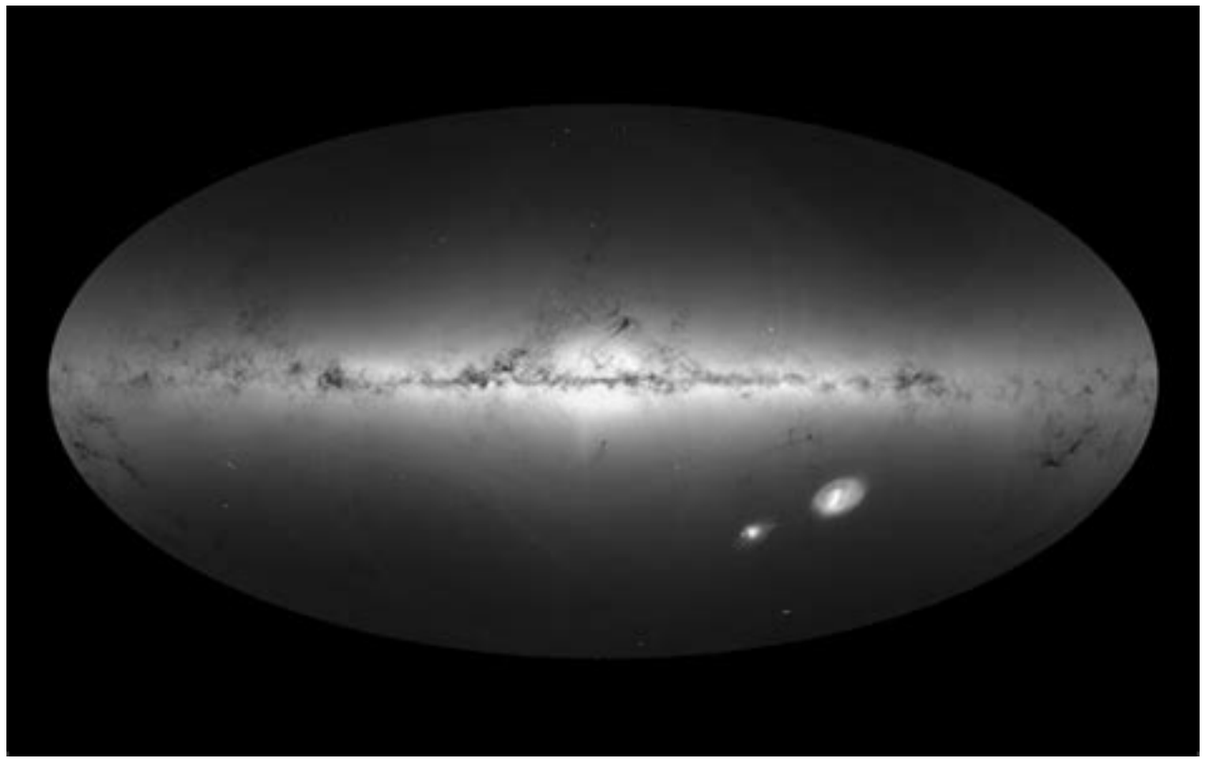
Orbital properties of the Bulge giants with Gaia DR2



