

Intermediate mass black holes in star clusters: “fake” clusters and strange centers

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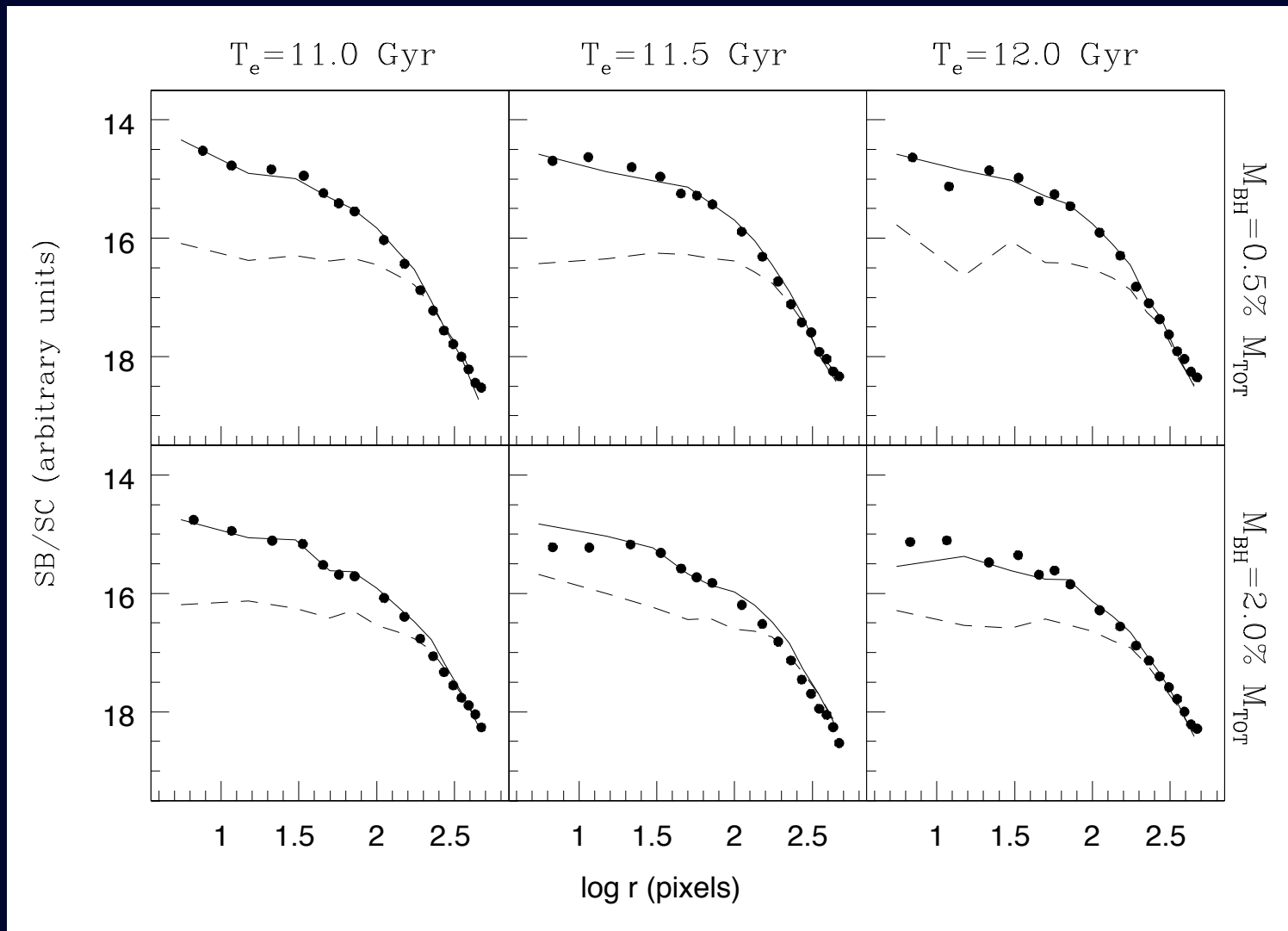
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Kissler-Patig, Tim de Zeeuw, Marcel Bergmann



