χ^2M2M Modelling of the Milky Way

Victor P. Debattista

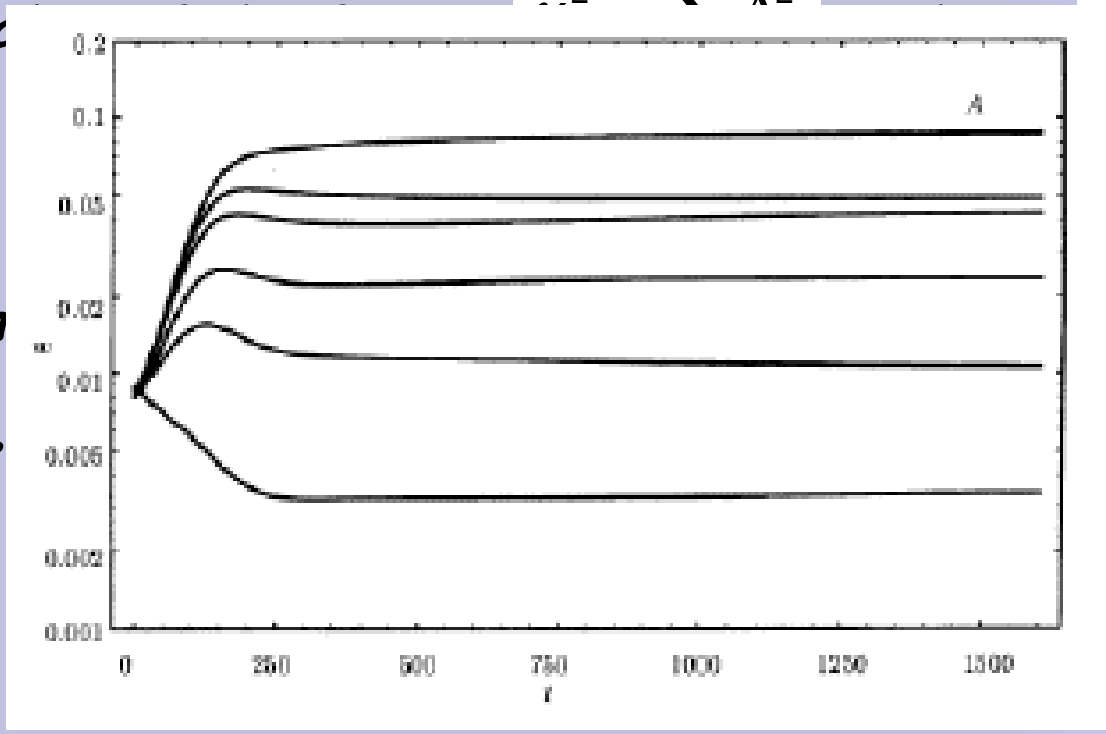
χ^2M2M in a nutshell

- *Extend M2M to take into account observational errors $\sigma(Y_j)$ for target observable Y_j*
- *Measure qu*
- *If the FOC*

  the w_i will h *ximized.*
- *Incorporate* *ed model observables*

$$\chi^2 = \sum \Delta^2$$

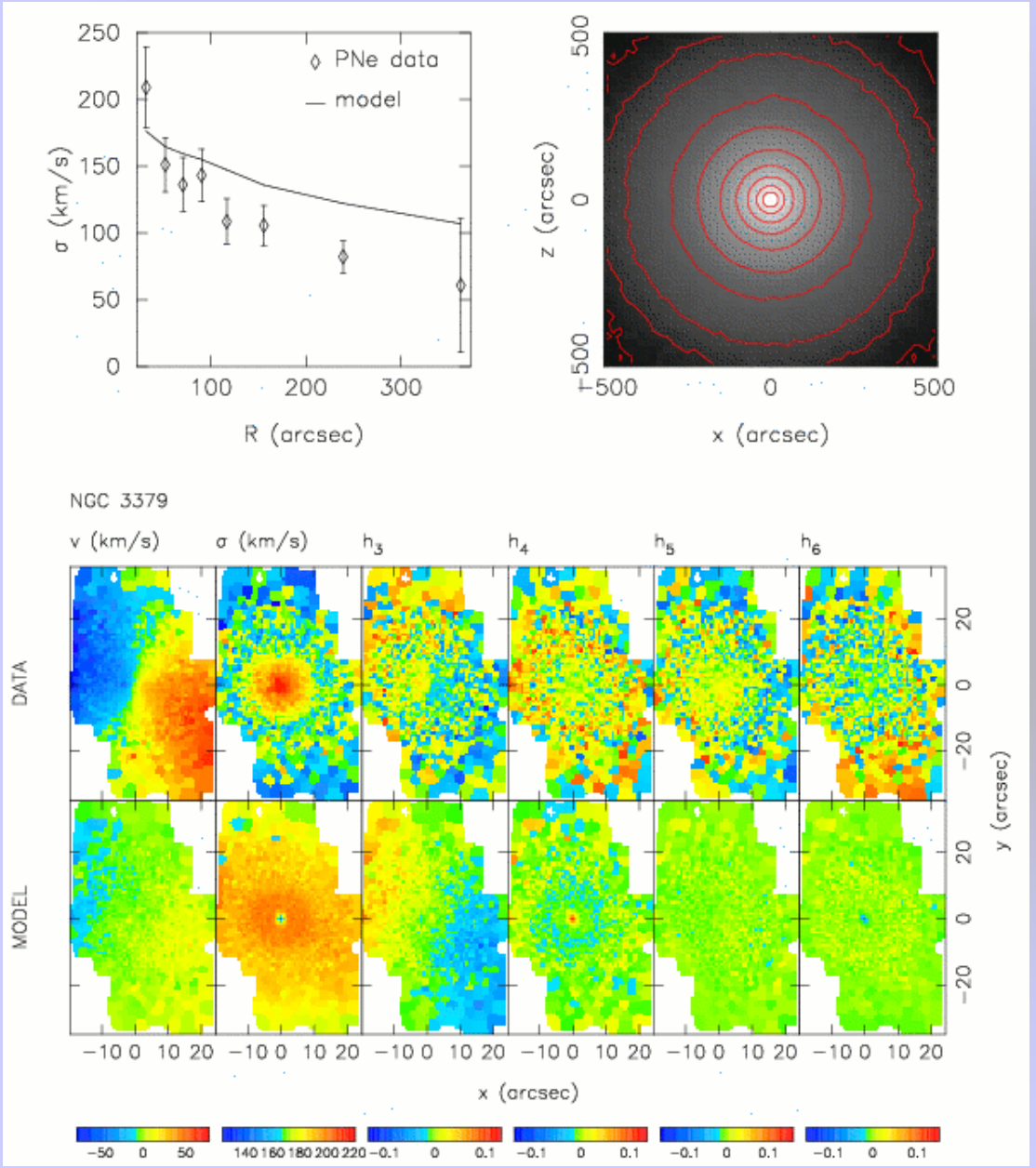
$$\Delta_j = \frac{y_j - Y_j}{\sigma(Y_j)}$$