Iulia Simion

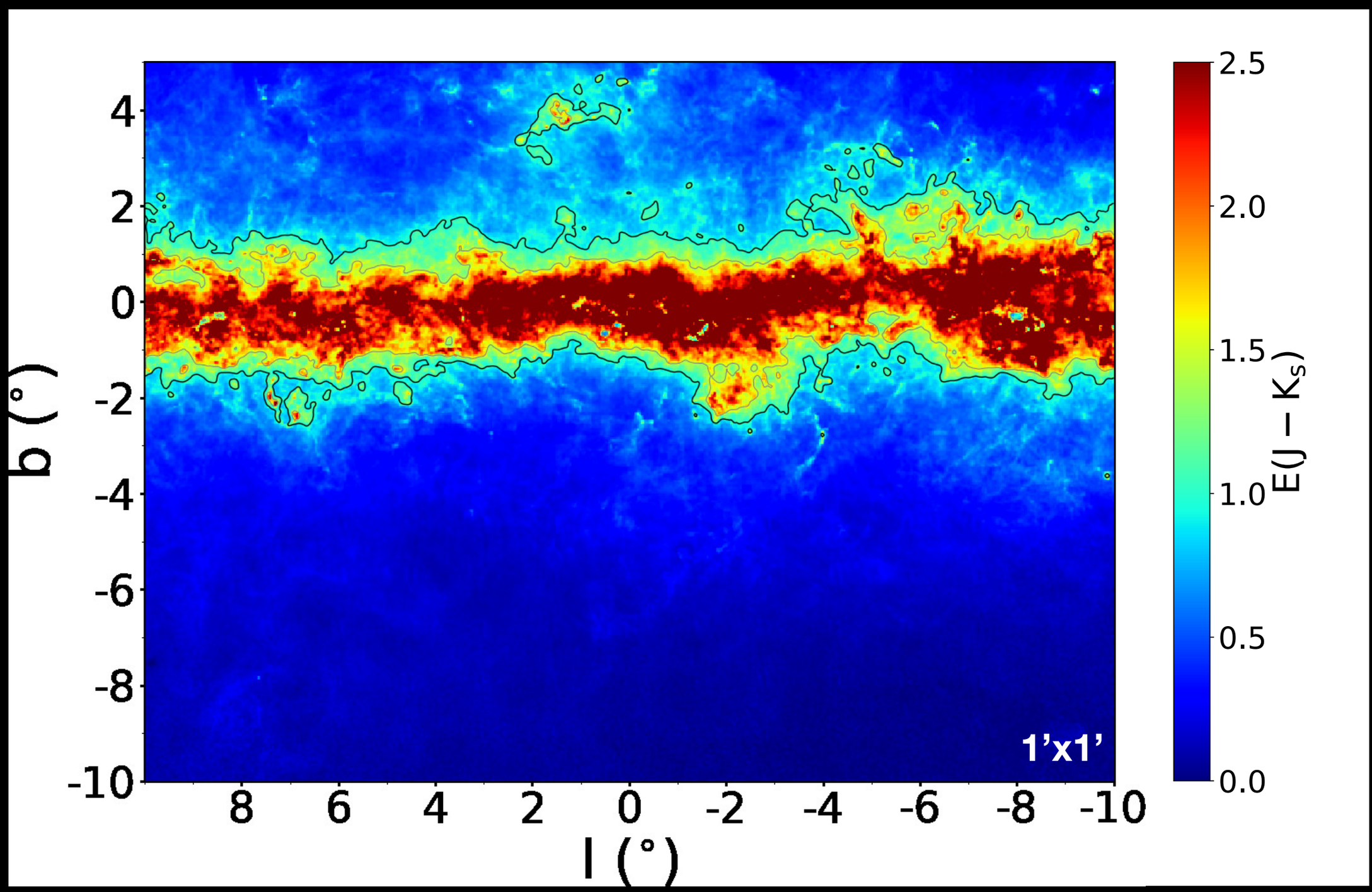
with J.G. Fernandez-Trincado

GBX2018

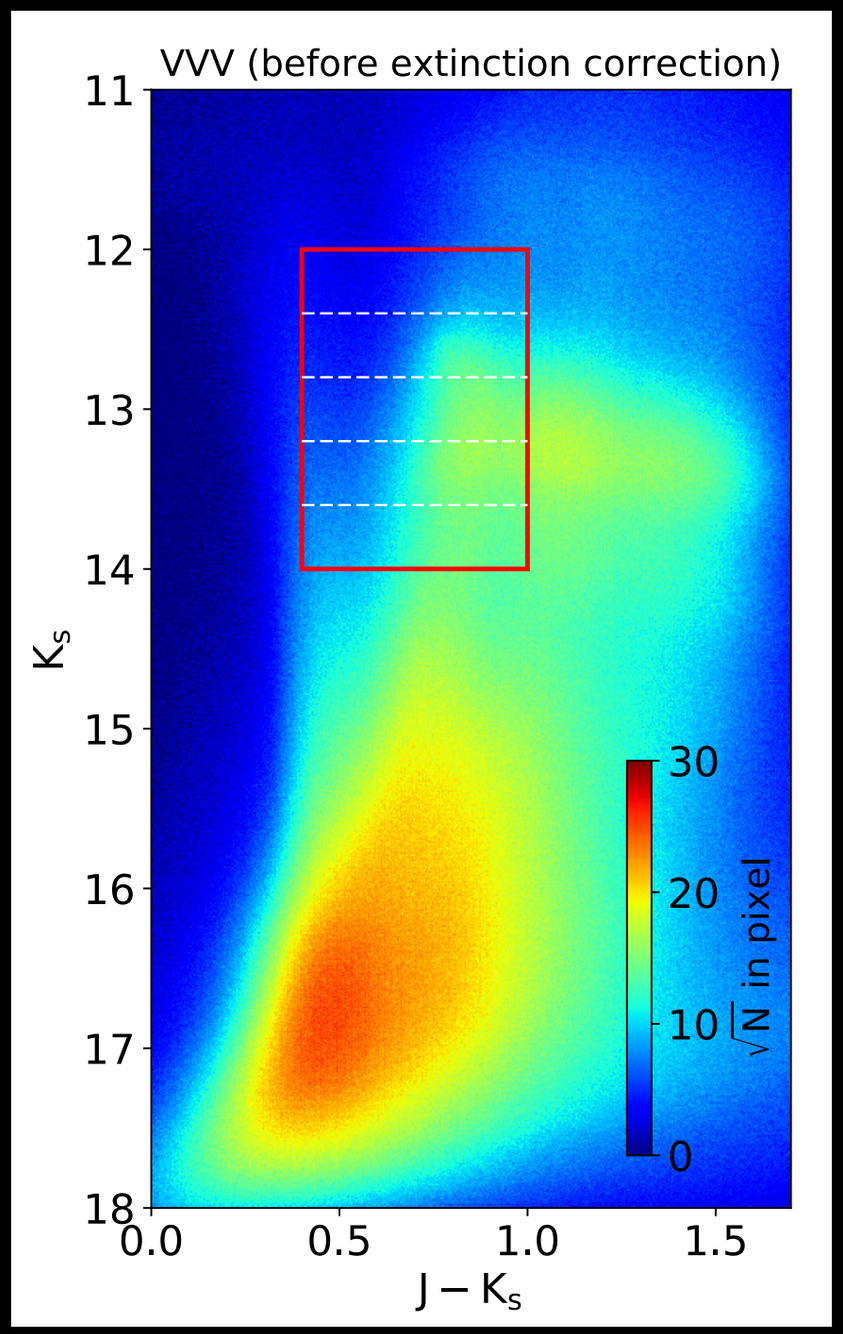
A parametric description of the 3D structure of the Galactic Bar/Bulge using the VVV survey

VVV survey of the Bulge (see Maren Hempel's talk on Wednesday)

