Making the best of the data:
discrete dynamical modelling of Omega Centauri

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Dynamics meets kinematic tracers, Ringberg, 12 April 2012
Omega Centauri
Omega Centauri is interesting
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- GCs vs dSphs
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- dark matter?
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Omega Centauri is interesting

- GCs vs dSphs
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- lots of good data
some Local Group objects have fantastic data sets

2163 stars
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2163 stars

2295 stars
we bin spatially
we bin spatially

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binning matches moments

\[ P(v) \]

\[ v \]
we can incorporate chemical information

Omega Cen metallicity distribution

Johnson & Pilachowski 2010
we don’t want to bin at all
we don’t want to bin at all

\[ \mathcal{L}(v_{\text{obs}} \mid \text{model}) \]
we don’t want to bin at all

\[ L( v_{\text{obs}} \mid \text{model}, \delta v_{\text{obs}} ) \]
we can improve membership probabilities
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\[ L(v_{\text{obs}} \mid \text{model}) \]
we can improve membership probabilities

\[ L( v_{obs} \mid \text{model} )^p \times L( v_{obs} \mid \text{background} )^{1-p} \]
we can improve membership probabilities

$$\mathcal{L}( v_{\text{obs}} | \text{model} )^p \times \mathcal{L}( v_{\text{obs}} | \text{background} )^{1-p}$$
calculate velocity moments using Jeans models
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* fast(er)
calculate velocity moments using Jeans models

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- simpler
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  ✔ anisotropy constant: $<v_{R}^2> = b <v_{Z}^2>$
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  ✵ velocity ellipsoid aligned with cylindrical coordinate system
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  ✵ rotation parameter: $<v_\phi> = k \ ( <v_\phi^2> - <v_R^2> )^{1/2}$
we have 5 free parameters
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- velocity anisotropy: \( \beta = 1 - \frac{\langle v_z^2 \rangle}{\langle v_R^2 \rangle} \)
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- probability of membership, VL sample: \( p_{VL} \) (~1)
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*emcee* MCMC  Foreman-Mackey et al. 2012
preliminary results
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**Graphs:**

- Beta distribution
- Inclination distribution
- Mass to Light ratio distribution

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- $p_{VL} (~1) : 1.000 \pm 0.000$
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Omegac Cen
wish list

- Omega Cen
  - add more data (less conservative cuts)
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- Local Group dSphs and GCs
- Milky Way
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杂质

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includes improved membership determination and chemical tagging
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preliminary results looks promising!
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Binned model evolution
Binned model parameters

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