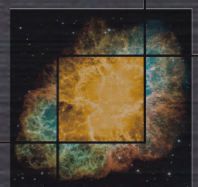


DOES THE GLOBULAR CLUSTER NGC 6388 HOST AN INTERMEDIATE-MASS BLACK HOLE?



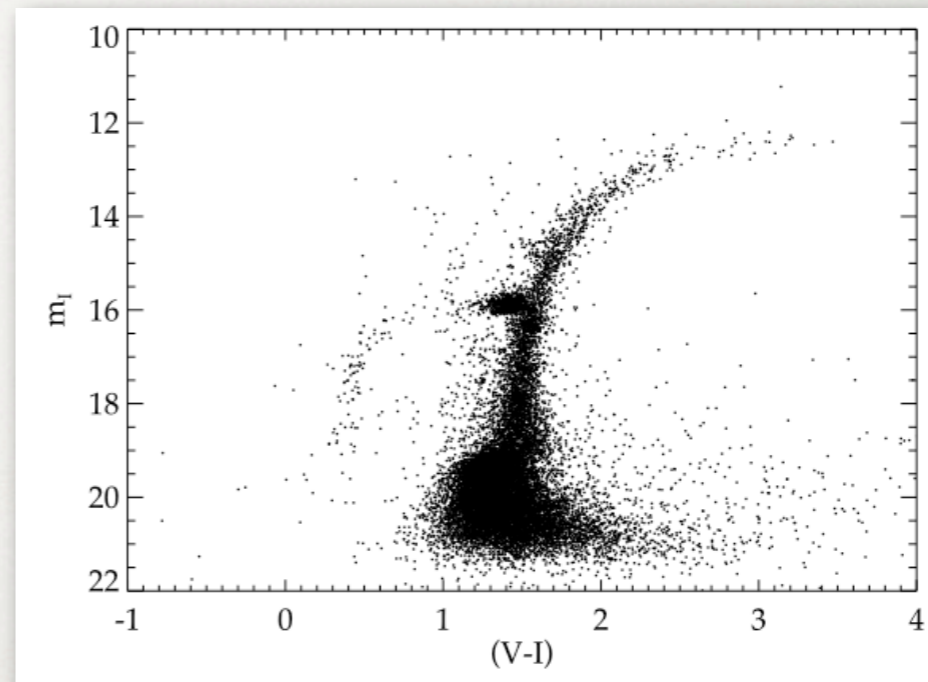
NORA LÜTZGENDORF

- DYNAMICS OF LOW-MASS STELLAR SYSTEMS 2011, SANTIAGO -
M. KISSLER-PATIG, E. NOYOLA, B. JALALI, T. DE ZEEUW, K. GEBHARDT, H. BAUMGARDT

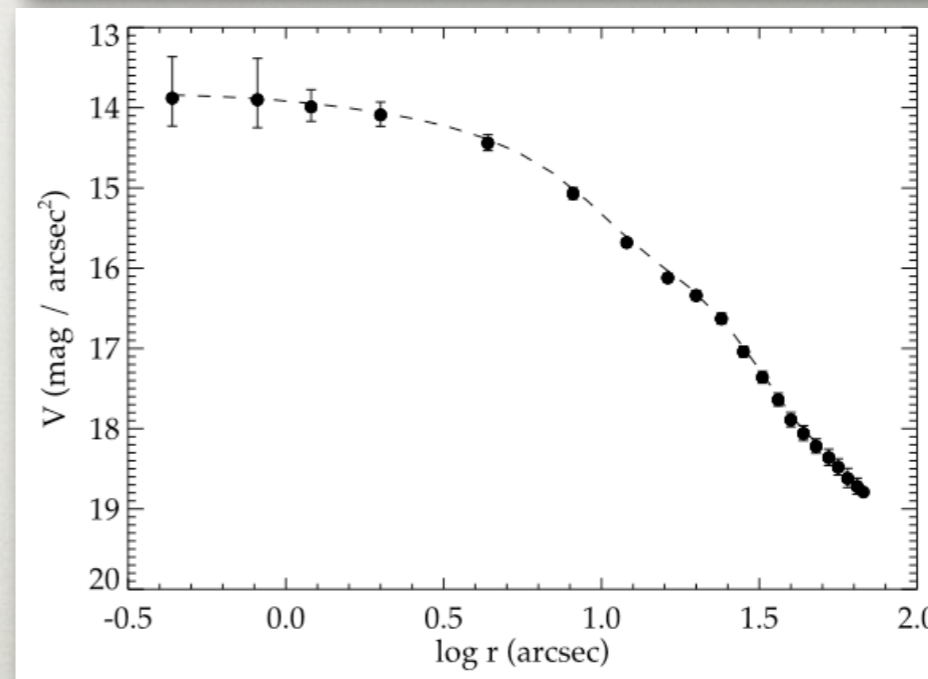


NGC 6388

GAL. LONG.	345.56°
GAL. LAT.	-6.74°
DISTANCE	10 kpc
[Fe/H]	-0.6 dex
MASS	$1.3 \times 10^6 M_\odot$
VELOCITY DISP.	$18.9 \text{ km} \cdot \text{s}^{-1}$
BH-MASS (PHOT.)	$5.7 \times 10^3 M_\odot$
<small>(LANZONI ET AL. 2007)</small>	