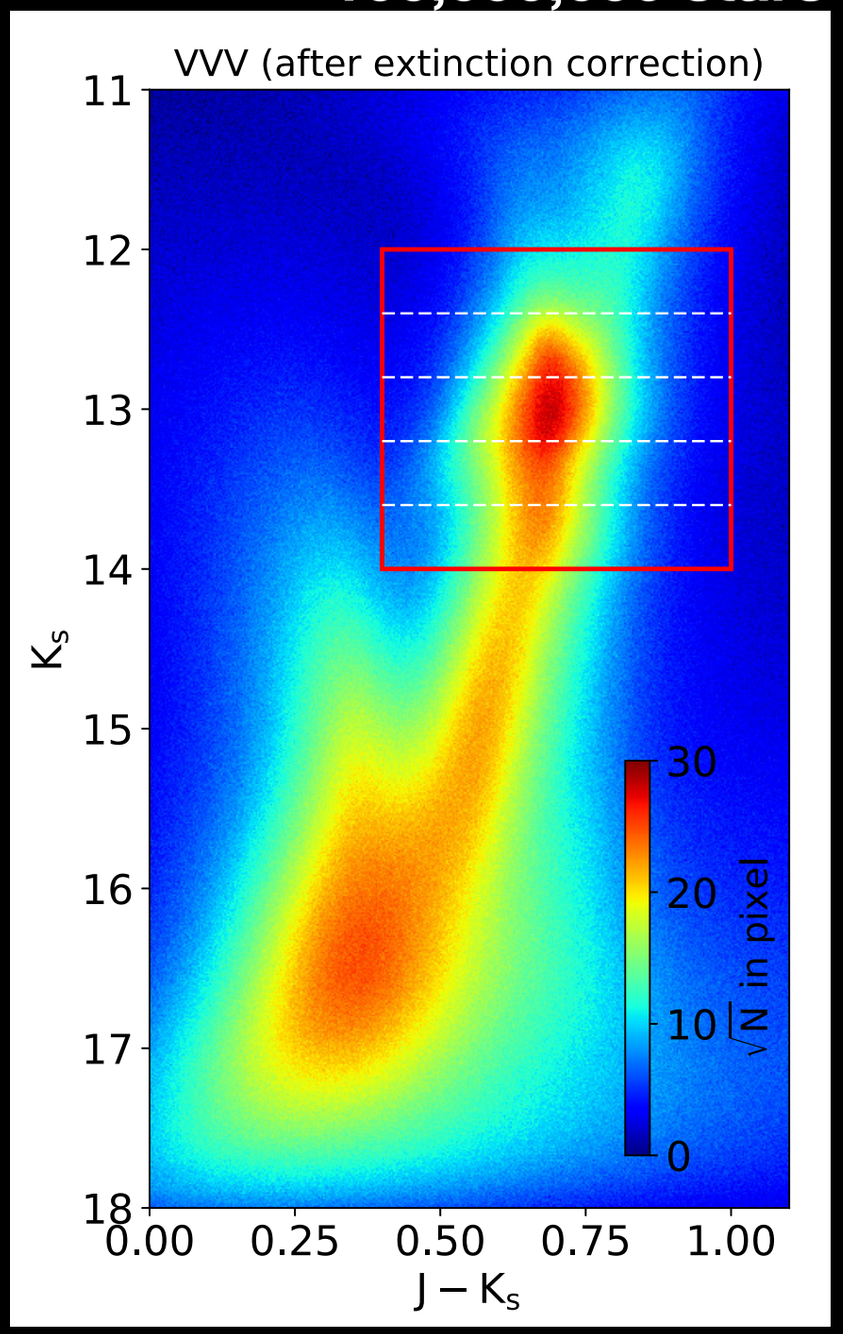
The reddening problem



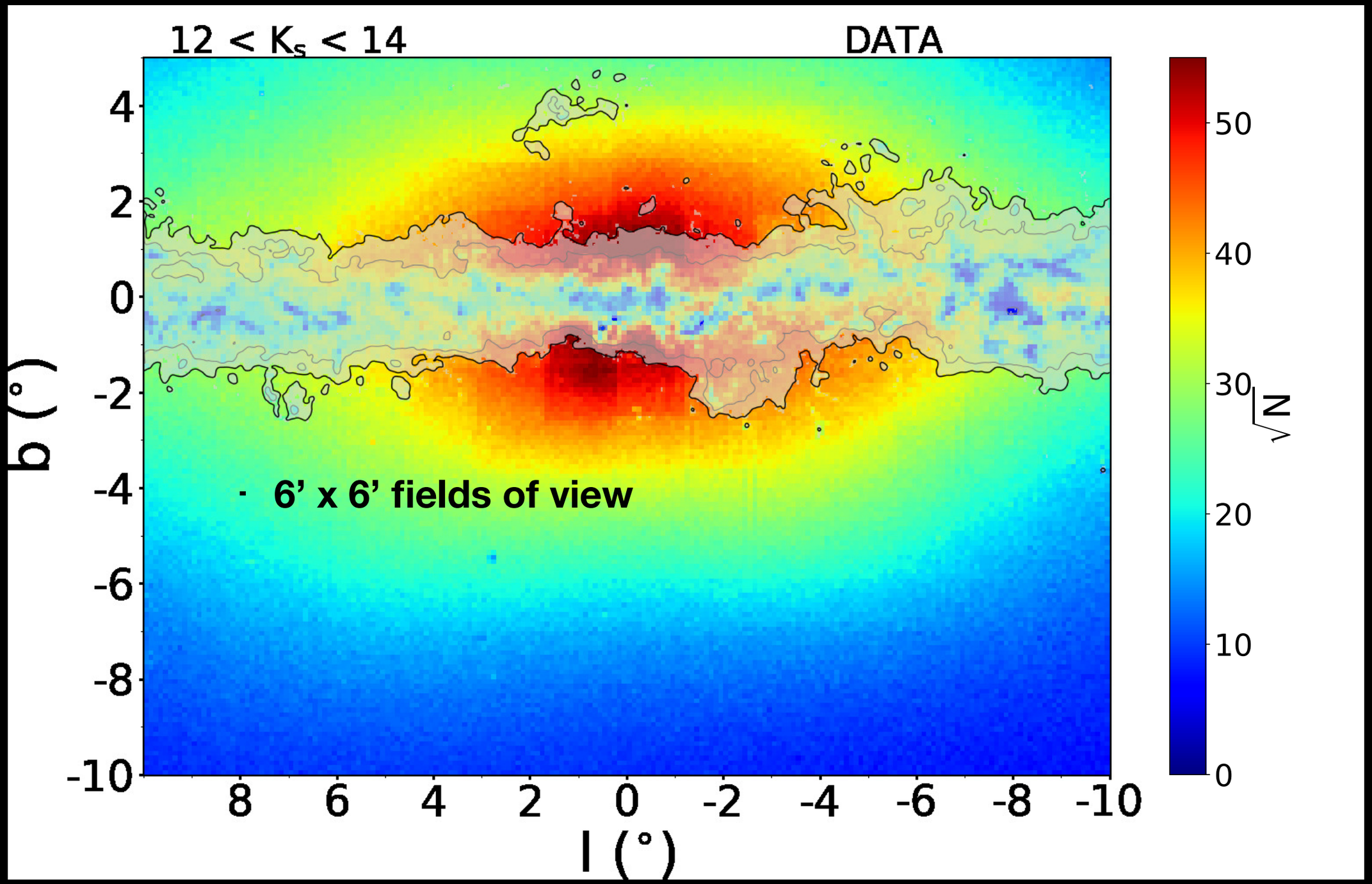
The reddening problem

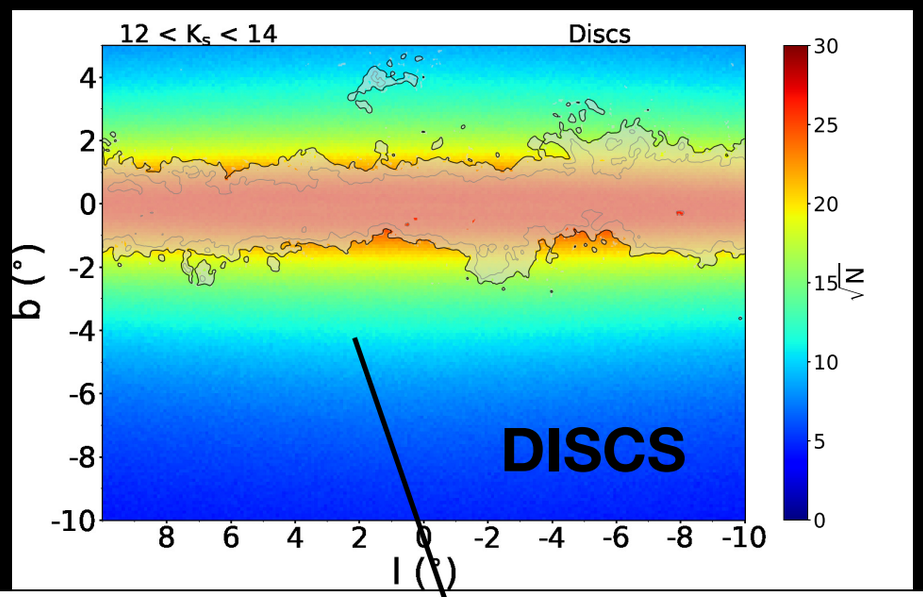