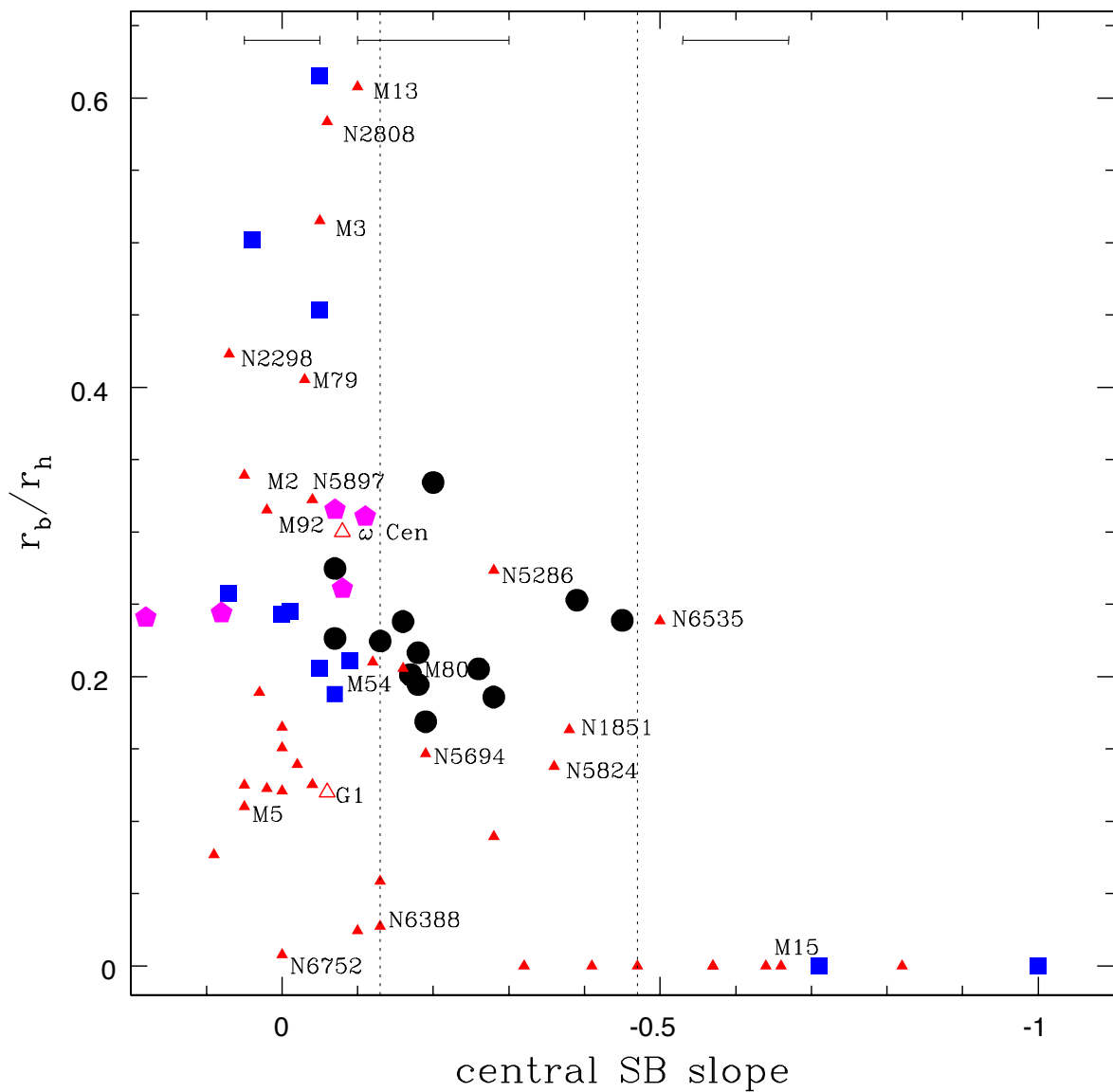


Integrated light vs. star counts



- Integrated light follows input profile for stars brighter than 16 magnitudes
- Star counts from the same brightness group, require corrections due to crowding. Corrections vary from model to model

BH diagnostics



- models with central IMBH
- models without central IMBH
- ◆ models with stellar mass BHs

- Very concentrated clusters (such as M15) appear not to have central BHs
- Models with IMBHs show cusps steeper than -0.12
- There are models containing IMBHs very flat central profiles

Completeness issues

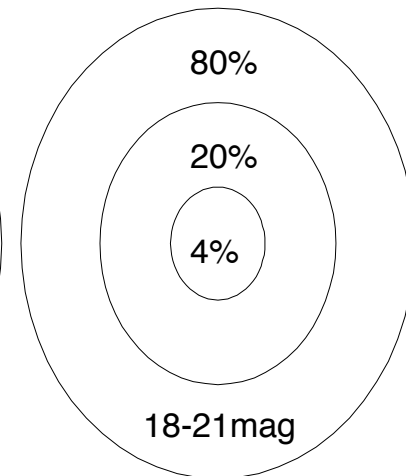
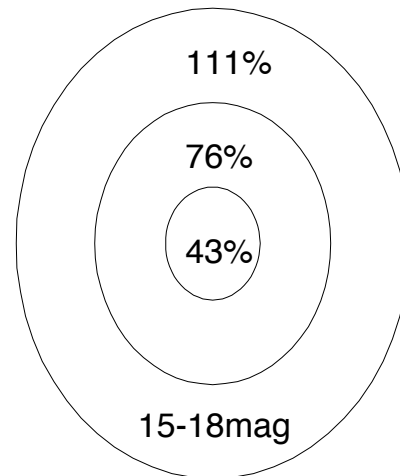
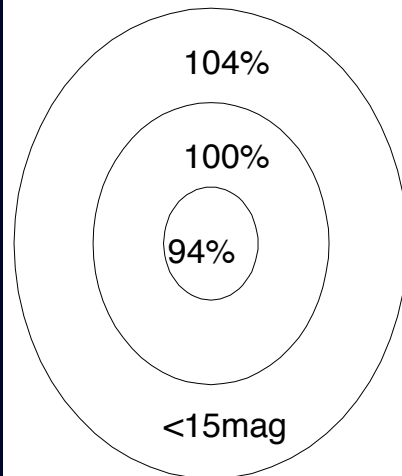