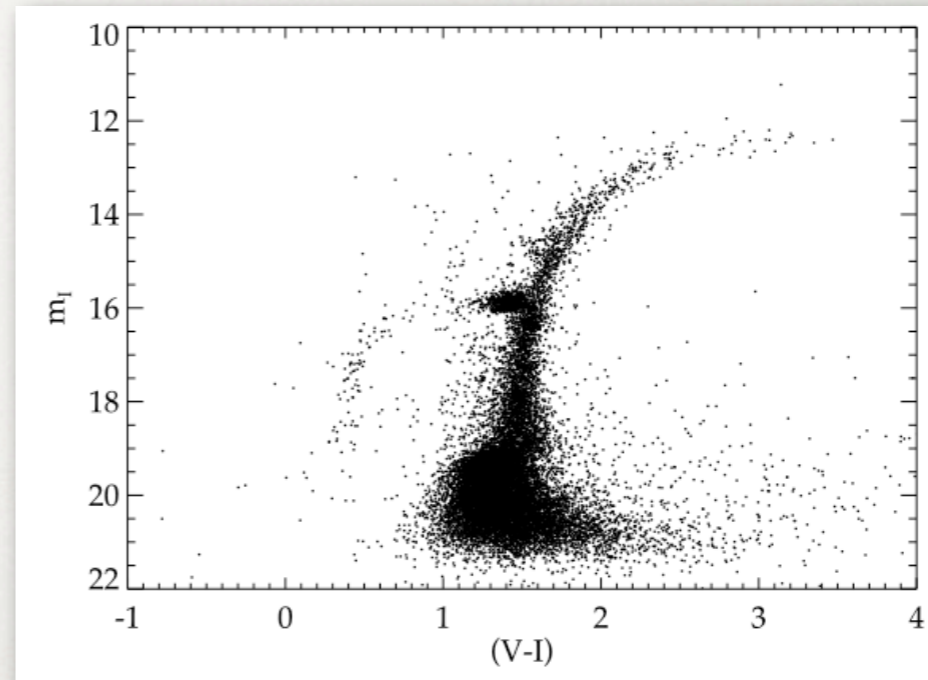
◀ Our color-magnitude diagram from HST/ASC data



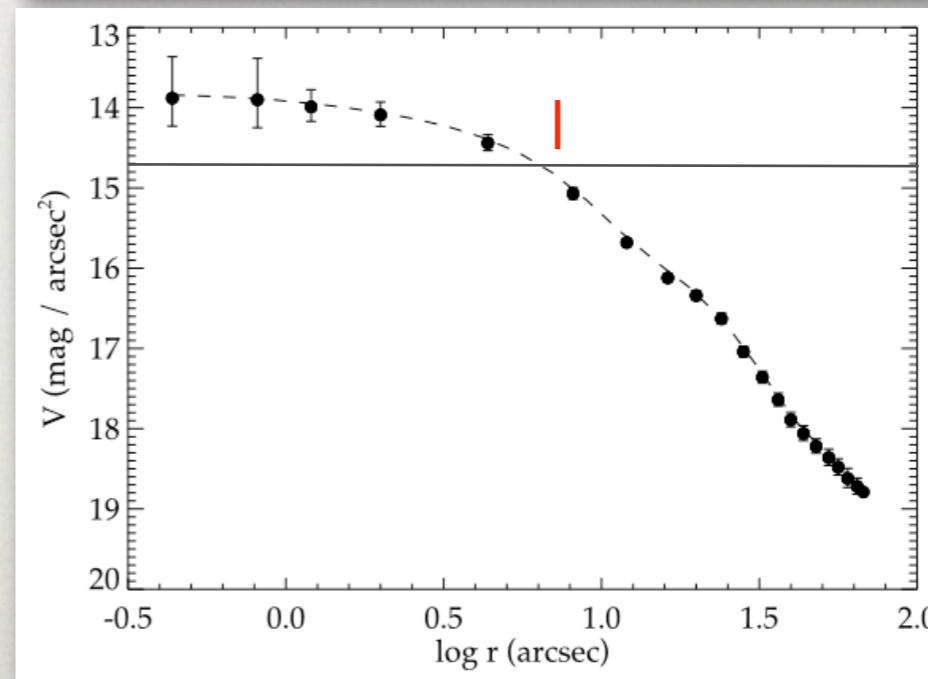
◀ Surface brightness profile (Lützgendorf et al. 2011, submitted)

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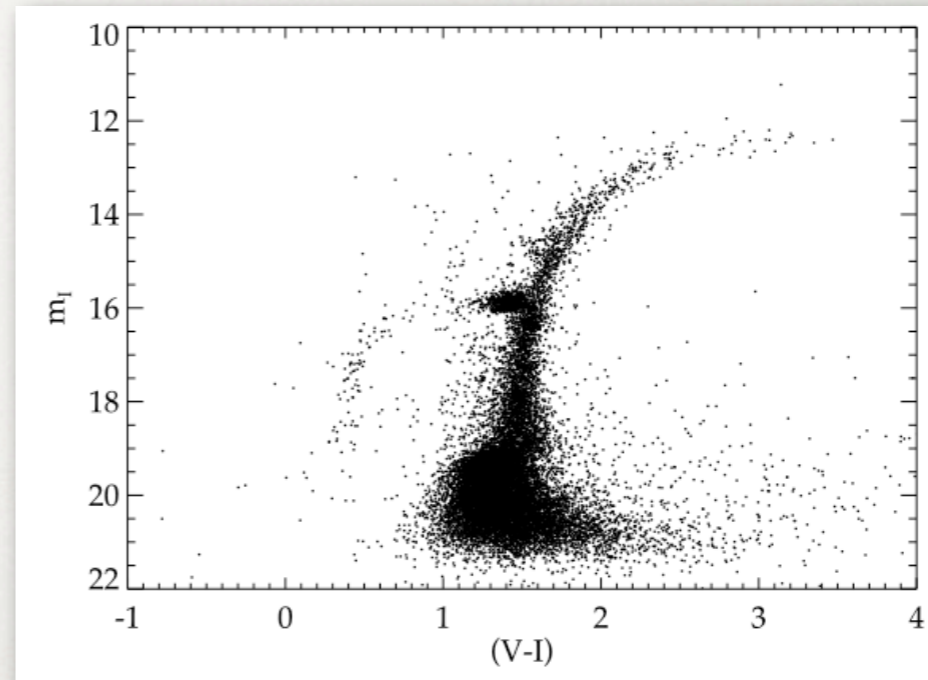
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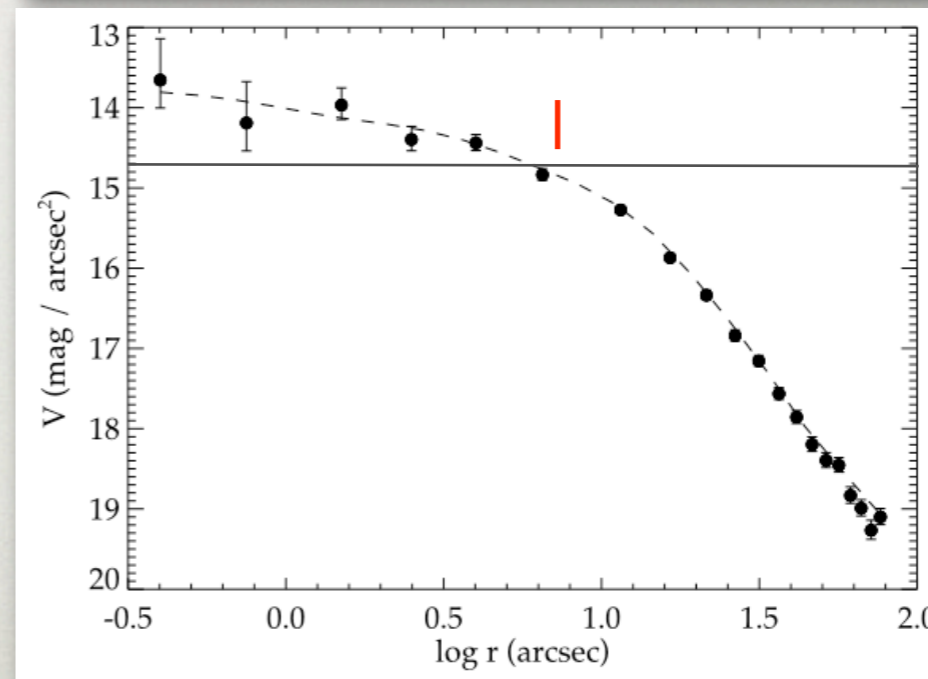
◀ Surface brightness profile (Noyola et al. 2006)