Syer & Tremaine 1996

De Lorenzi+ 2007

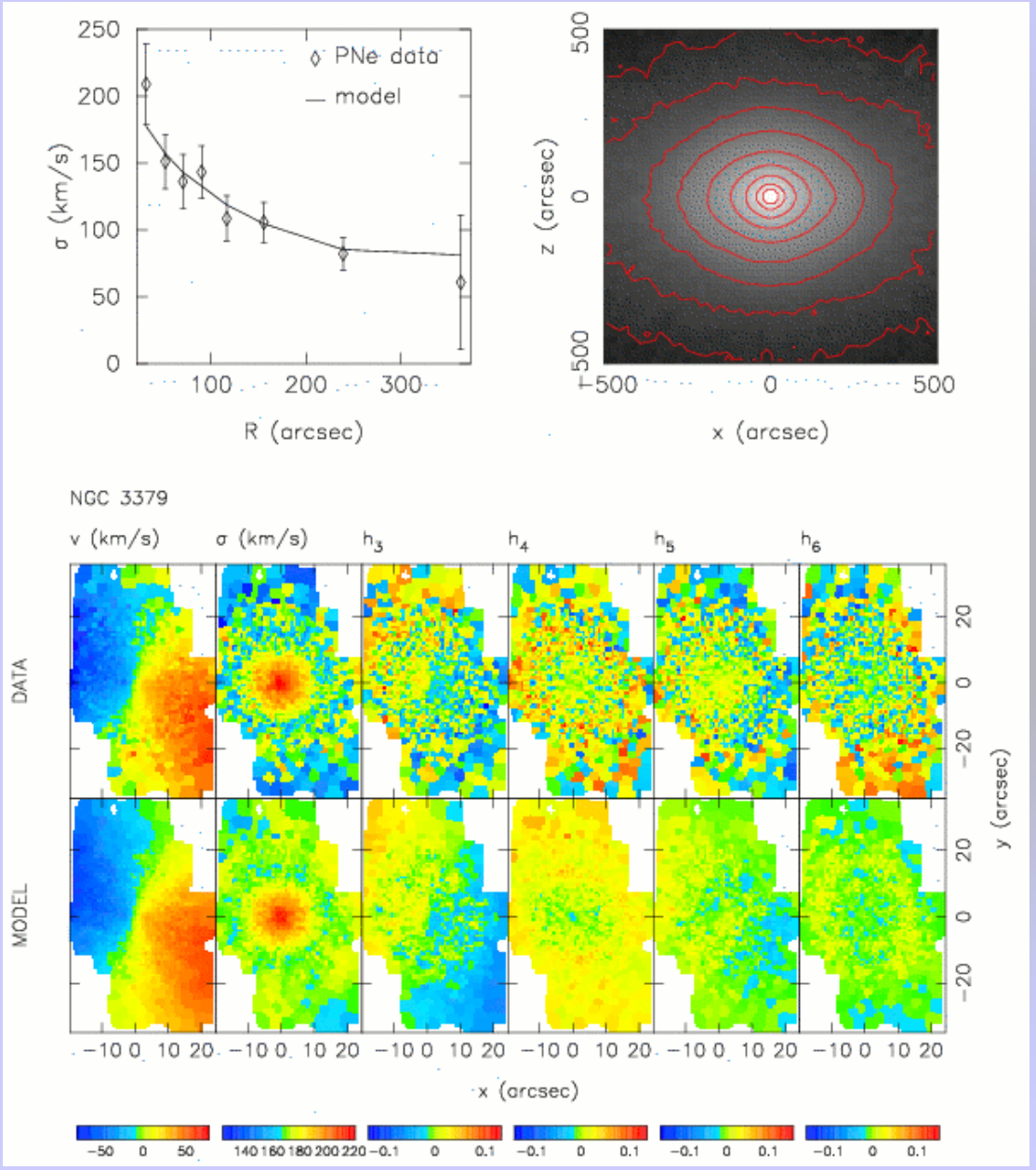
Example: NGC 3379



PNe data extending to 7 Reff

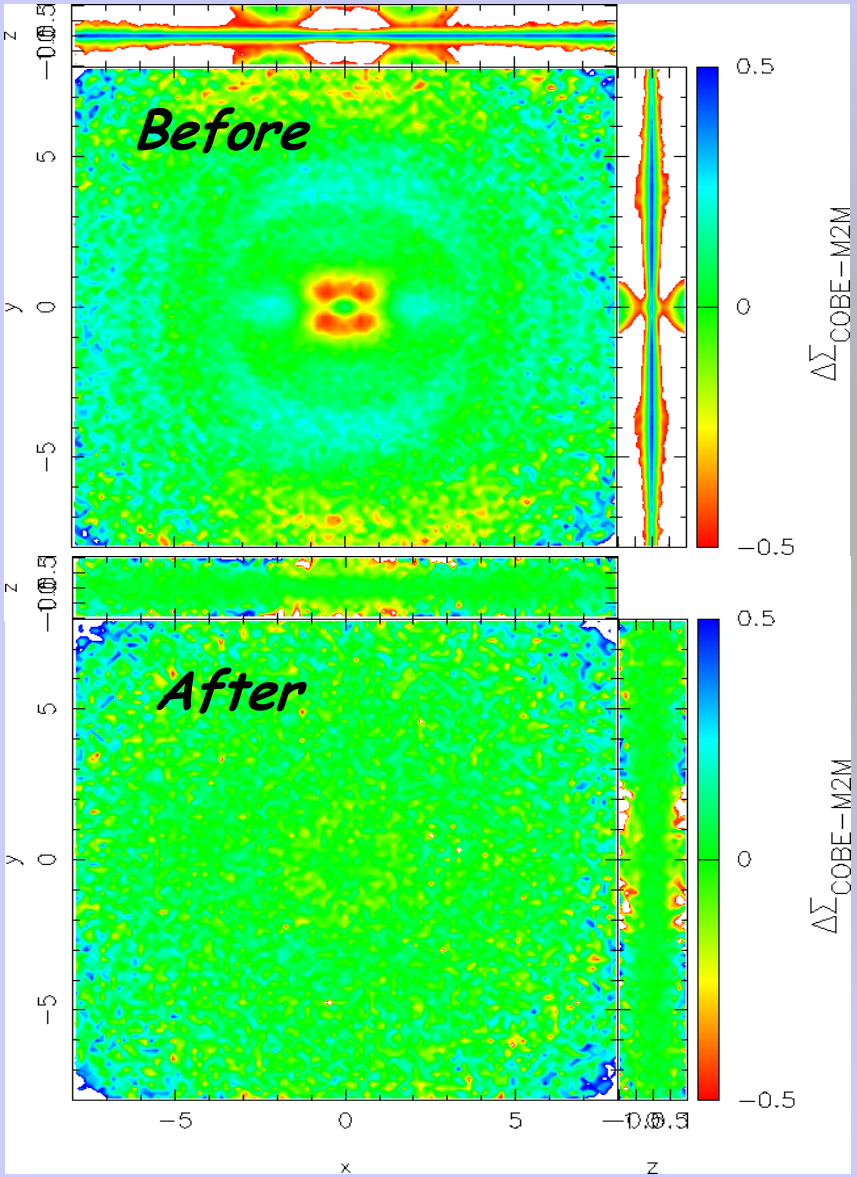
De Lorenzi+ 2009

Example: NGC 3379



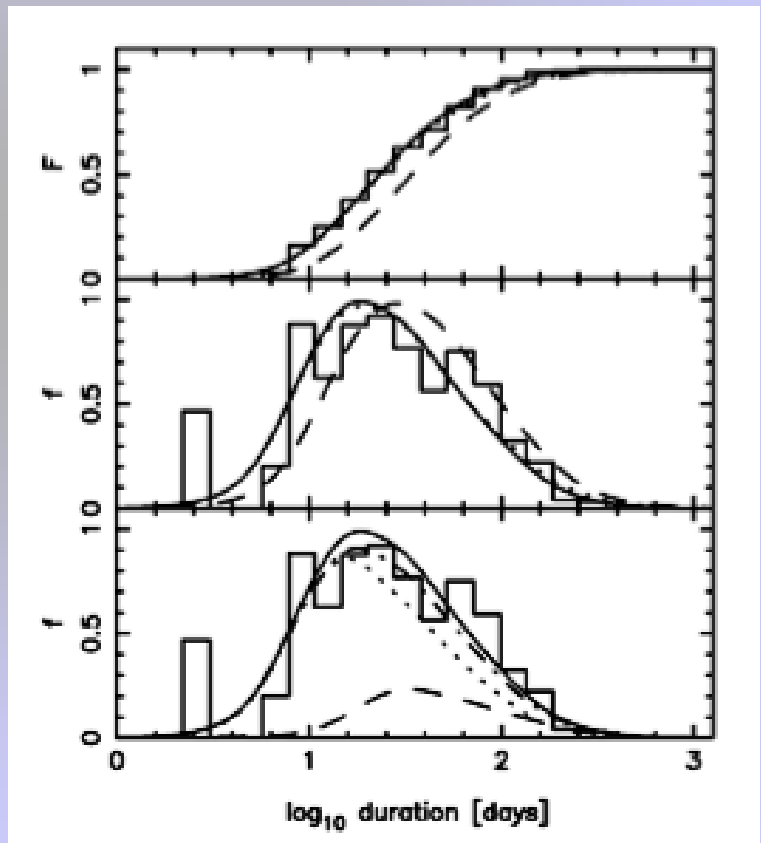