m1 and m2



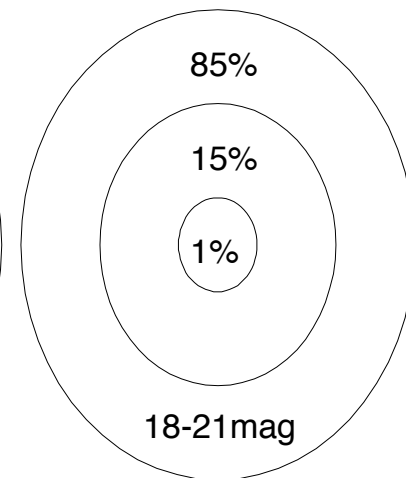
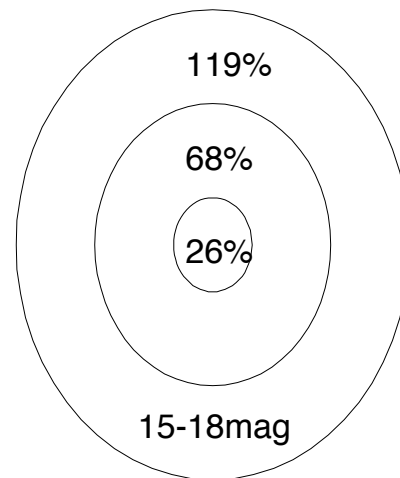
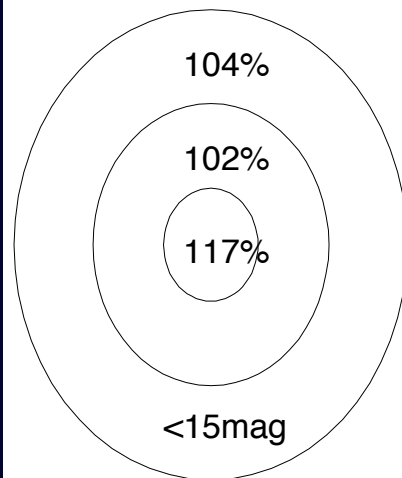
m1- δm

