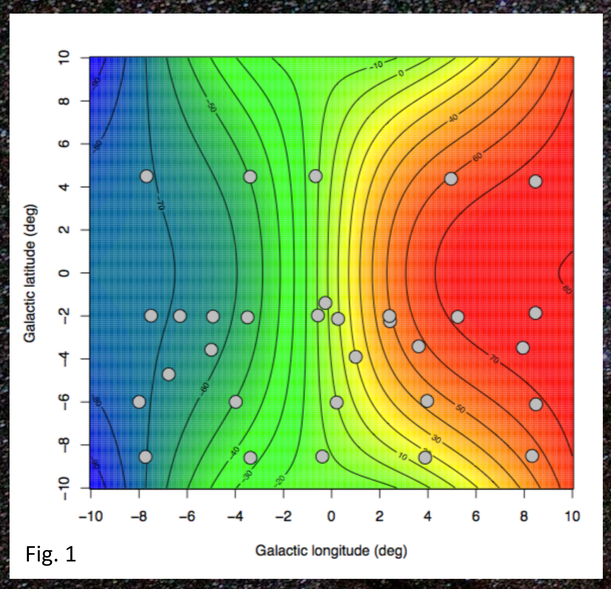

Fig. 1

Fig. 1 shows the Galactocentric radial velocity map derived from GIBS, overplotted with the 31 observed fields as gray dots. An asymmetry in radial velocity, respect to longitude, is found which can be explained by selection criteria. The map also show symmetry respect latitude.

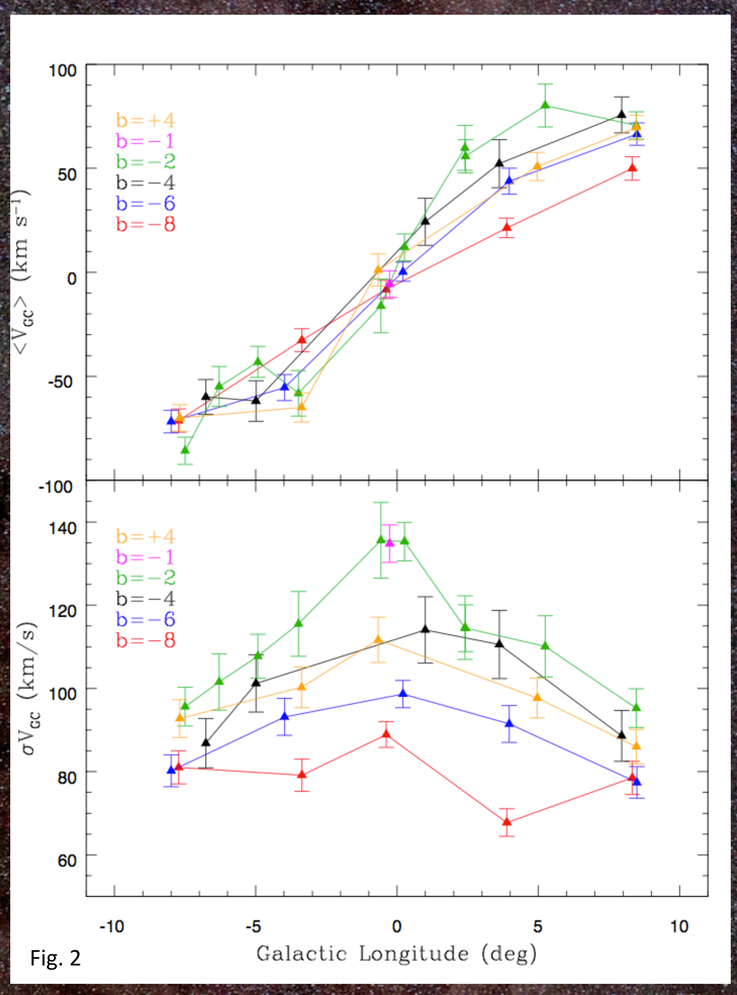

Fig. 2

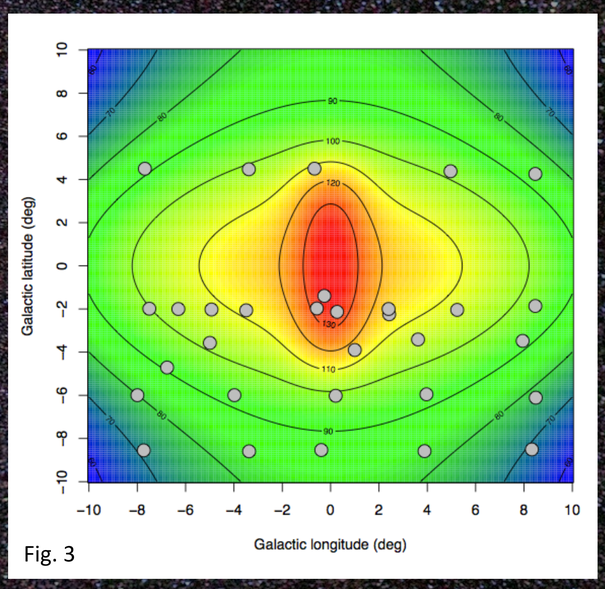

Fig. 3

Fig. 2 show Individual rotation curves and velocity dispersion from GIBS. We probe the cylindrical rotation as close to the plane as b=-2. Velocity dispersion shows a strong peak close to the center (l=0, |b|<4) which is not present in the current Milky Way models.