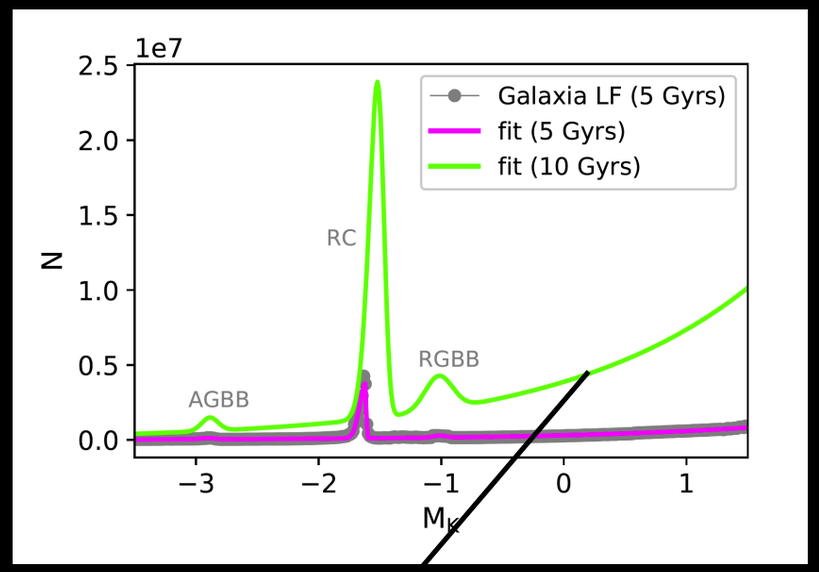
100,000,000 stars

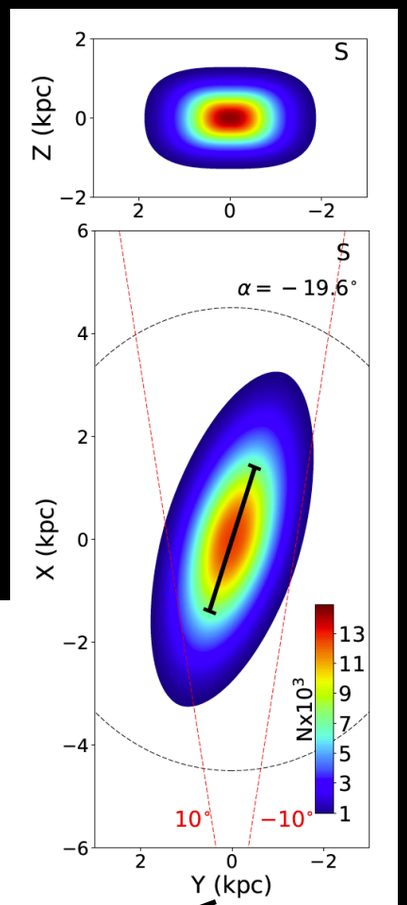


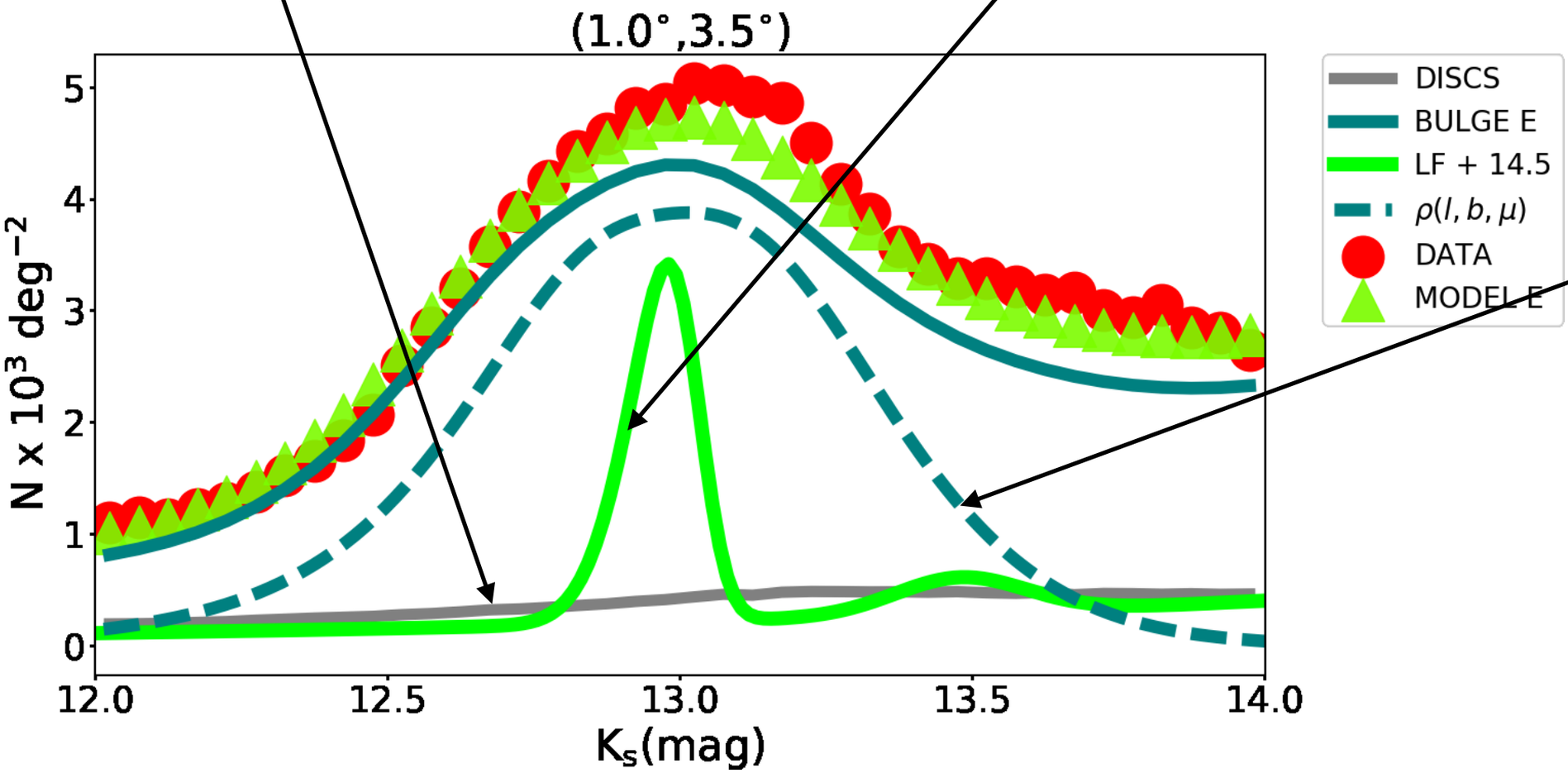
Fitting the VVV data