mb4t11.5 M_{BH}=2% t=11.5



TO~15.5

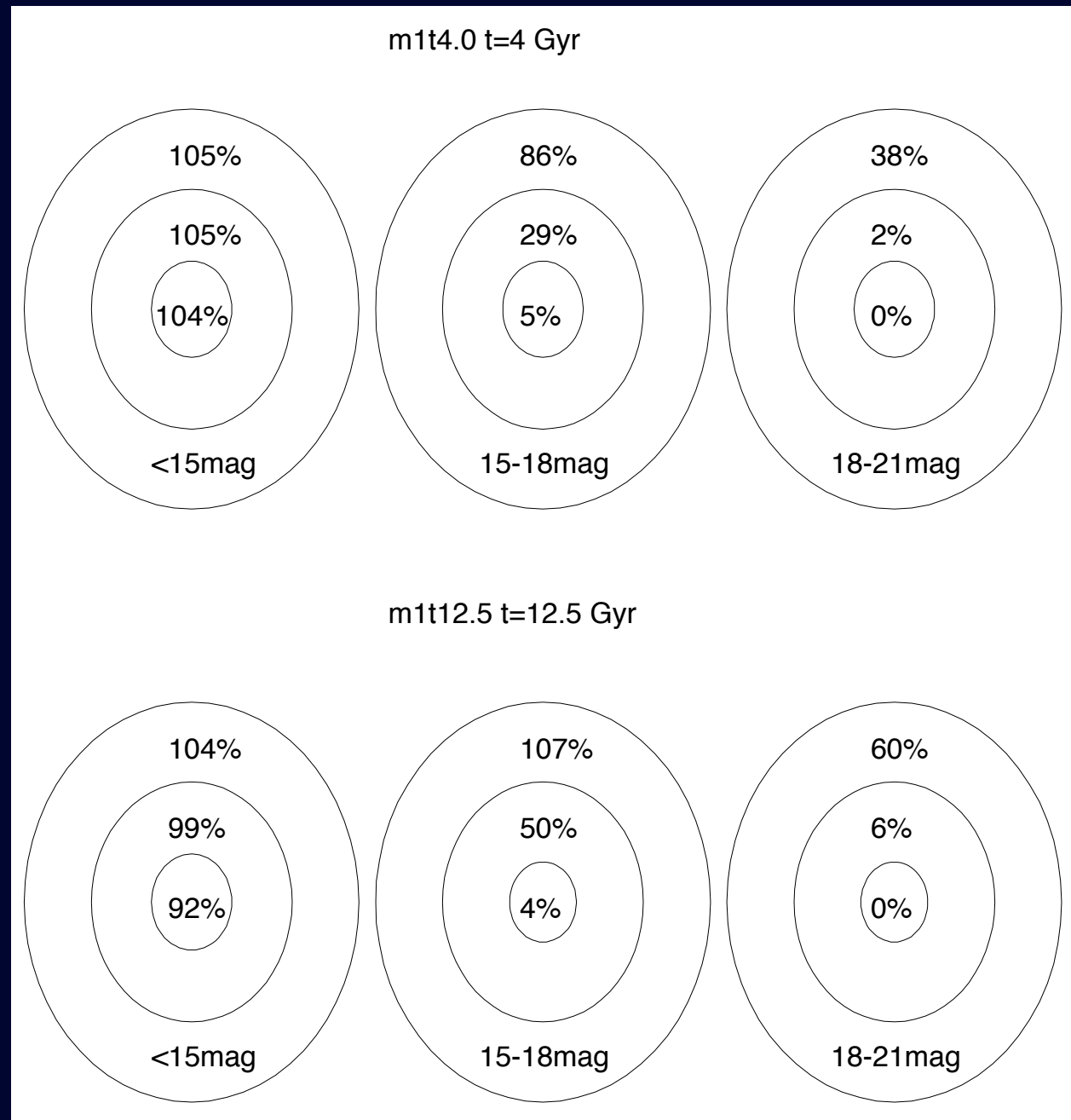
mb5t11.8 M_{BH}=2% t=11.8



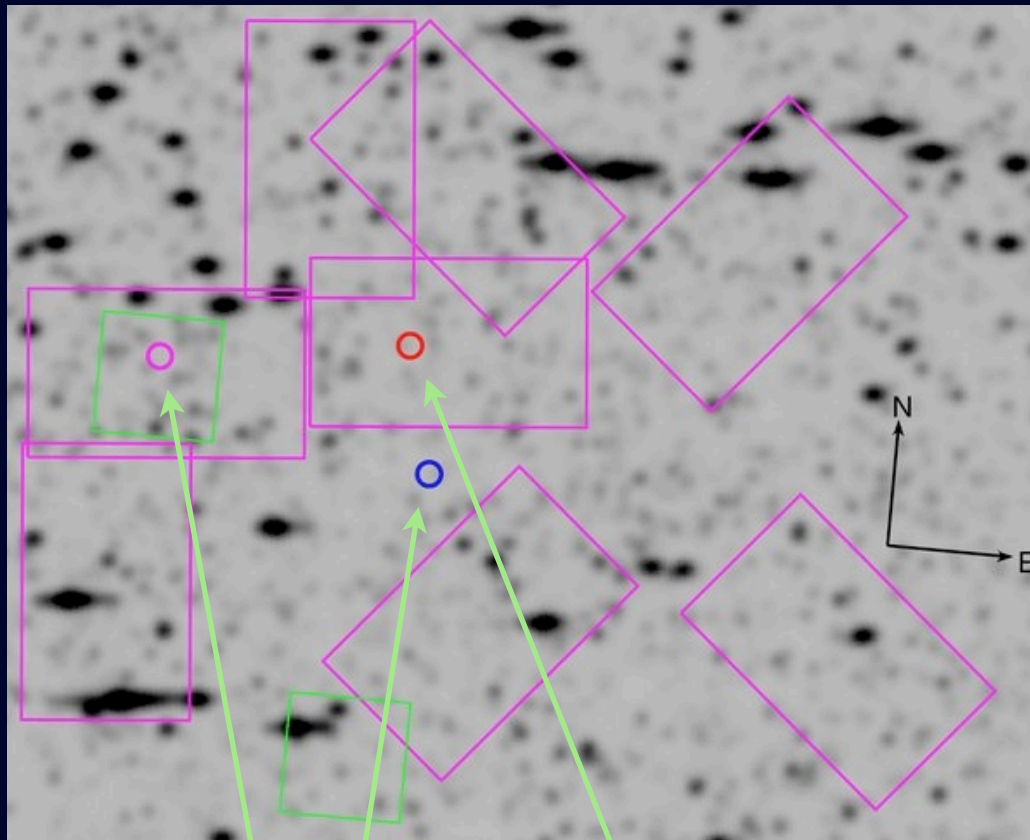
- For rich clusters, incompleteness is a huge problem inside the core, even at intermediate magnitudes

- The problem is worse for younger and concentrated clusters

- How problematic is this for finding centers?