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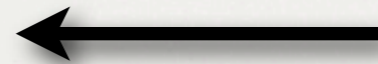
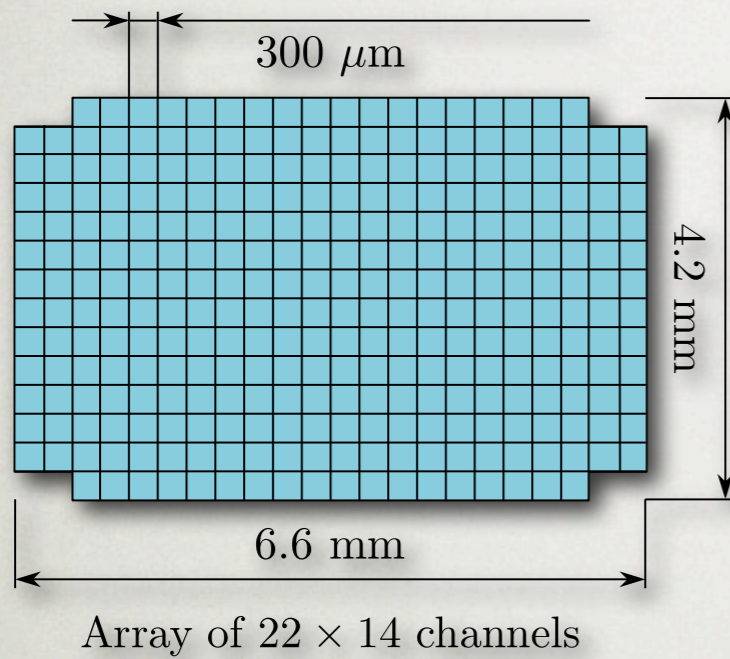


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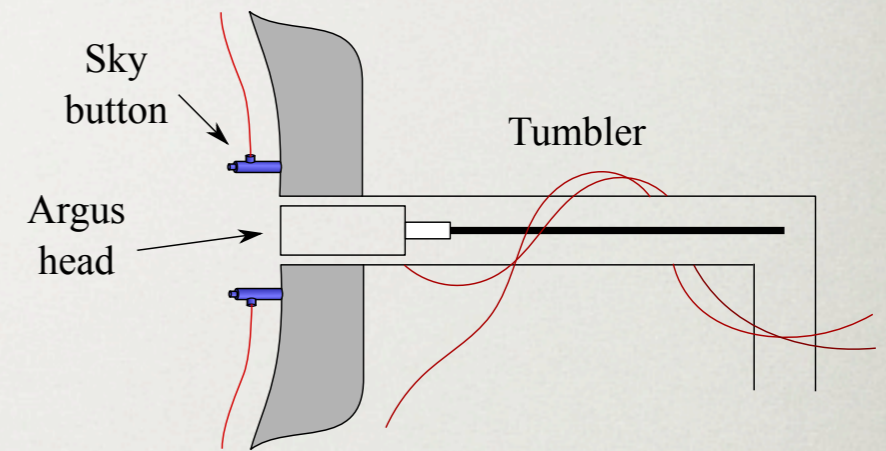


◀ Surface brightness profile

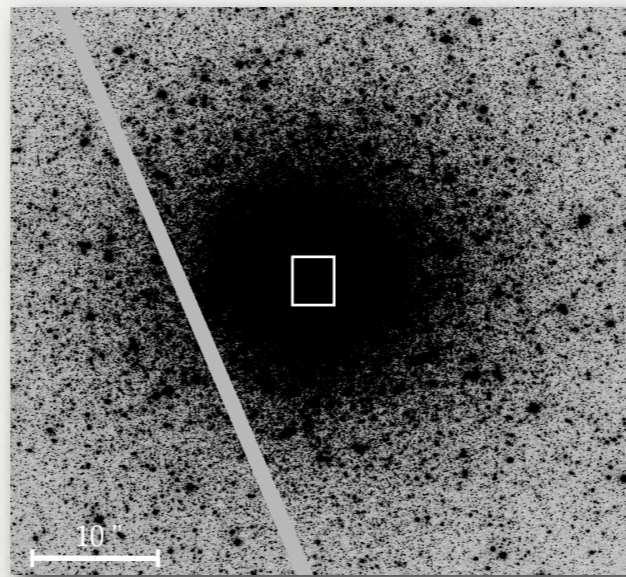
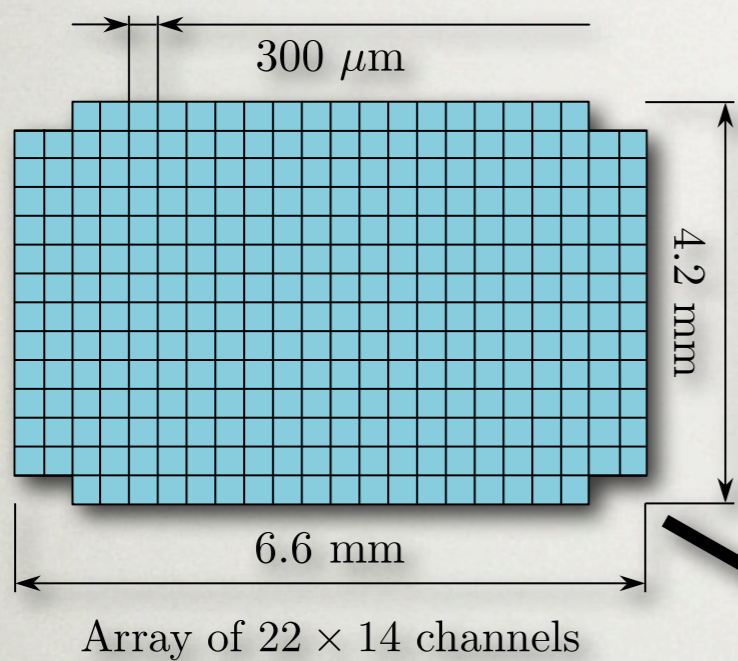
SPECTROSCOPY-OBSERVATIONS