- see also Wegg & Gerhard 2013 for a non-parametric study

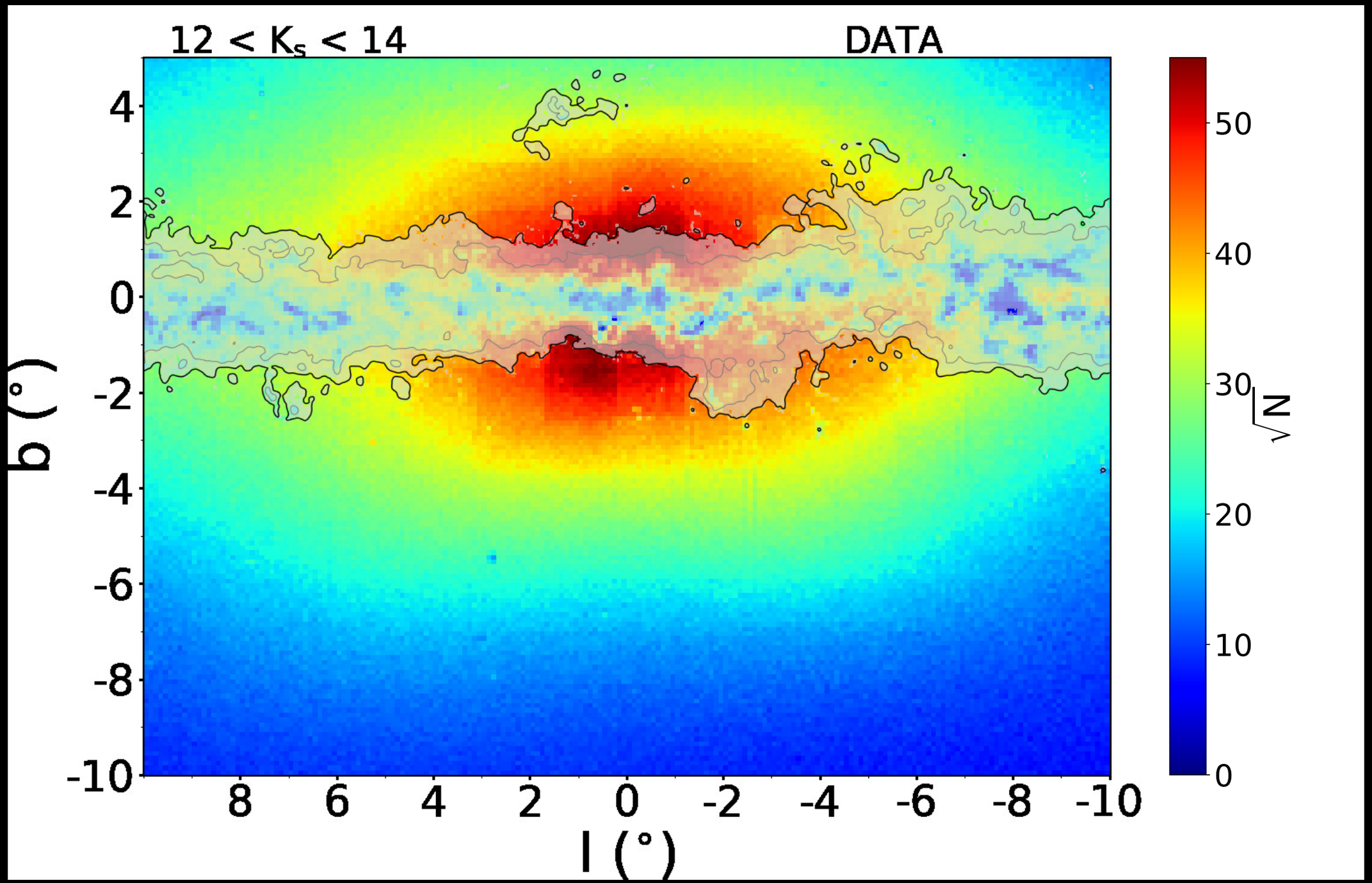
$$\rho_B = \rho_0 \exp^{-0.5 r_s^n} \quad \text{(model } E\text{)}$$