De Lorenzi+ 2009

Density Fits



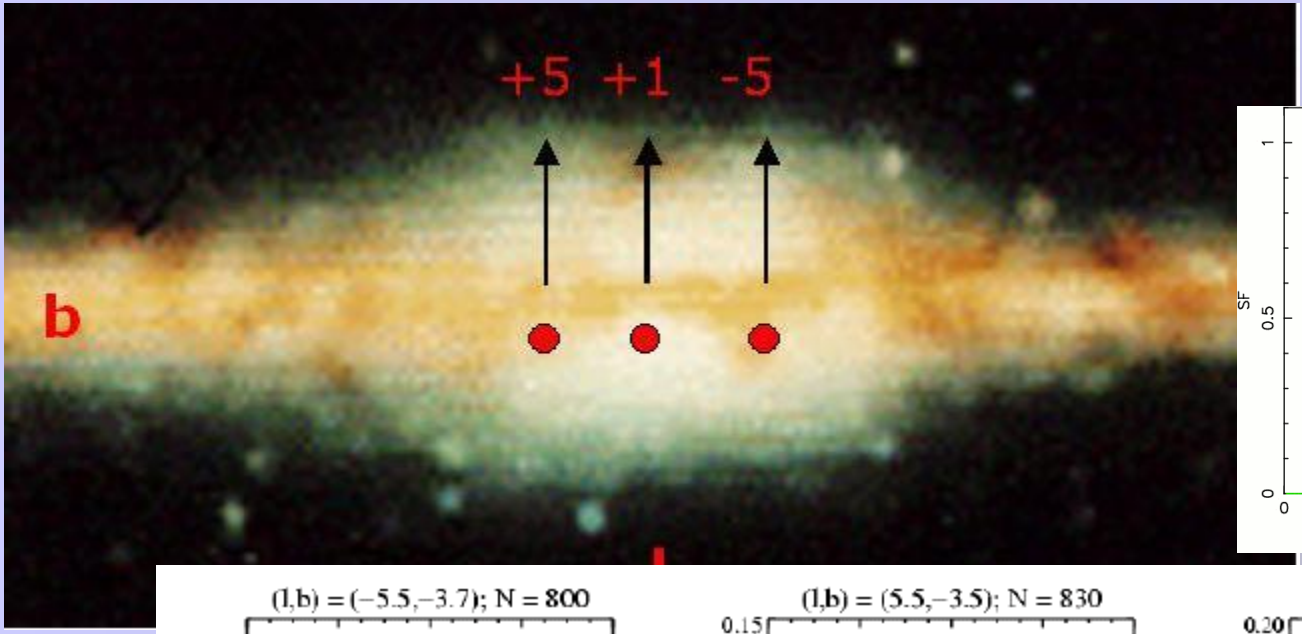
At start poor fit by the model (discrepancies > 50%)

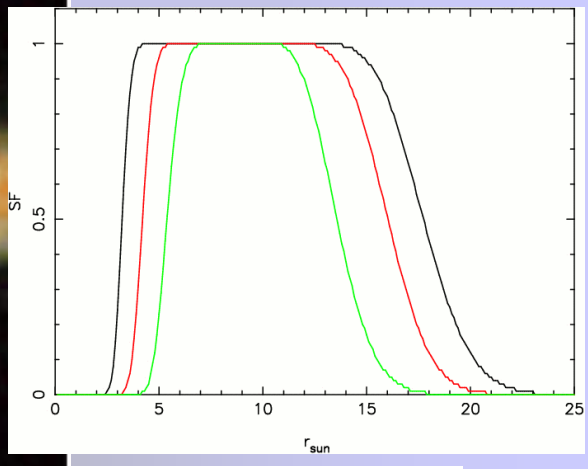
After kMWM2M code, density error mostly <50%