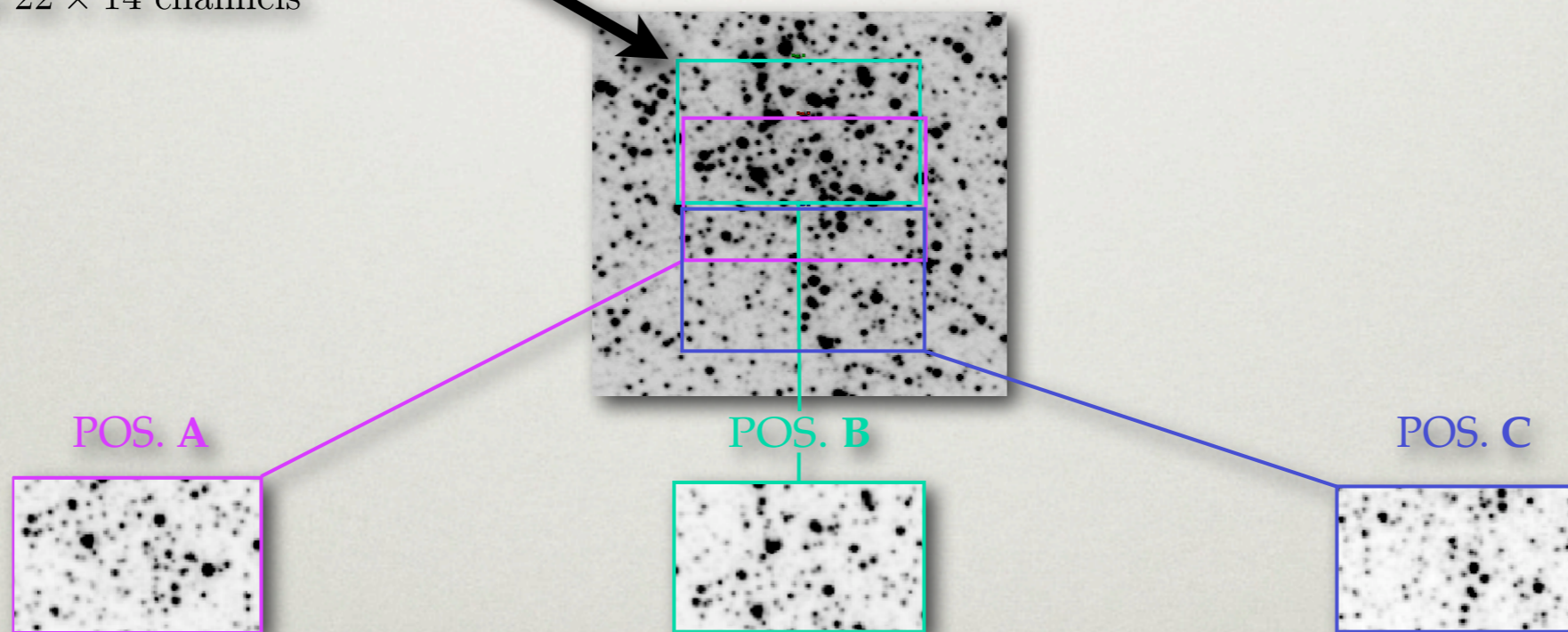
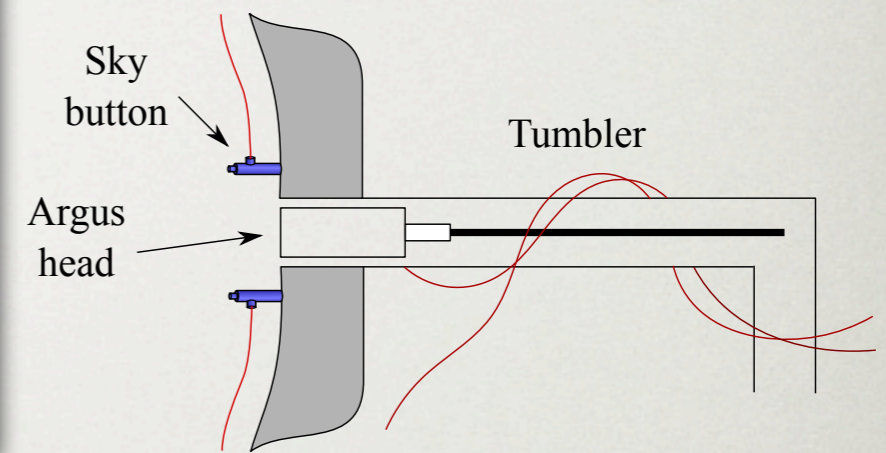
INTEGRATION IN OZPOZ