where,

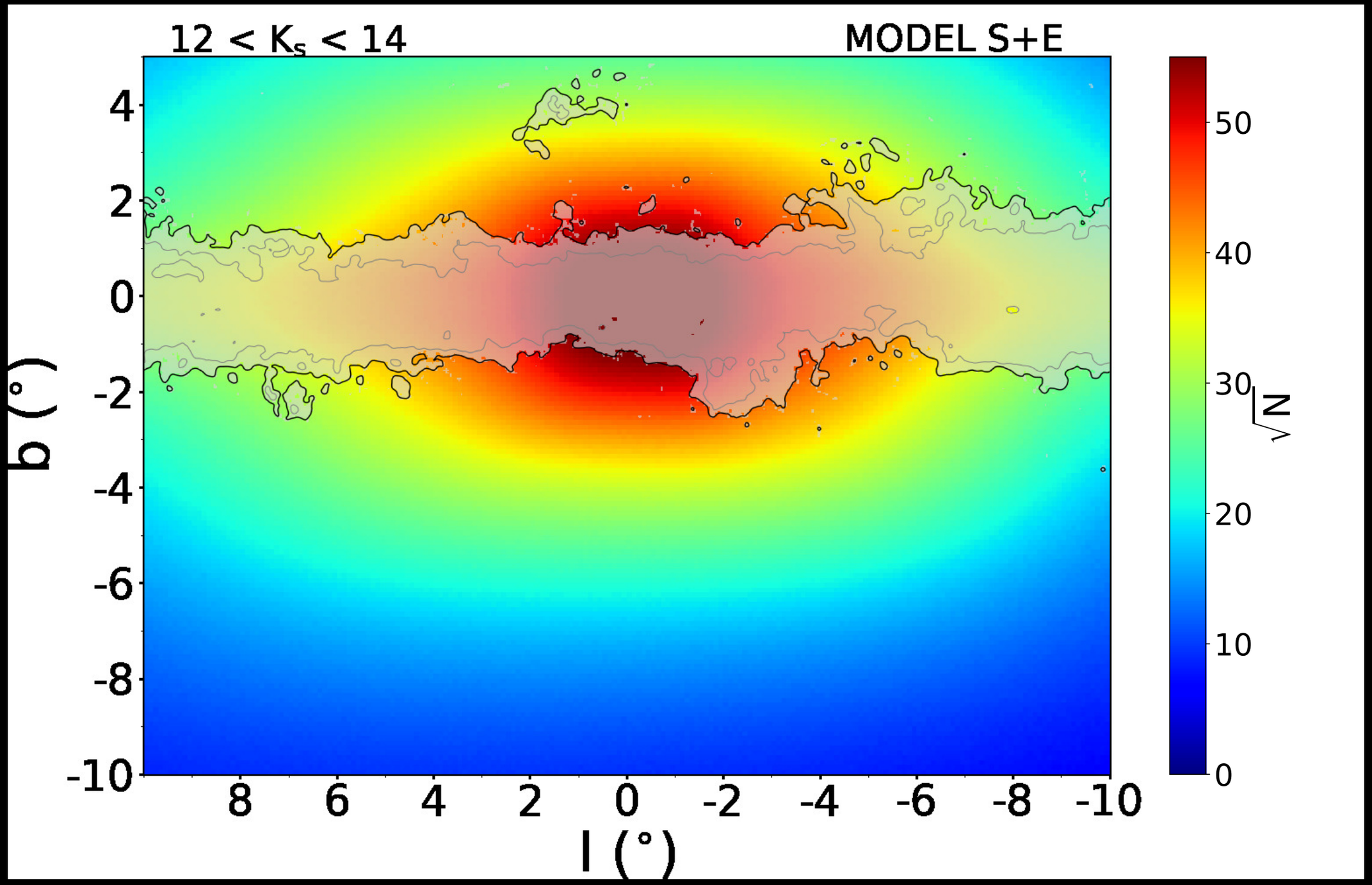
$$r_s^{c_\parallel} = \left[\left(\frac{X}{x_0} \right)^{c_\perp} + \left(\frac{Y}{y_0} \right)^{c_\perp} \right]^{\frac{c_\parallel}{c_\perp}} + \left(\frac{Z}{z_0} \right)^{c_\parallel}$$

Freudenreich (1998)

The data sample



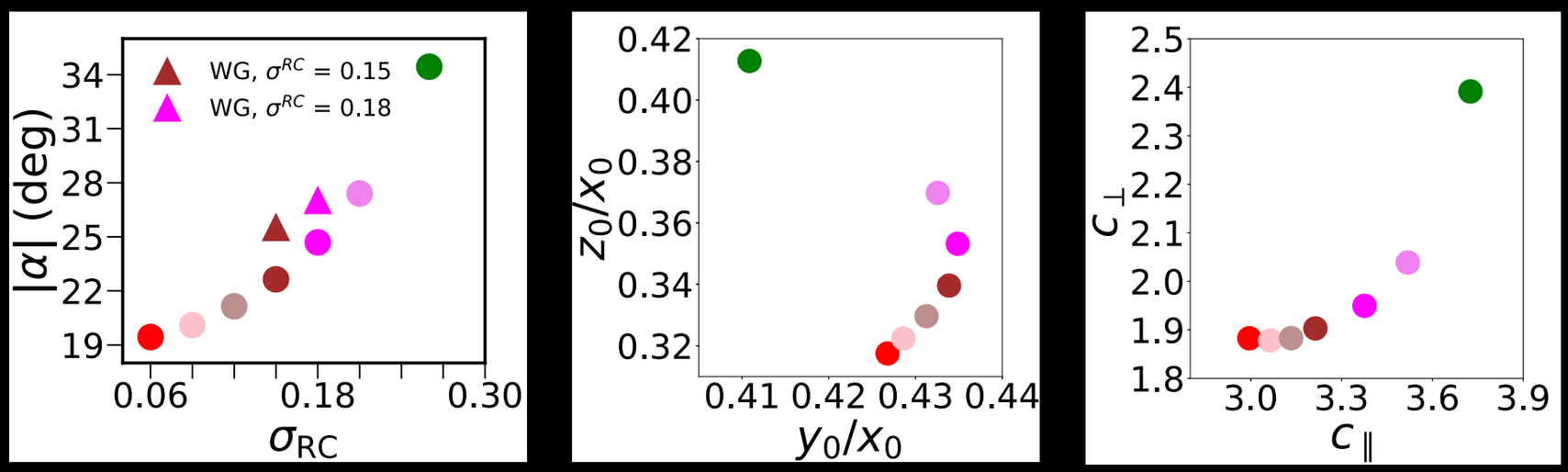
The model



VVV summary:

- Obtain extinction maps sensitive to small scale variations;
- The Bulge/Bar is “boxy”, with an axis ratio of [1:0.44:0.31] and a viewing angle of 20 degrees;
- strong degeneracy between the viewing angle and the dispersion of the RC absolute magnitude distribution;
- assuming sigma RC = 0.18 we find a viewing angle of 25 degrees, closer to the value reported in Wegg & Gerhard 2013, of -26.5 degrees;
- Mass Bulge = 2.3 x 10^10 Msun.