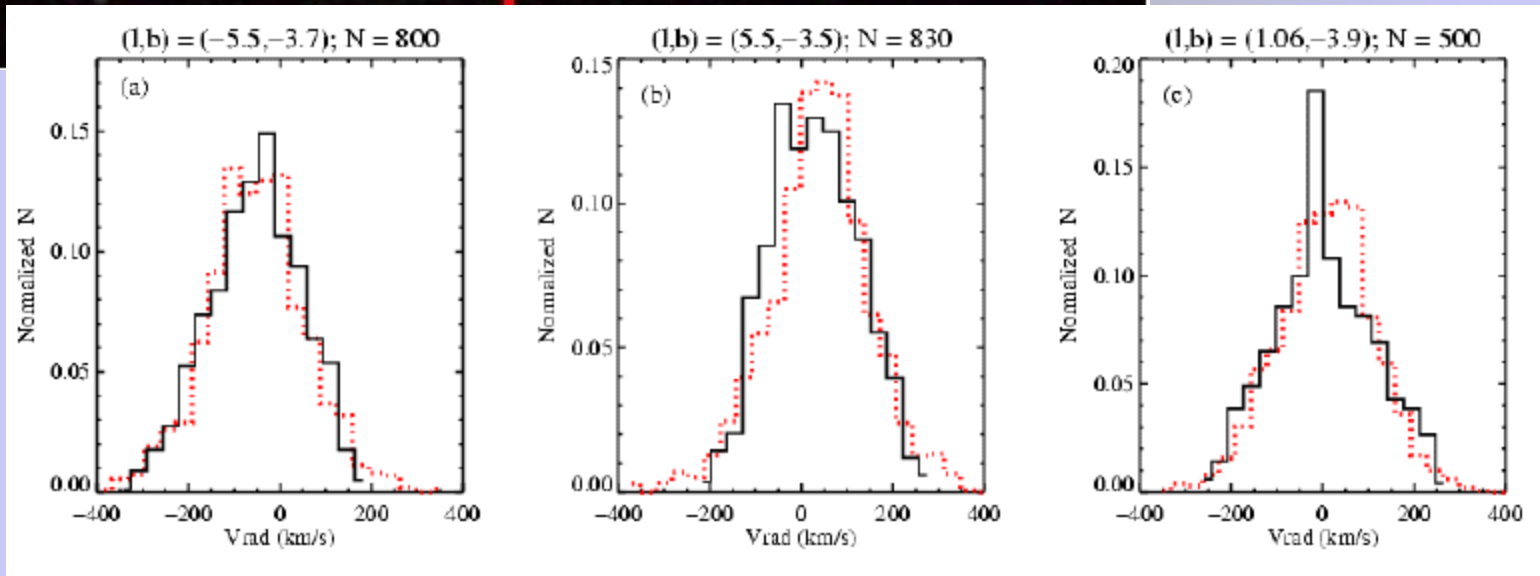


Bissantz+ 2004

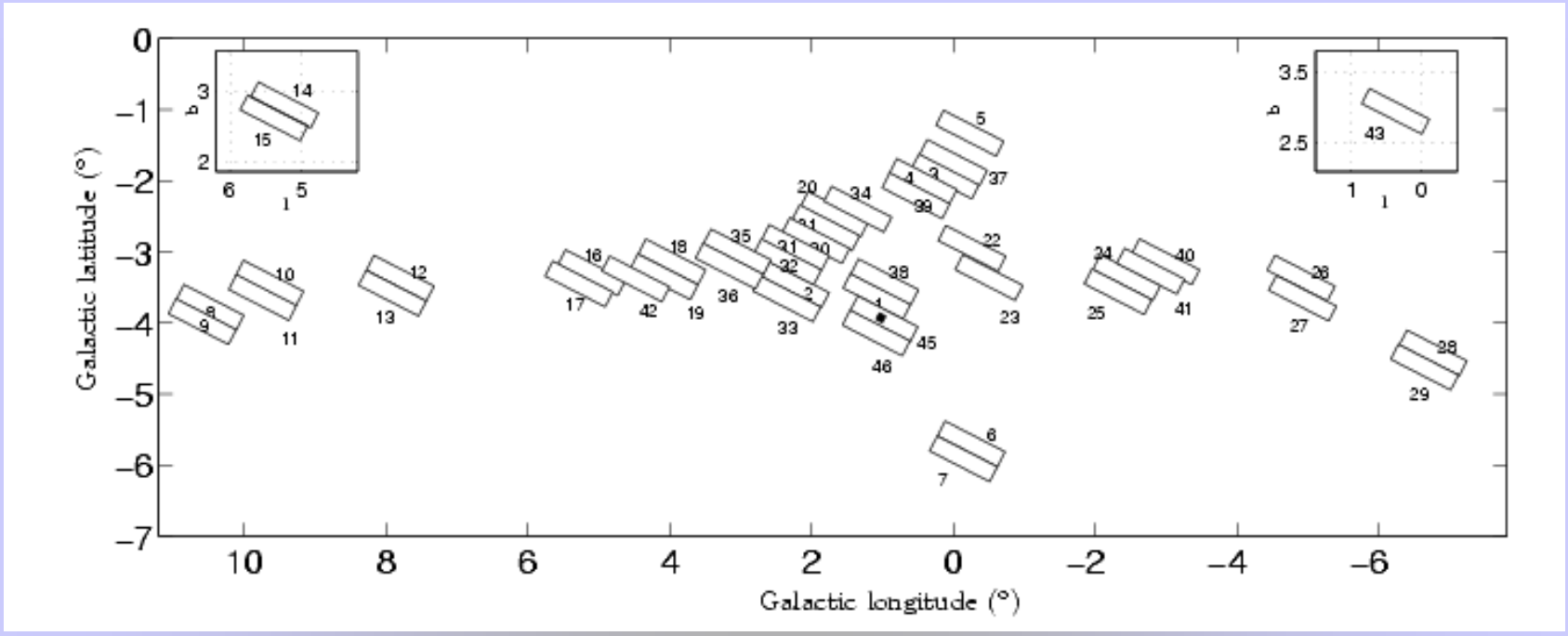
Kinematic Fits to RCGs

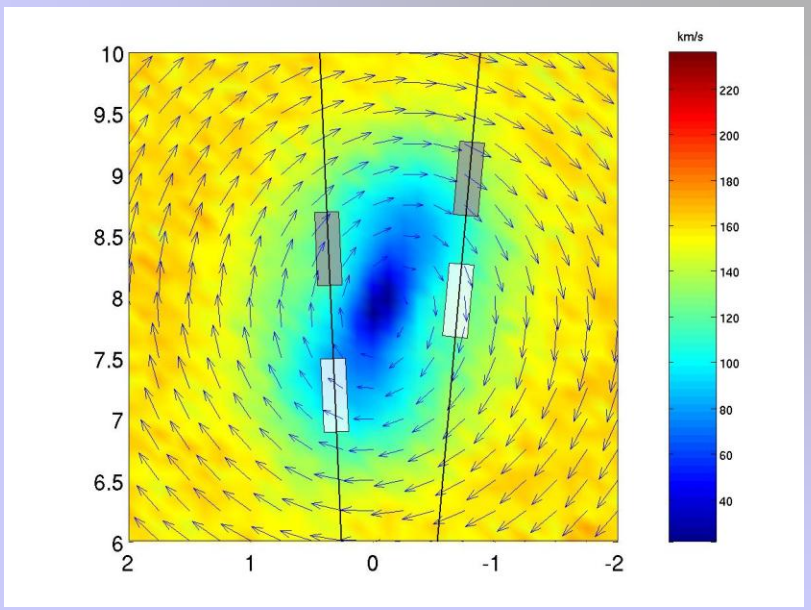


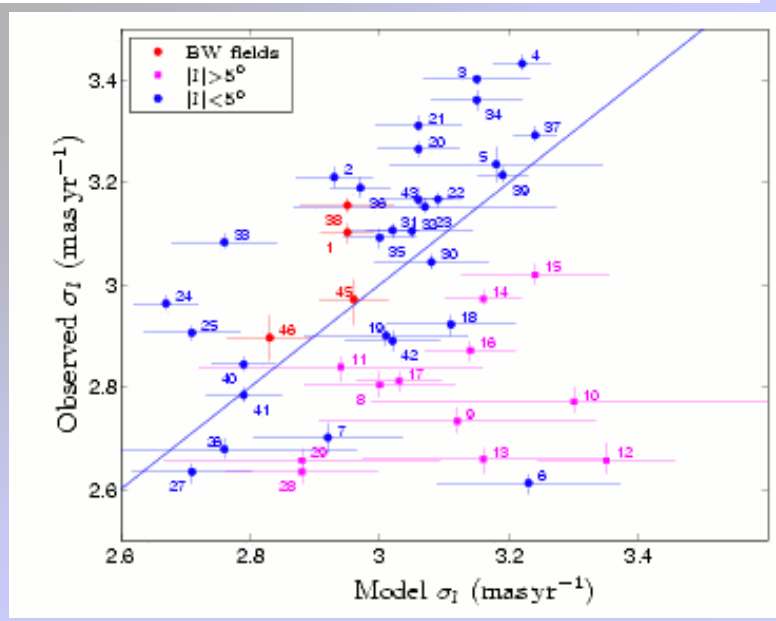




Data: Rangwala+ 2009

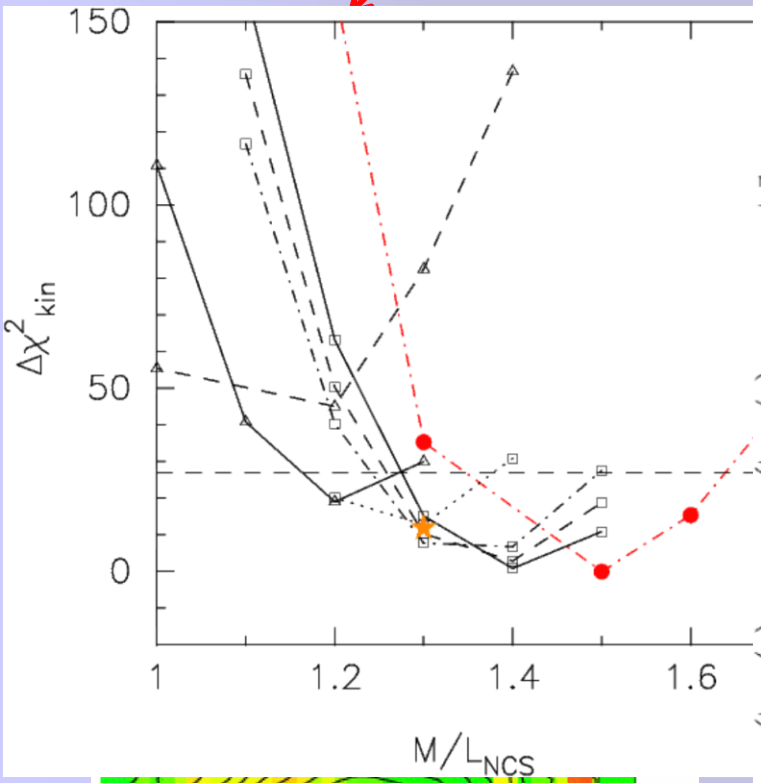


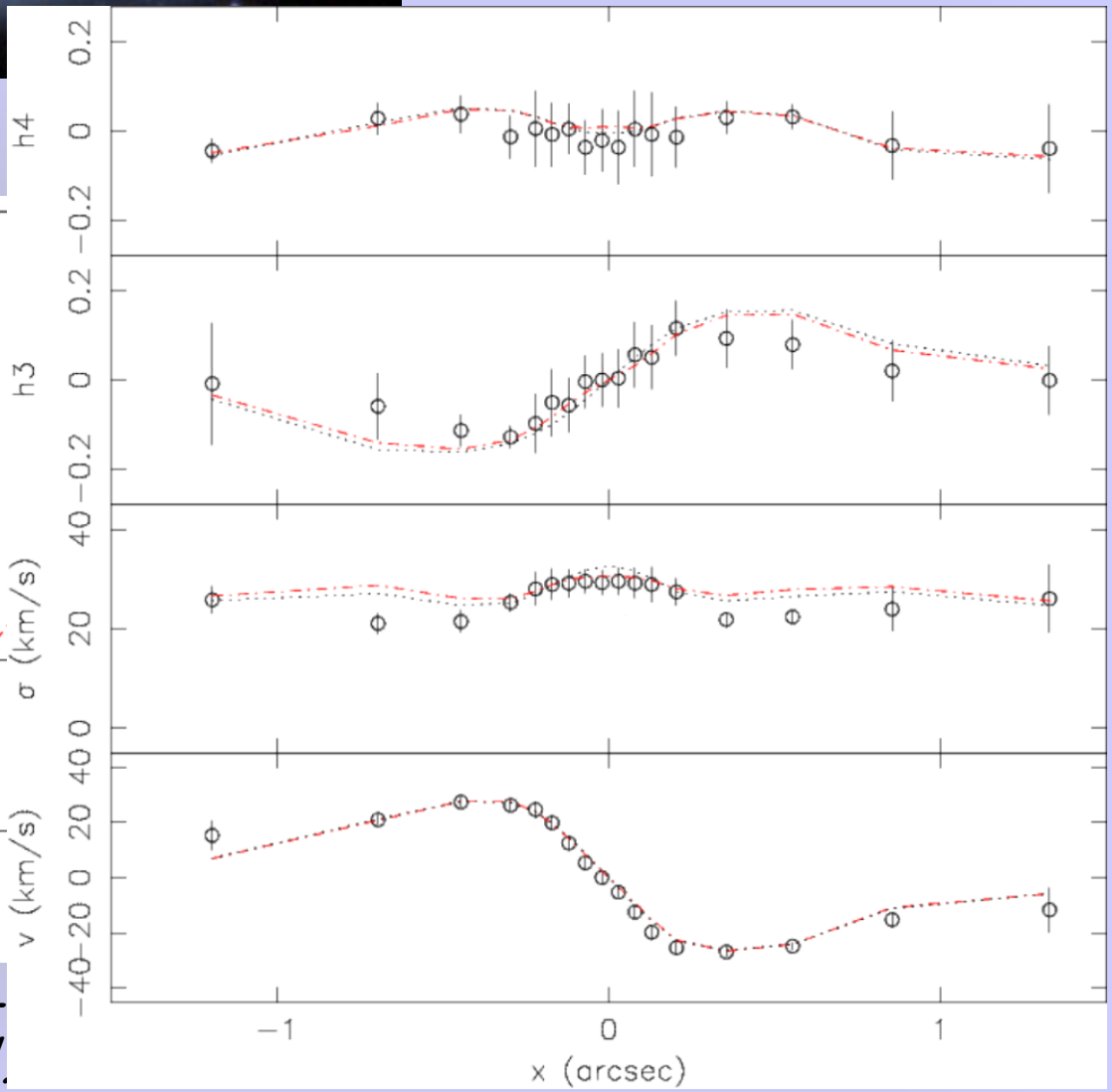