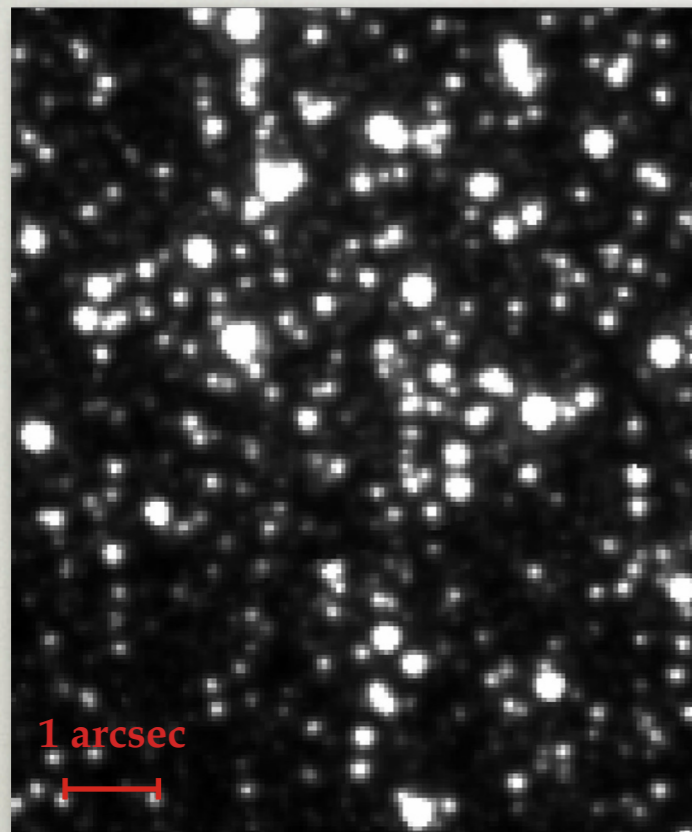
SPECTROSCOPY-OBSERVATIONS



INTEGRATION IN OZPOZ

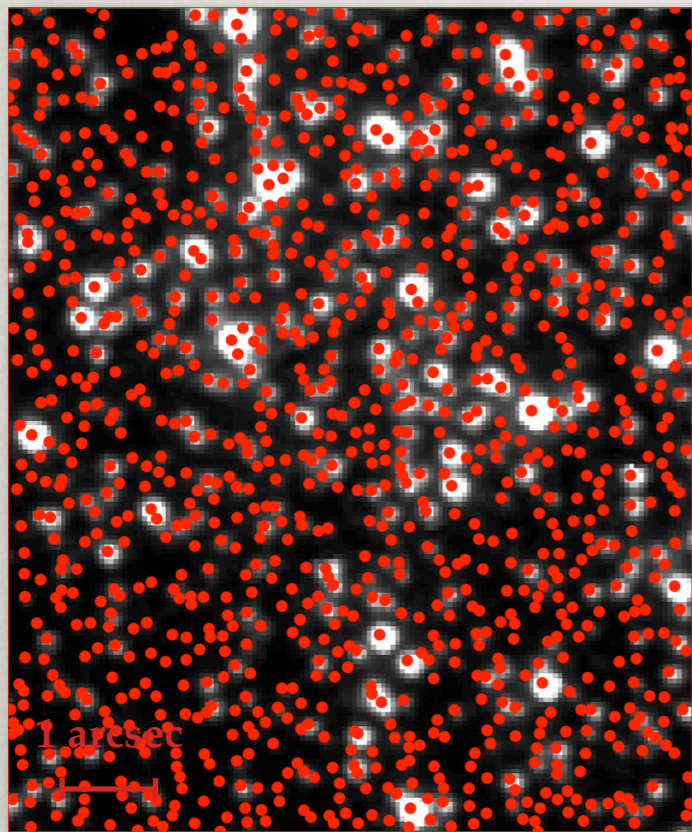


SPECTROSCOPY-ANALYSIS



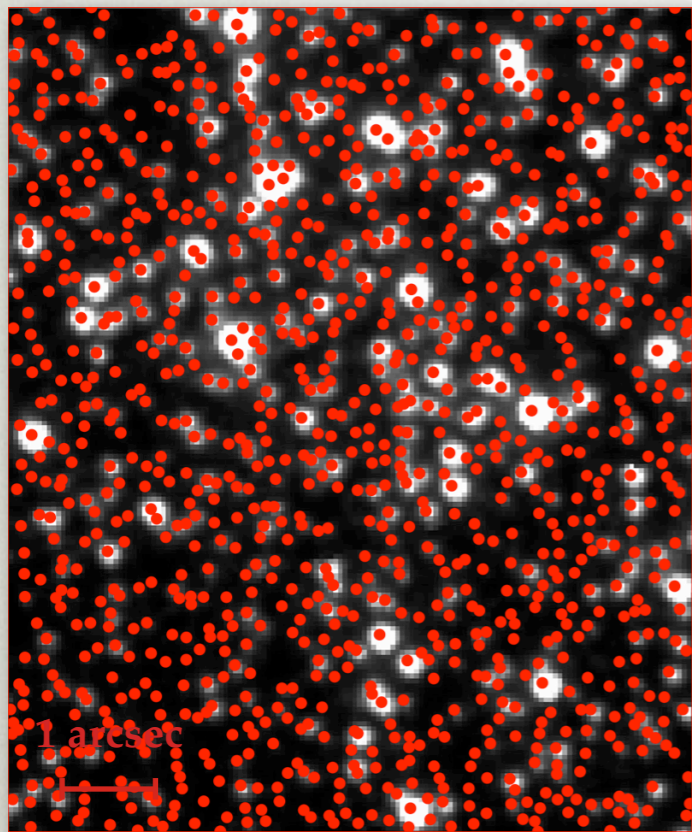