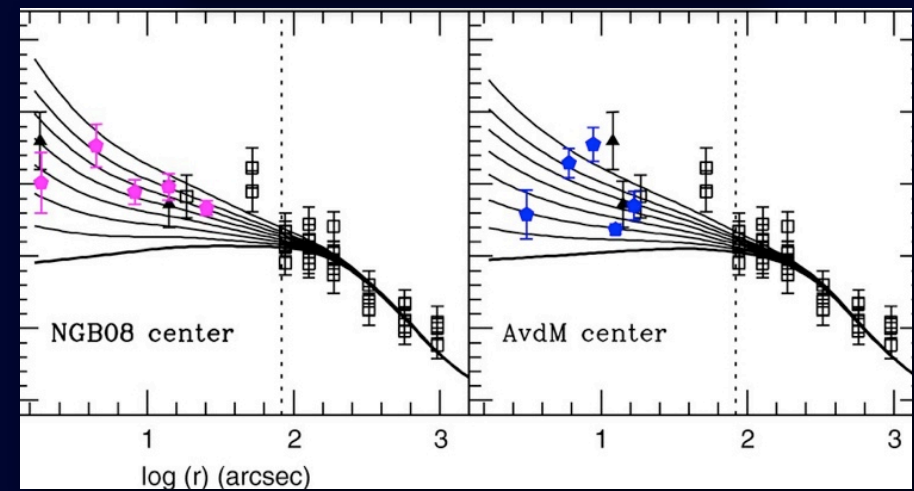
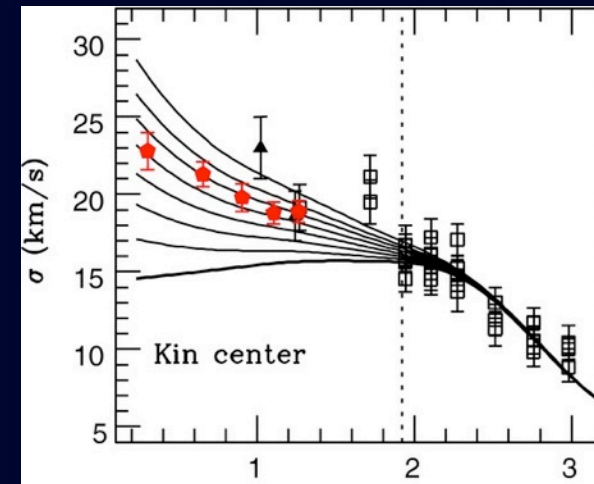
The many centers of omega Centauri



photometric centers