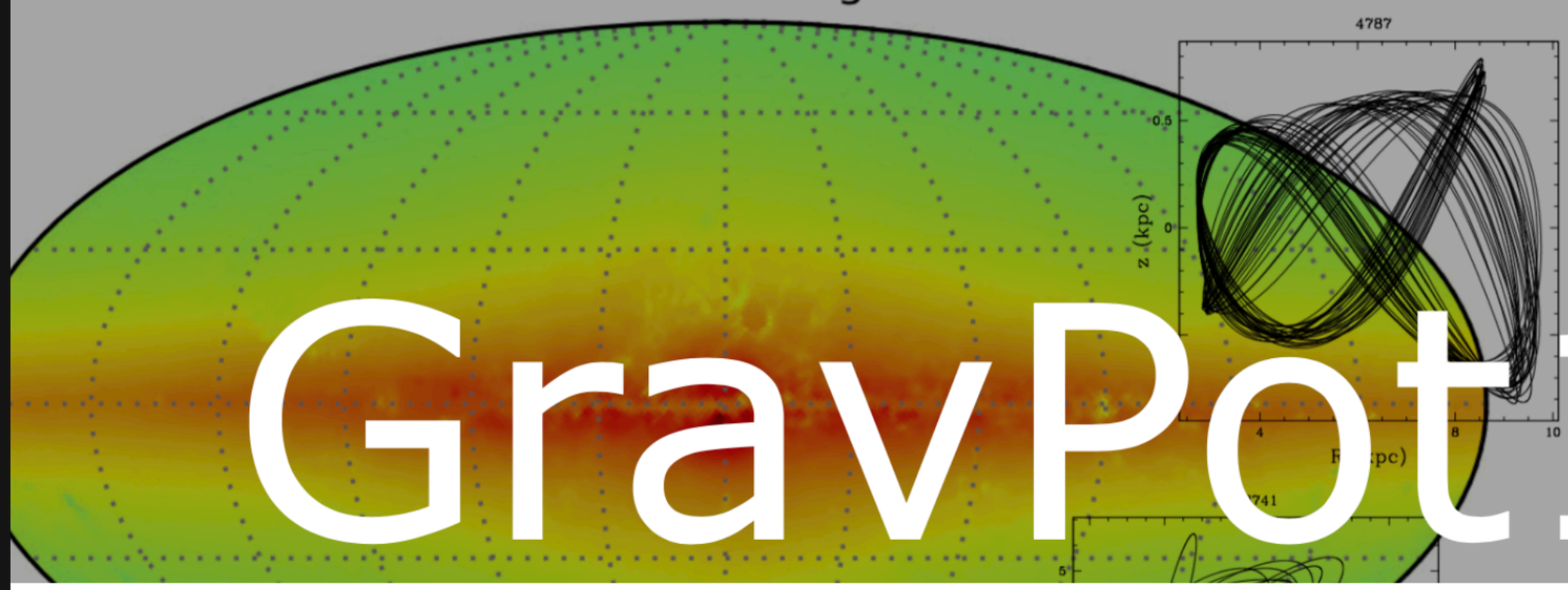
Simion et al. 2017



Welcome to GravPot16

The Gravitational Potential of the Milky Way based on the Besançon galaxy model

G < 20 mag



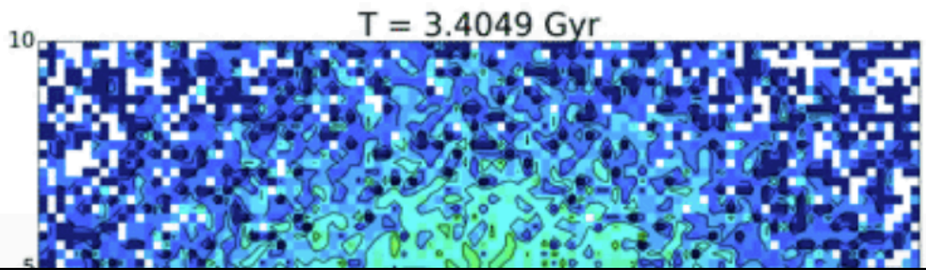
GravPot16

THE GRAVITATIONAL POTENTIAL OF THE MILKY WAY: A DYNAMICAL MODEL FOR ORBIT CALCULATIONS BASED ON THE BESANCON GALAXY MODEL

GravPot16 is a code that performs a variety of analysis. The typical use of GravPot16 is to compute orbital parameters and test particle simulations in an axisymmteric and/or nonaxisymetric gravitational potential, including a boxy bar.

https://fernandez- trincado.github.io/GravPot16/

(Fernandez-Trincado, et al. in preparation)

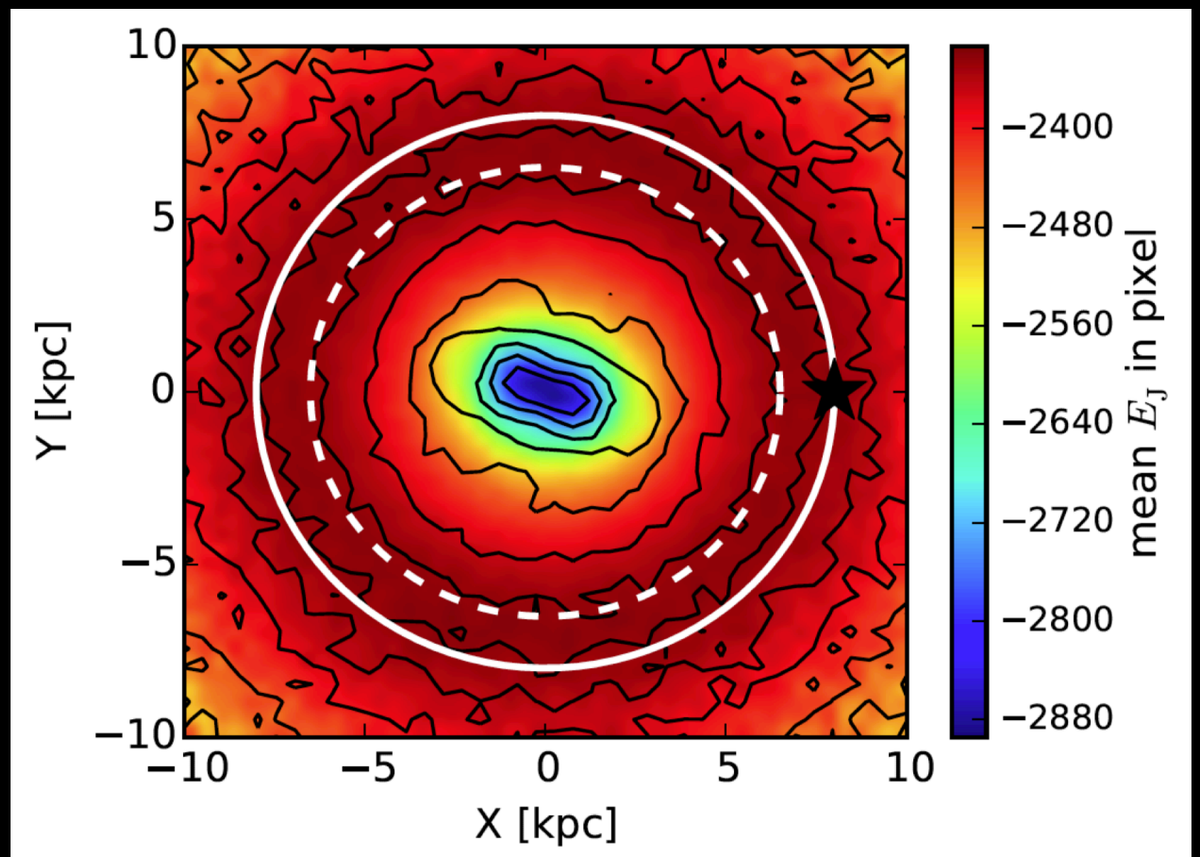


GravPot16:
orbital study of particles in the inner region of the Milky Way

- model the **gravitational potential** of the Milky Way based on the density distributions of the Besancon Galaxy model