HST

SPECTROSCOPY-ANALYSIS

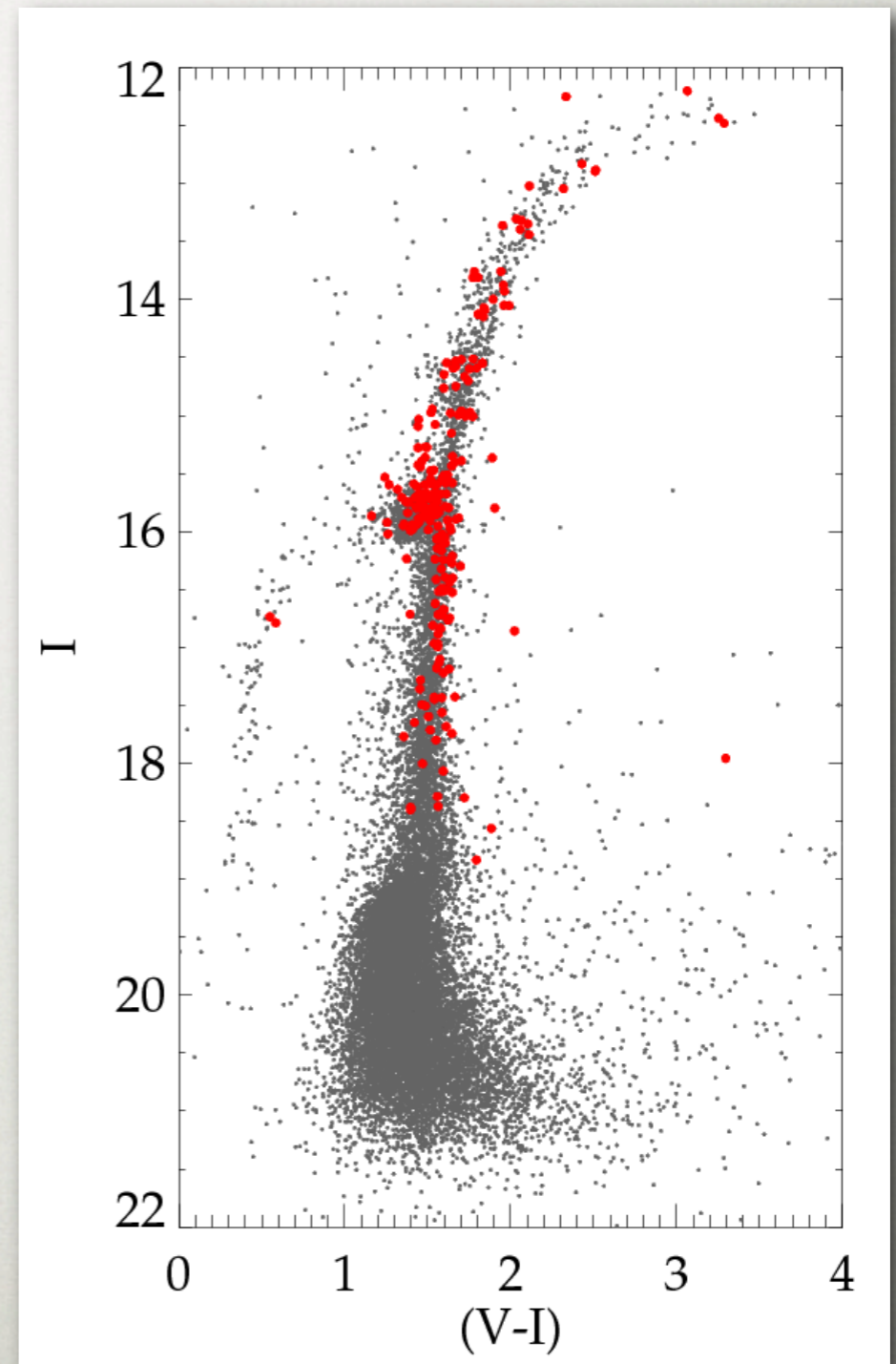


HST

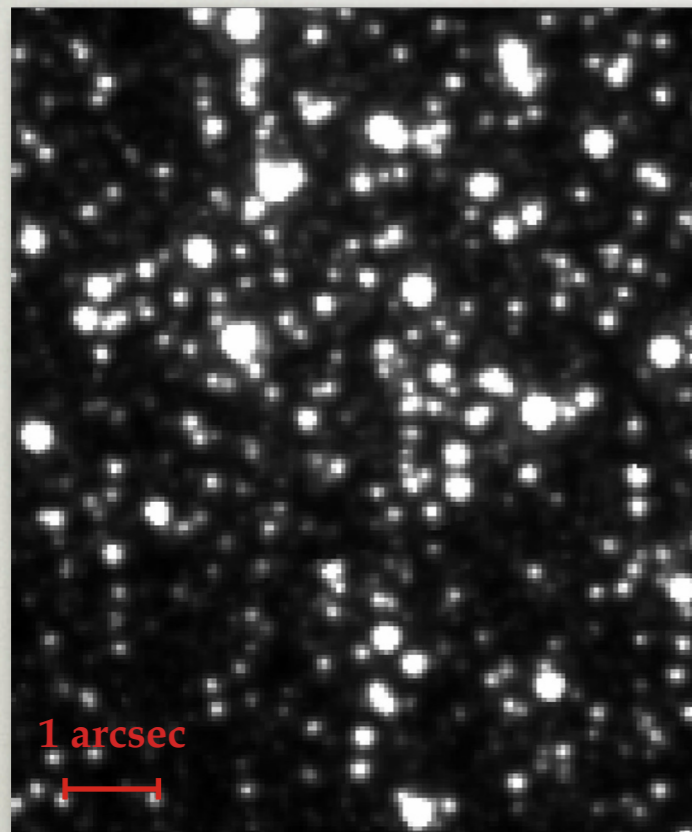
SPECTROSCOPY-ANALYSIS



HST

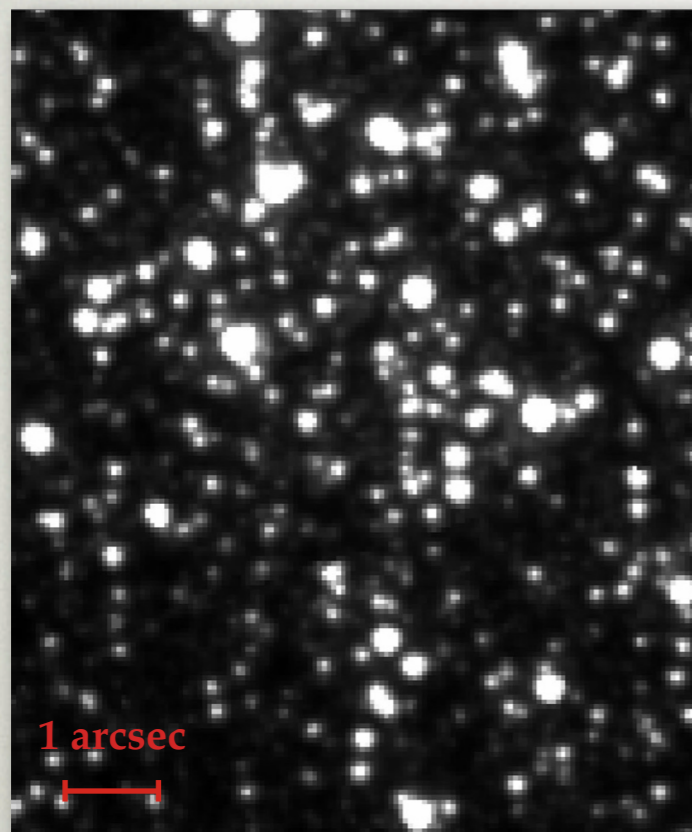