577735 RCGs with relative proper motions from OGLE-II

Rattenbury+ 2007

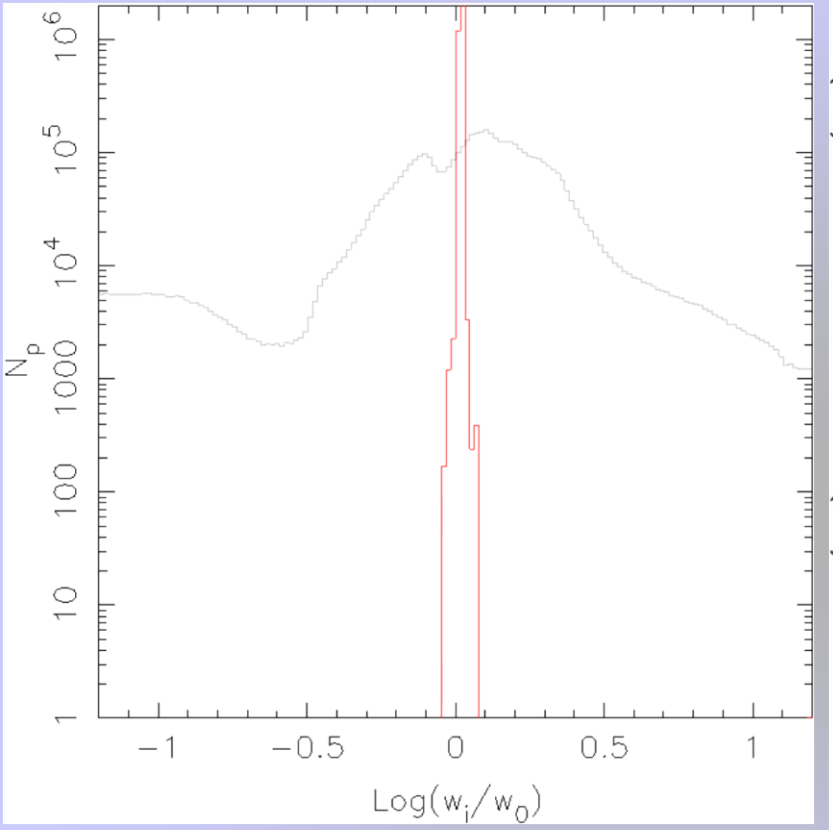


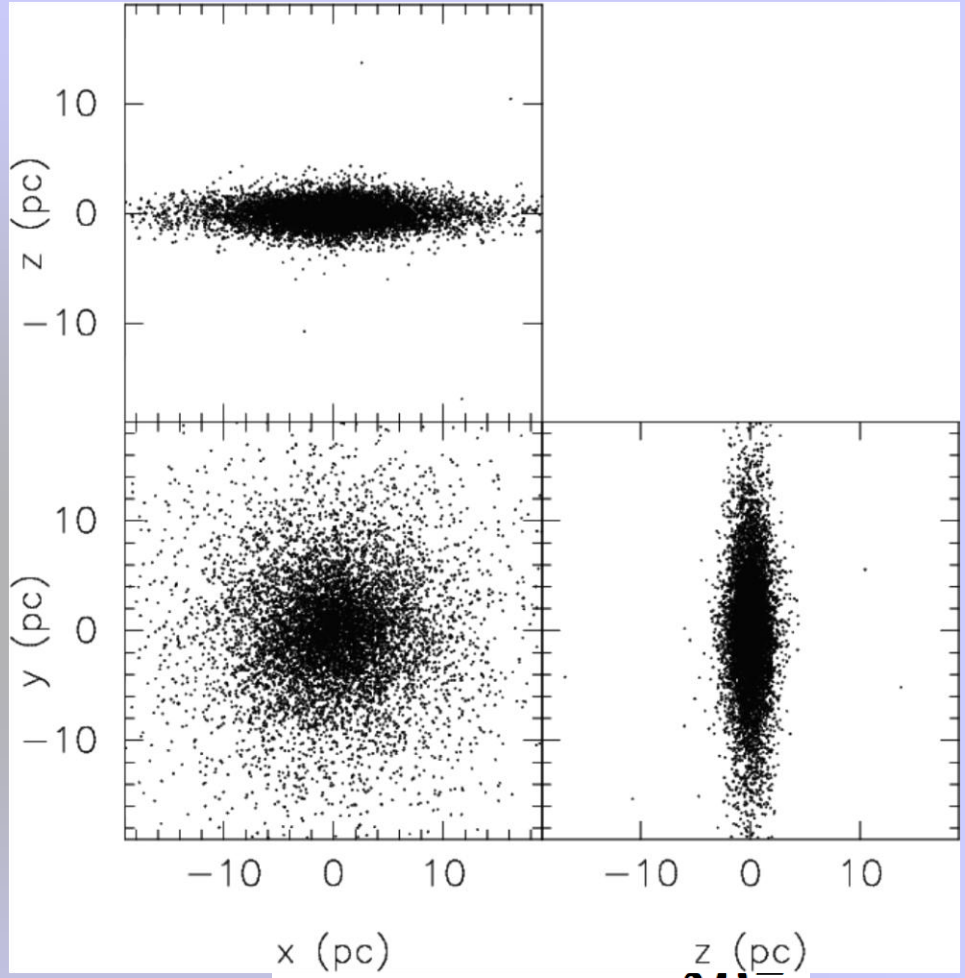


collisionless (e.g. Tremaine+
(studied in Hartmann+ 2011)

or gas fed (e.g. Milosavljević 2004, Bekki+ 2006) (to be studied by STFC funded PDRA)