- a **B/P bulge,** a Hernquist **stellar halo**, seven stellar Einasto **thin disks**, two stellar **thick disks**, a gaseous exponential disk, and a **dark matter halo**

- provides a detailed Milky Way axisymmetric and non-axisymmetric potential, observationally and dynamically constrained



$$E_J = \frac{1}{2}\vec{v}^2 + \Phi_{axi}(R,Z) + \Phi_{bar}(R,Z) - \frac{1}{2}|\vec{\Omega}_{bar} \times \vec{R}|^2$$

(Fernandez-Trincado, et al. in preparation)

GravPot16:
A dynamical model for orbit calculations

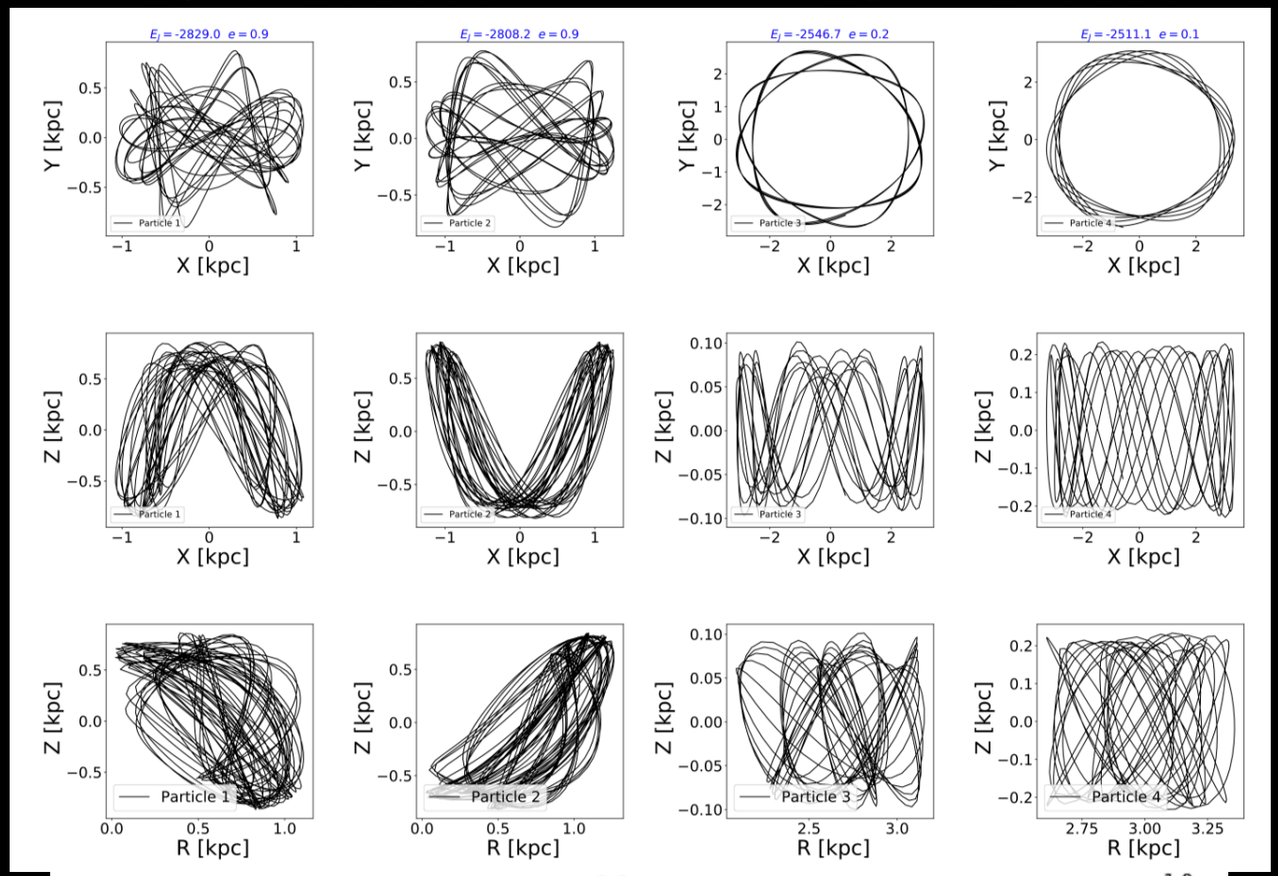
- Bar mass: 1.1 x 10^10 Msun
- Viewing angle: 20 degrees
- density law: S model (Robin+ 2012)
- 4 bar pattern speeds: 35, 40, 45 and 50 km/s/kpc

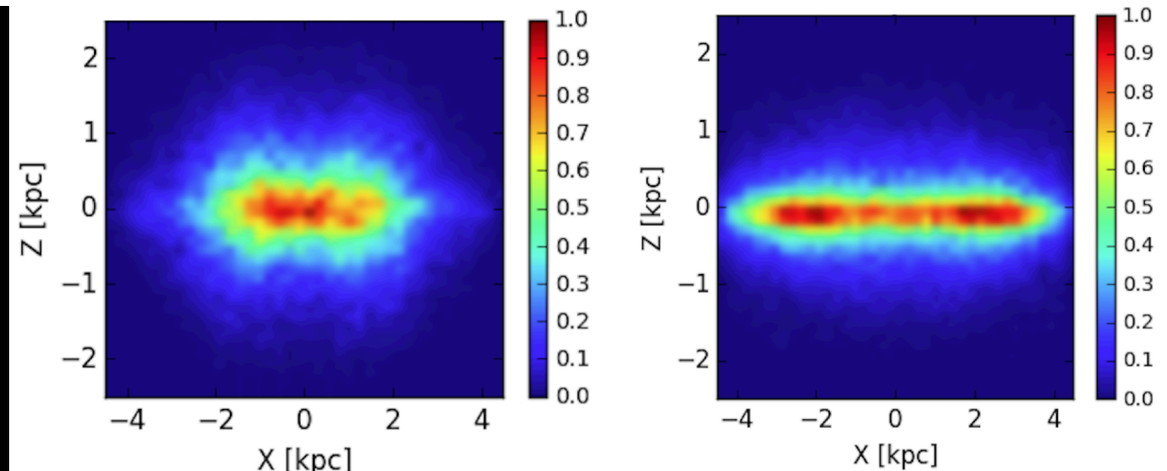
(Fernandez-Trincado et al. 2017)

Simulation

bar-trapped
EJ < -270000

not bar-trapped
EJ > -270000





Future plans:

- compare the observed velocity ellipsoids with simulations (Auriga, Shen et al. 2010 etc)
- study the velocity ellipsoid properties of the Bulge stars with metallicity and alpha abundances
- improve GravPot16 (update density model, Bulge mass)
- Bulge orbital properties