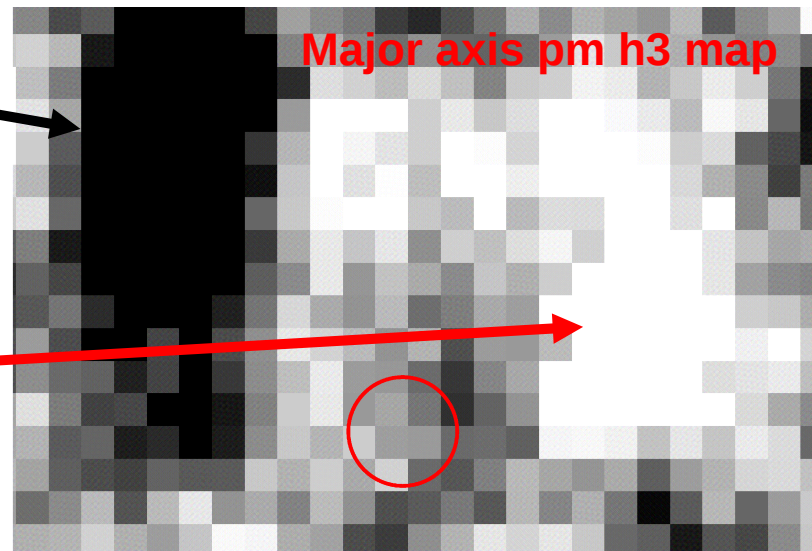
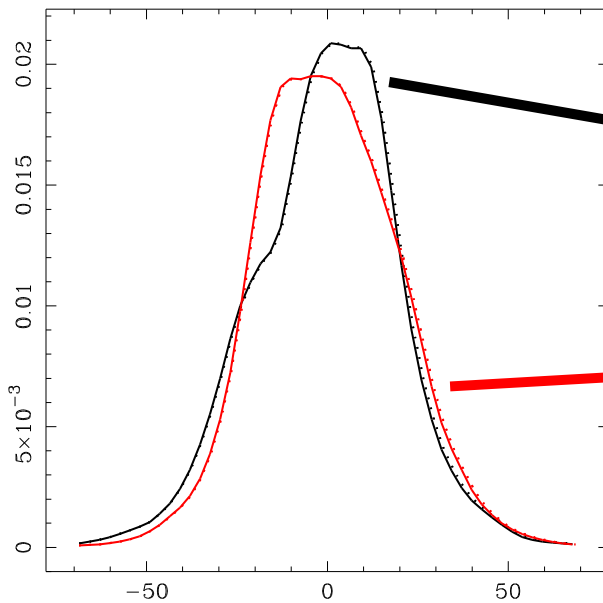
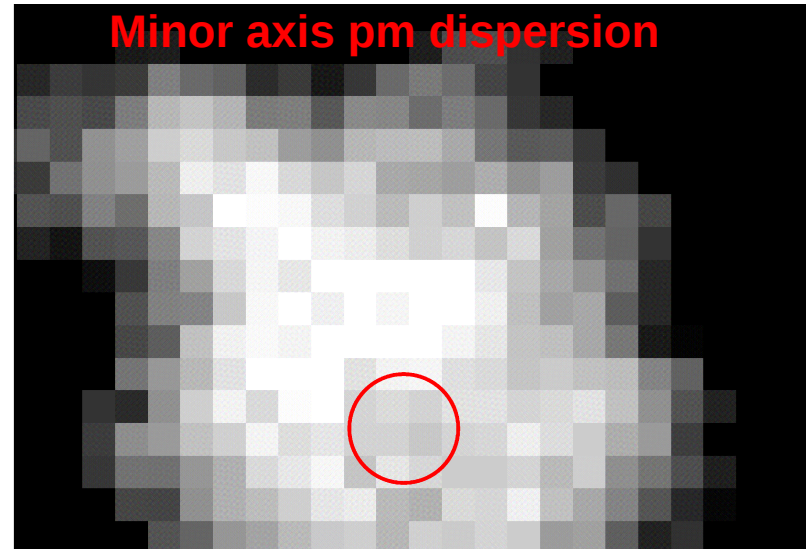
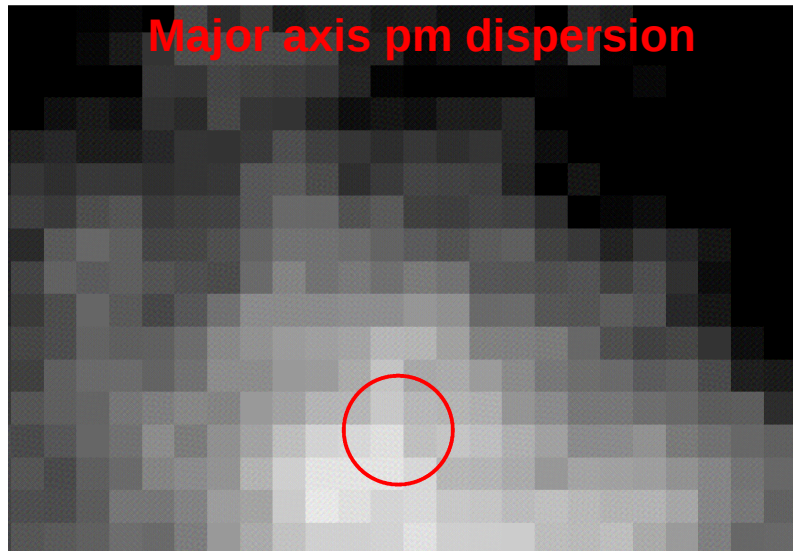
kinematic center