SPECTROSCOPY-ANALYSIS



HST

SPECTROSCOPY-ANALYSIS

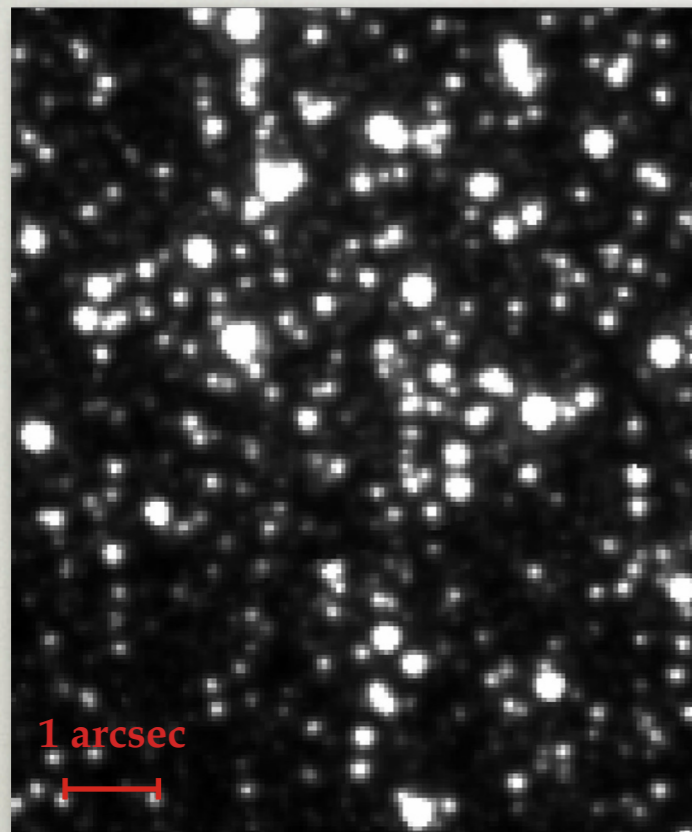


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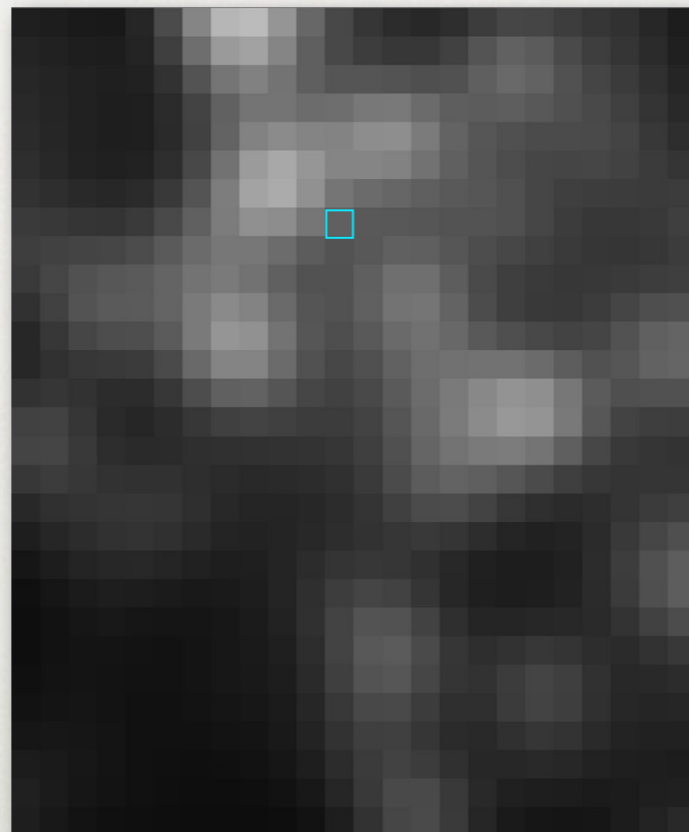