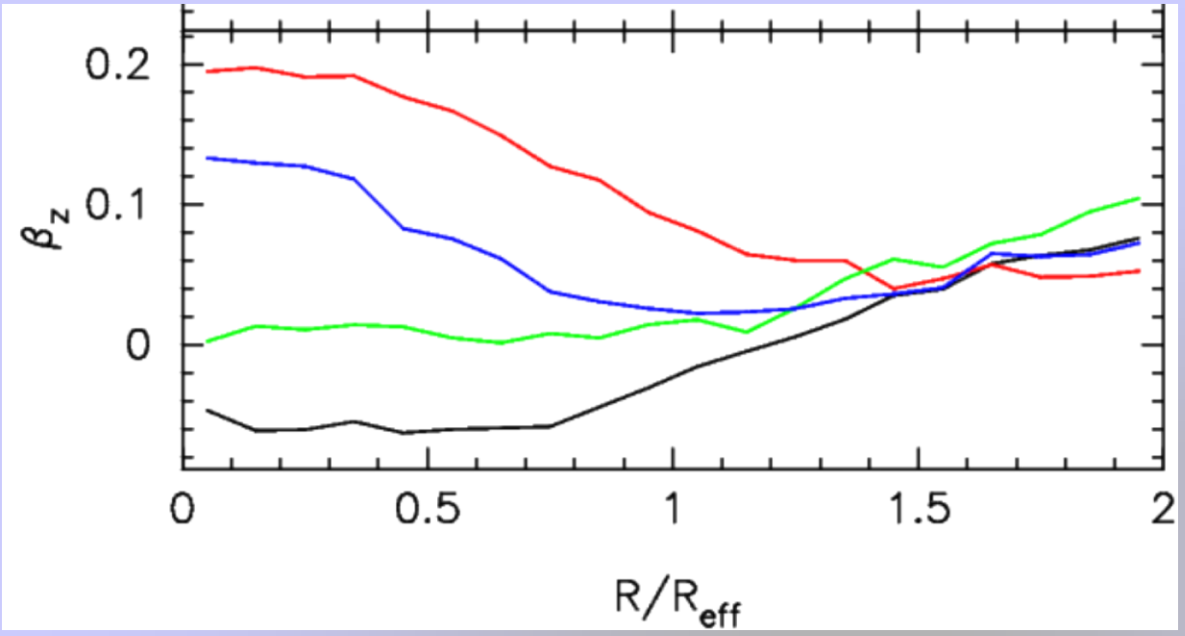
Weight Distributions

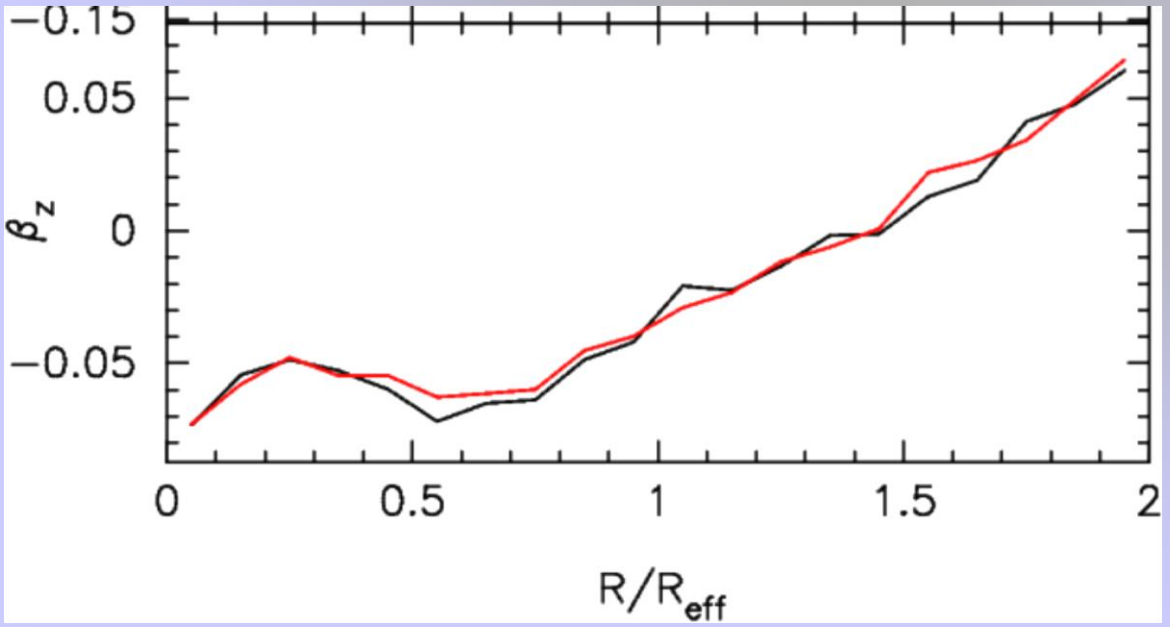




$$N_{\rm eff} \equiv N \frac{\overline{w}}{\overline{w^2}}$$

De Lorenzi+ 2012





β_z < 0 provides a constraint on the fraction of mass accreted directly as stars

Hartmann+ 2011

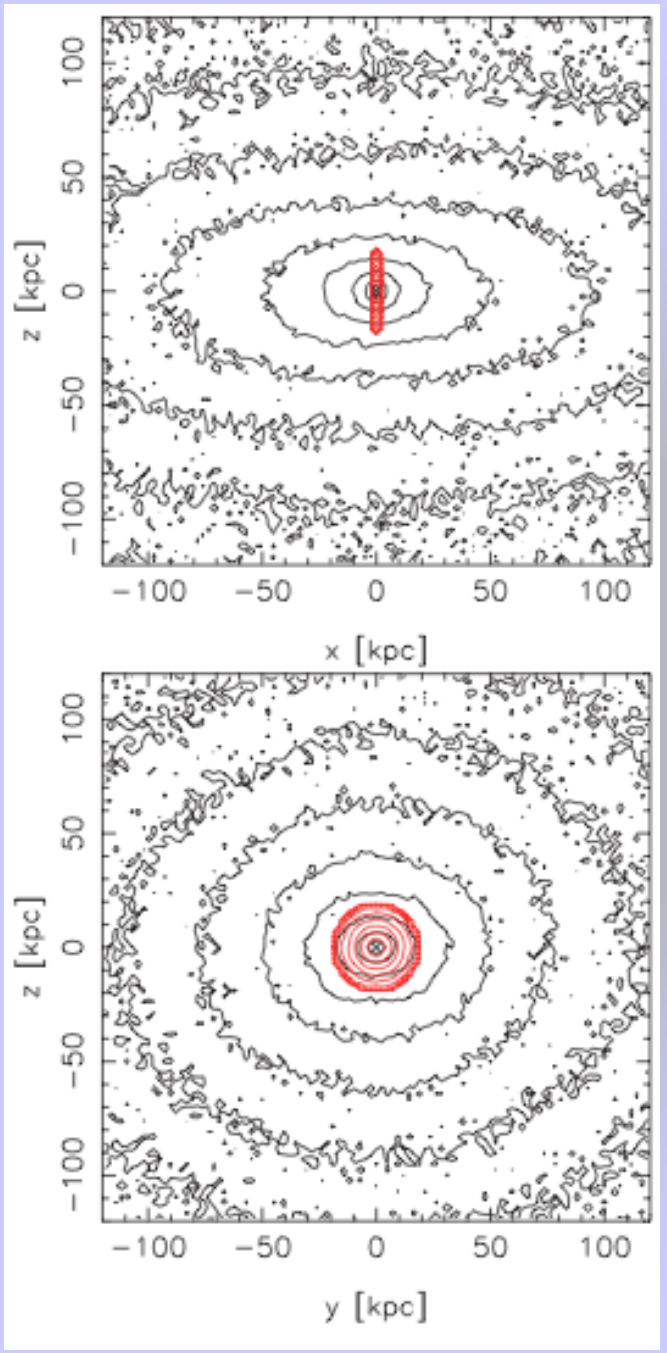
M2M:

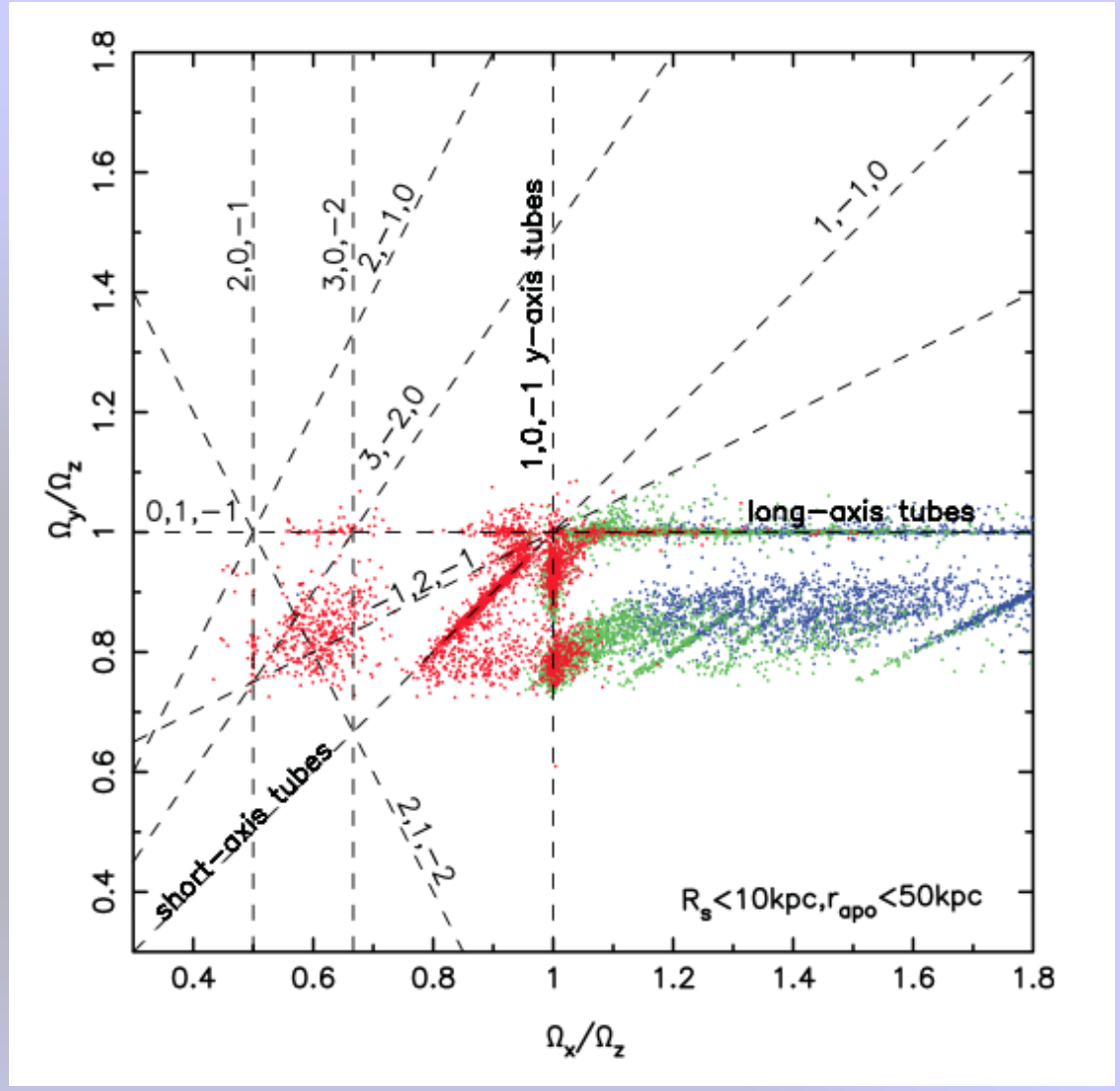
$M(r<15pc) = 1.0 \times 10^7 M_\odot$
$M_{BH} < 4.6 \times 10^5 M_\odot$

JAM:

$M(r<15pc) = 1.1 \times 10^7 M_\odot$
$M_{BH} < 10^5 M_\odot$
$\beta_z = -0.2$

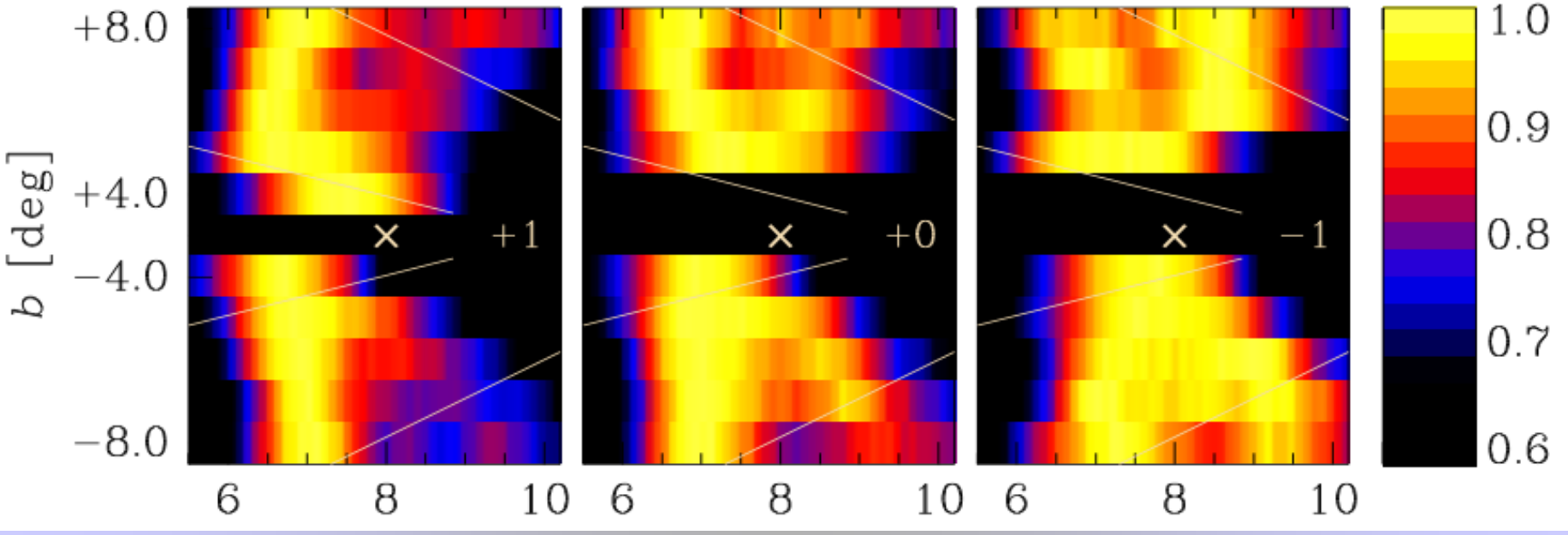
De Lorenzi+ 2012





Trapping at resonances (here of DM particles). Loads of useful information

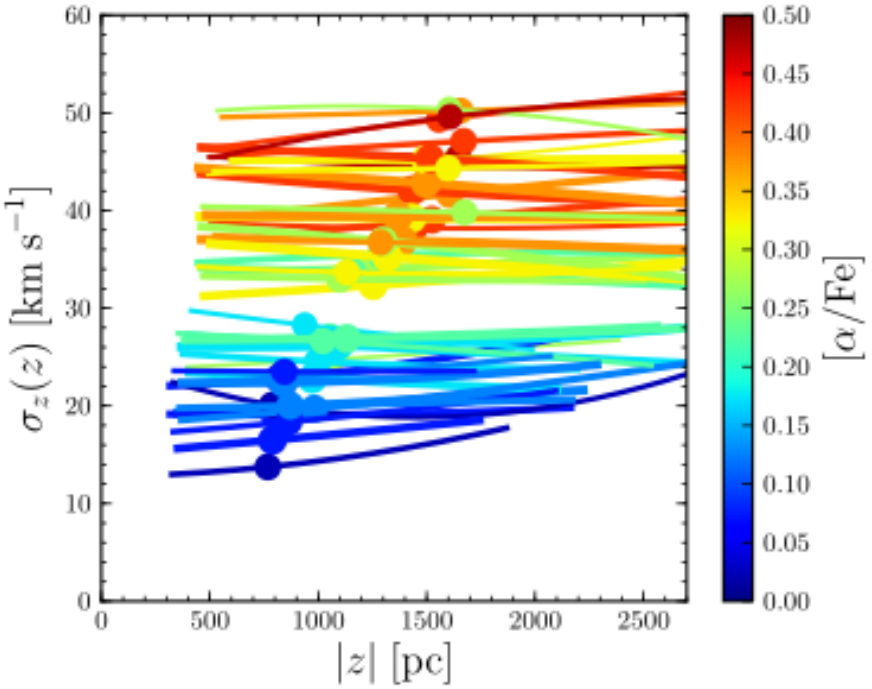
Valluri+ 2011

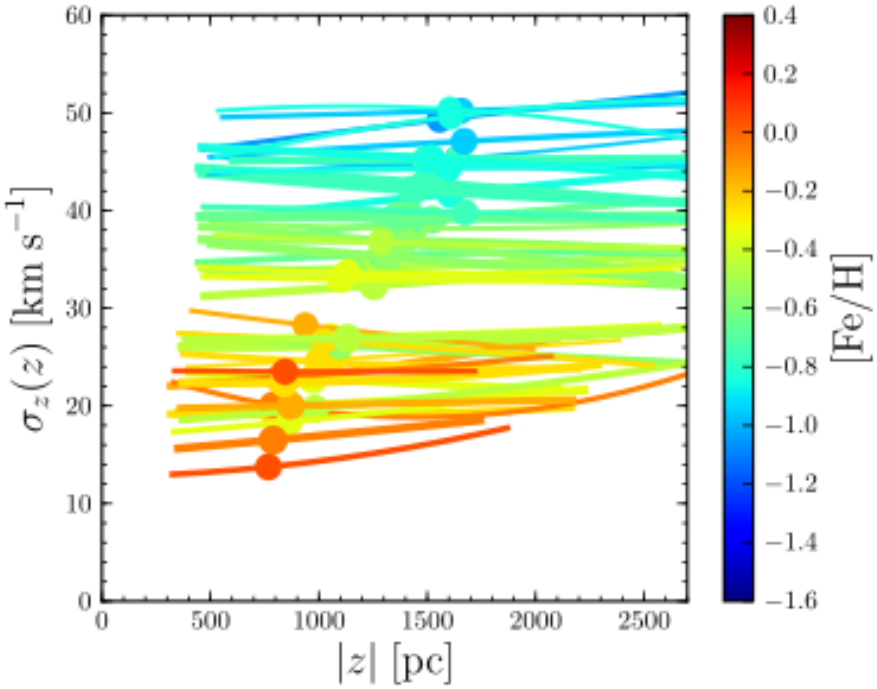


Saito+ 2011

As in external galaxies, the MW bulge is B/P-shaped. There has been plenty of opportunities for resonance trapping in the MW bulge & disk.

Stellar Populations

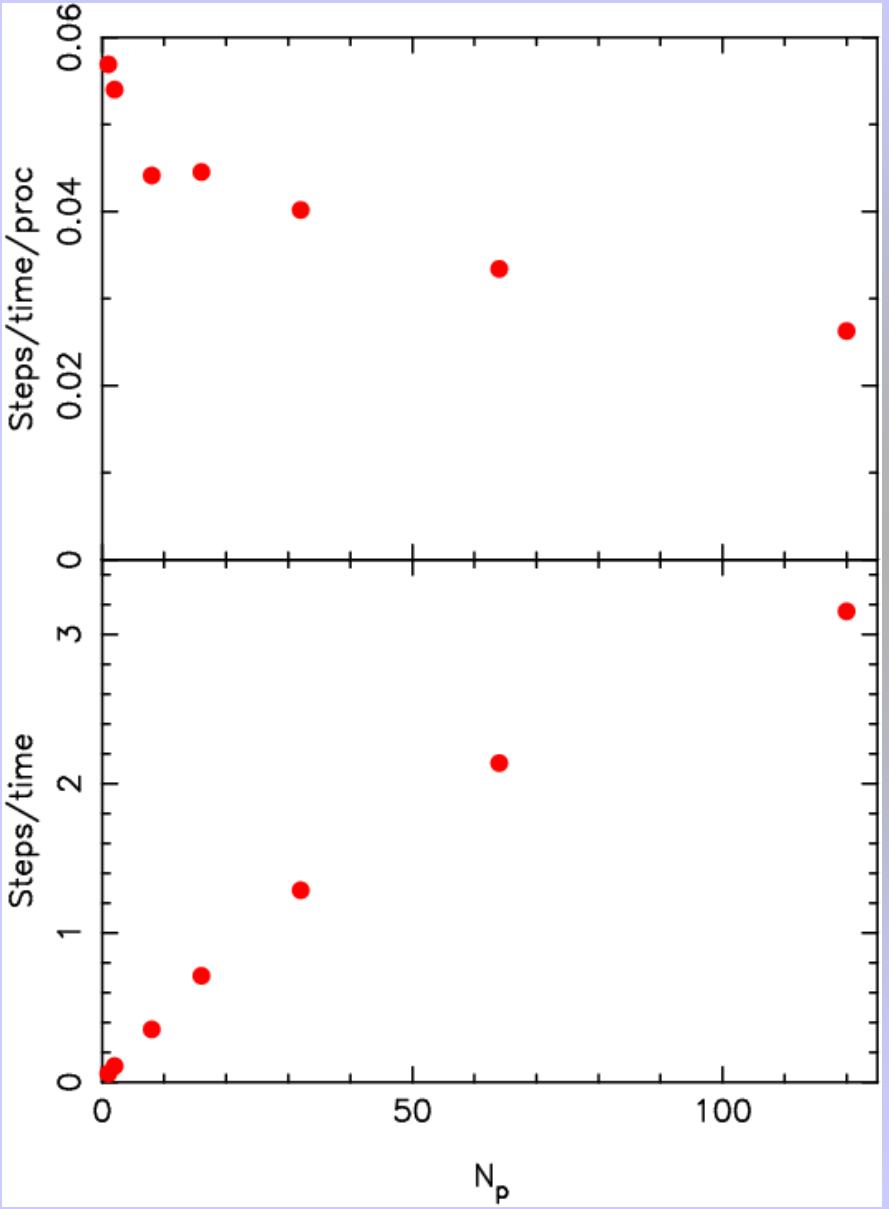




Including stellar populations may simply require the superposition of a large number of mono-abundance populations. In the solar neighborhood, these seem to be particularly simple.

Bovy+ 2012

Scaling



The code scales nearly linearly

This allows a denser sampling of particular regions of the phase space.