$$\Delta_{\text{pos}}/r_c \sim 1/20$$



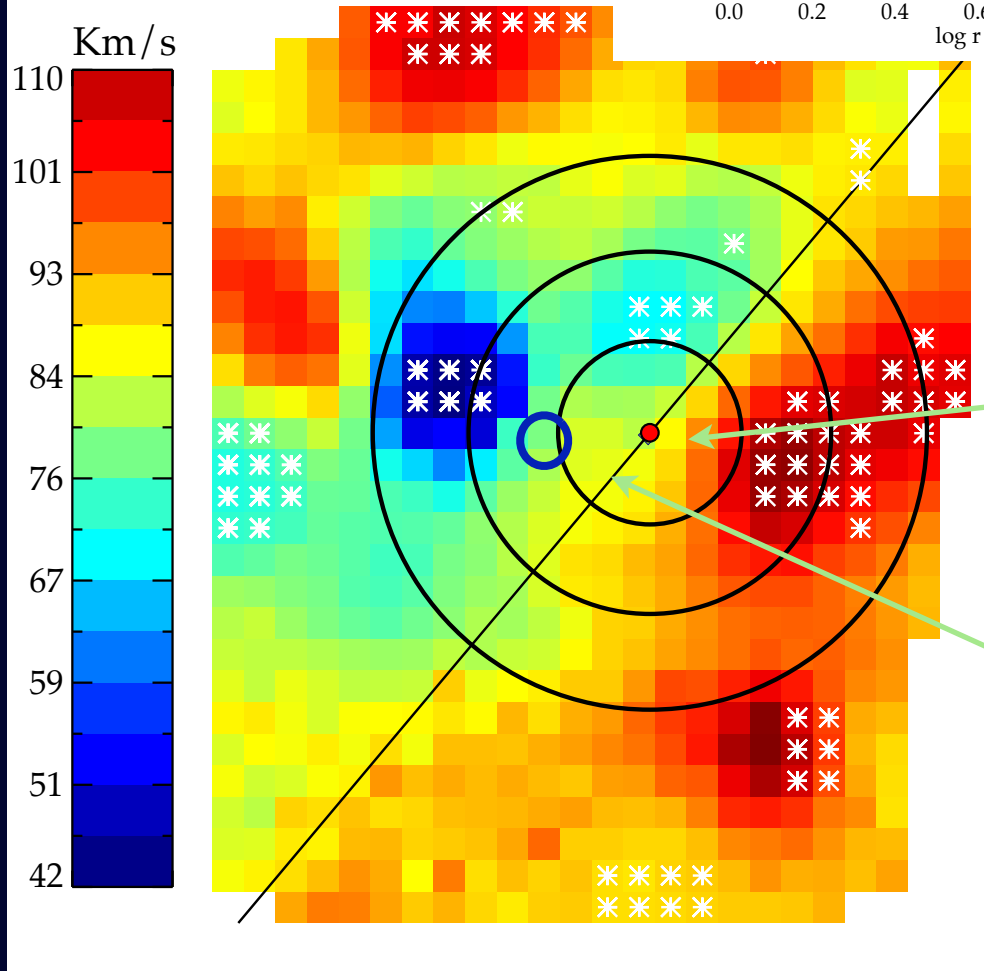
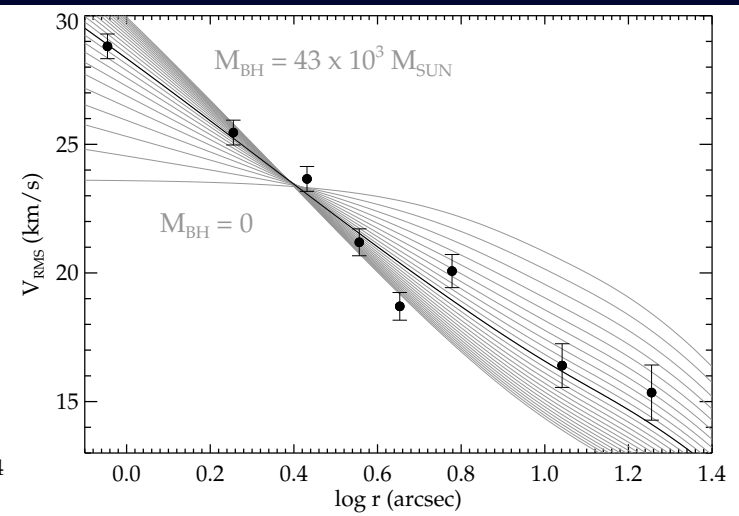
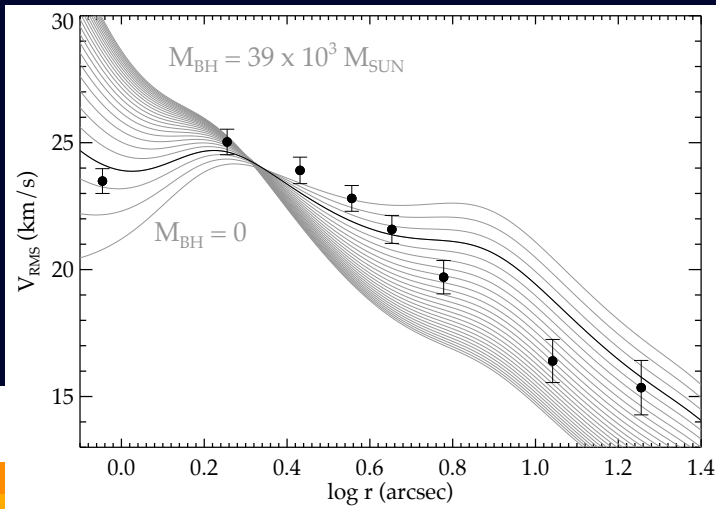
Noyola et al., 2010