We construct a proper CaT metallcity calibration for bulge stars. This calibration allow us to derive metallicity with a precision of ~0.2 dex from low resolution spectra even in the highly obscured fileds close to the galactic plane. Fig. 3 shows the CaT metallicity distributions for 22 low resolution fields observed in GIBS. We obtain a metallicity gradient respect to the longitudes wich is qualitatively consistent with previous determinations (Zoccali+2008, Gonzalez+2013).

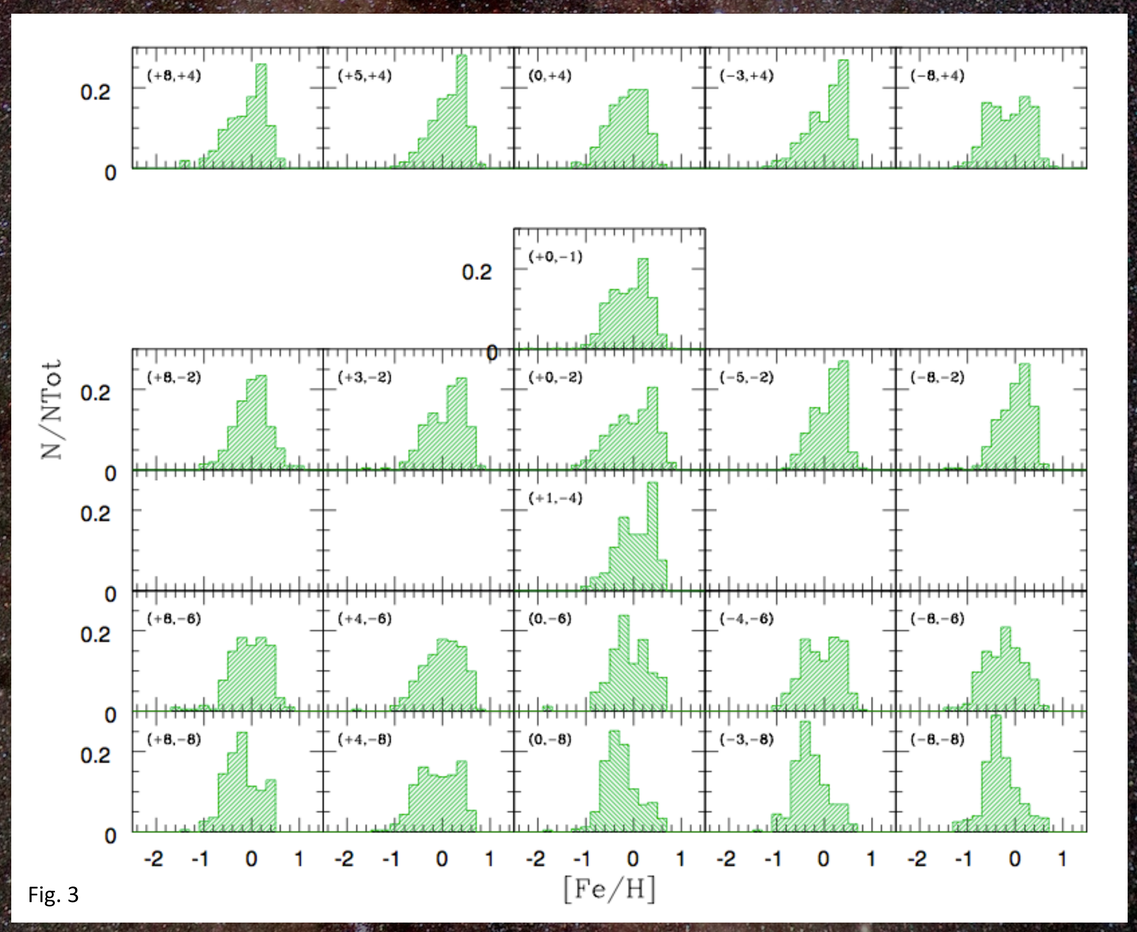

Fig. 3

Metallicity distributions along the minor axis (central strip in Fig. 3) of the Milky Way bulge show an absence of a metallicity gradient in the central region of the inner bulge (|b| < 4), based on ~450 RC stars from the fields (+0,-1), (+0,-2) and ~110 stars in (+1,-4). This result confirms the flat gradient found by Rich, Origlia and Valenti (2012), based on ~15 stars in two inner bulge fields.

Radial velocities and Metallicities from GIBS will provide strong constrains for Galaxy formation models, taking into account the inner bulge fields as close to plane as b=-2 (even b=-1). The strong peak in radial velocity dispersion found in the inner fields of GIBS possible indicate the presence of a high density peak in the central ~250 pc of the bulge.
Metallicities from low resolution spectra show the presence of a gradient in latitude which is flat in the inner regions (|b|<4).

References:
- Zoccali, Gonzalez, Vásquez, et. al 2013 (in prep.)
- Zoccali, Hill, Lecureur, et. al. 2008, A&A 486, 177
- Gonzalez, Rejkuba, Zoccali, et al. 2013, A&A, 552, 110
- Rich, Origlia & Valenti, ApJ, 746, 59