Kinematic center from proper motion velocities



- Accounting for rotation is key

NGC 6388



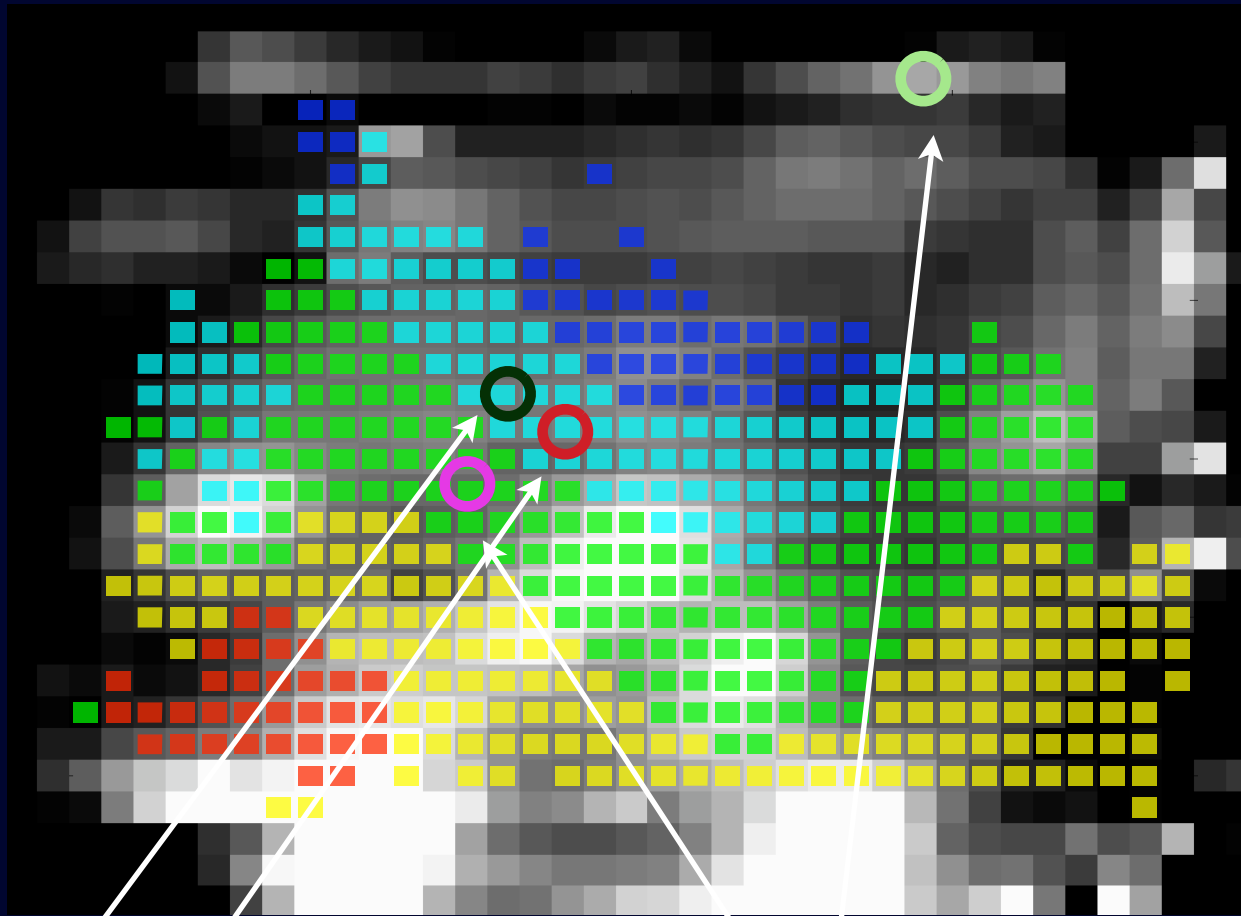
Lützgendorf et al., 2011 (submitted)

photometric center

$$\Delta_{\text{pos}}/r_c \sim 1/8$$

kinematic center

M54

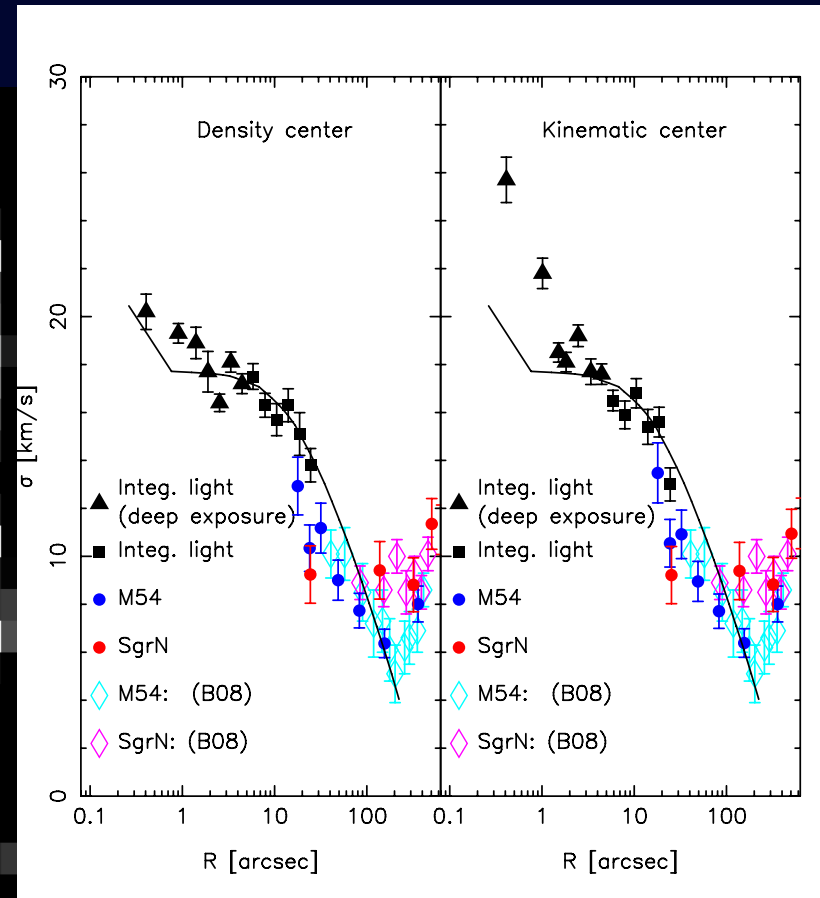


photometric centers

kinematic centers

$$\Delta\text{pos}_a/r_c \sim 1/6$$

$$\Delta\text{pos}_b/r_c \sim 1/1.2$$



Ibata et al., 2009

Conclusions

- It is worth turning models into images when comparing them to observations
- Photometric corrections due to crowding are heavily dependent on the detailed structure of each star cluster, they also affect bright stars
- Can the center discrepancies be blamed on photometric errors?
- Are kinematic centers systematically different than photometric centers?