ARGUS

SPECTROSCOPY-ANALYSIS

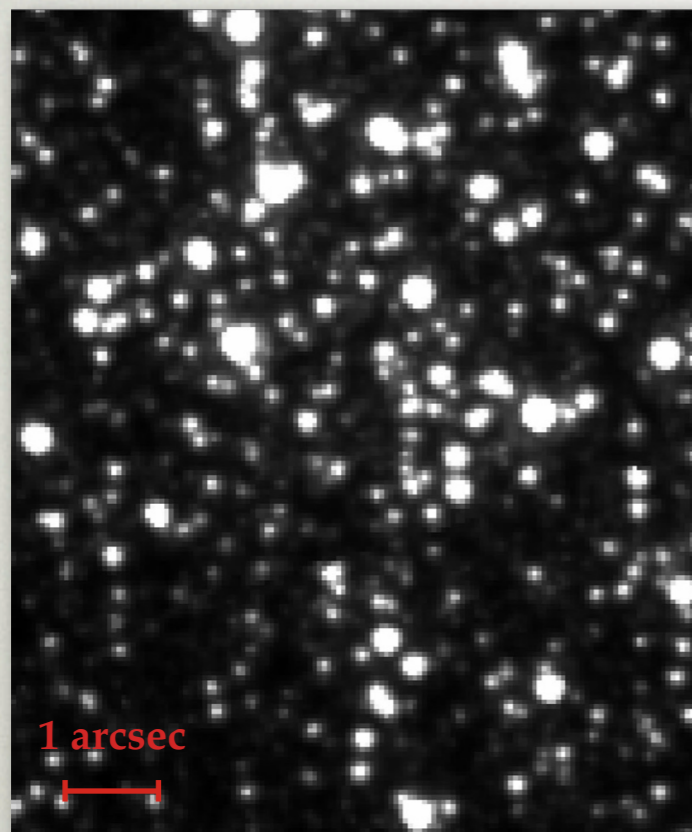


HST

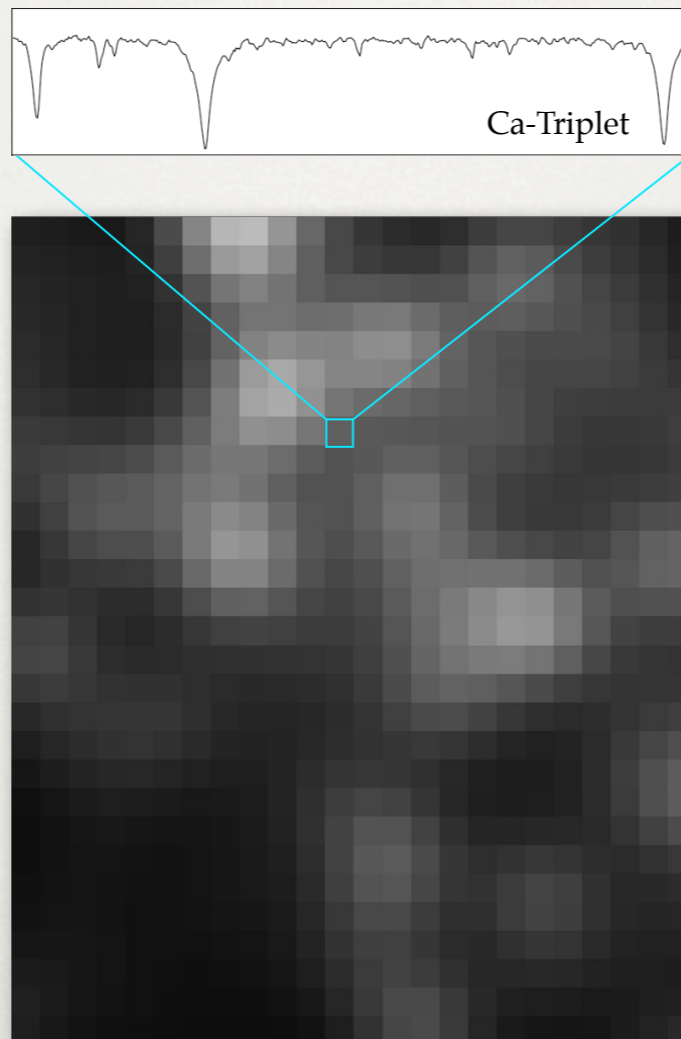


ARGUS

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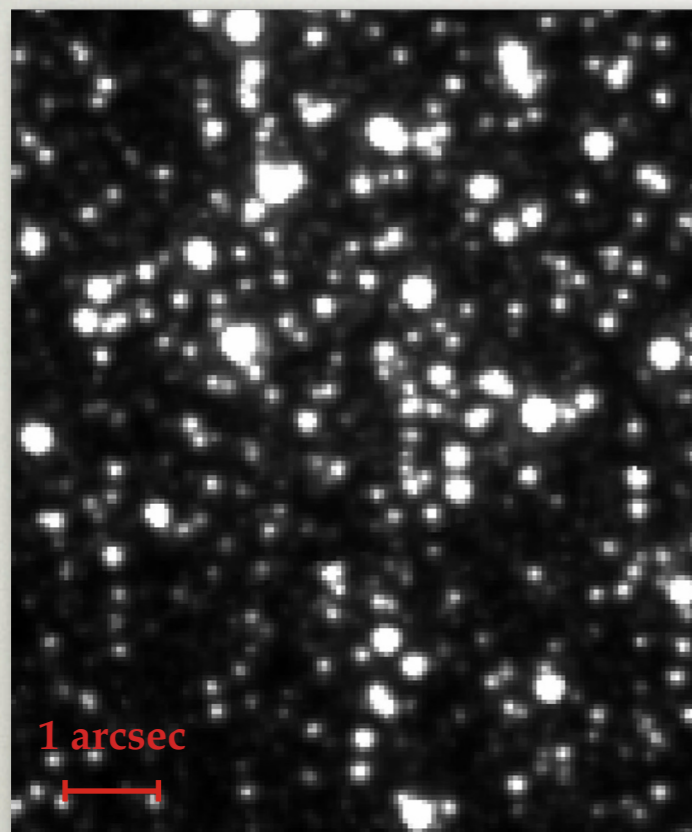


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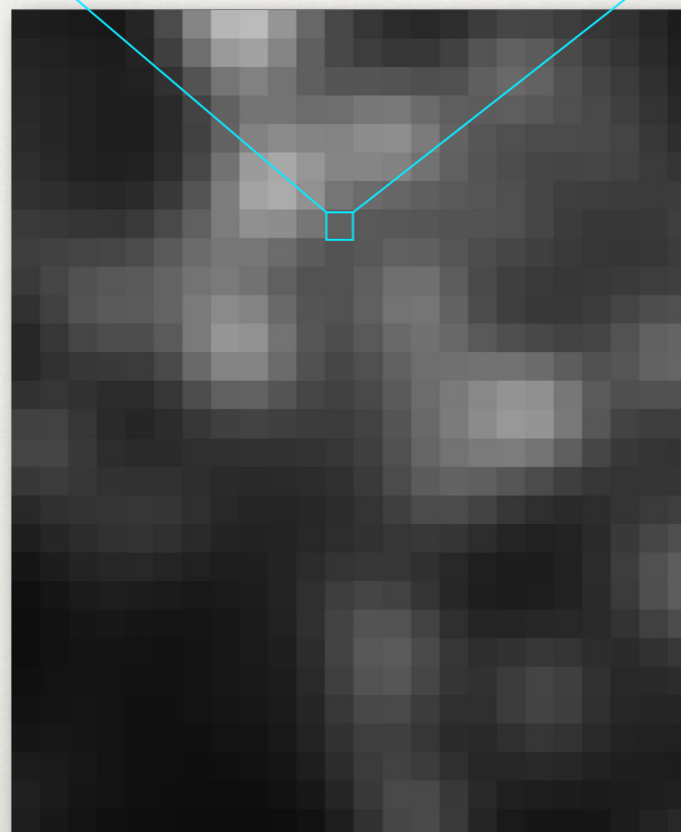
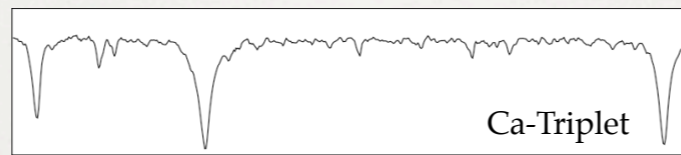


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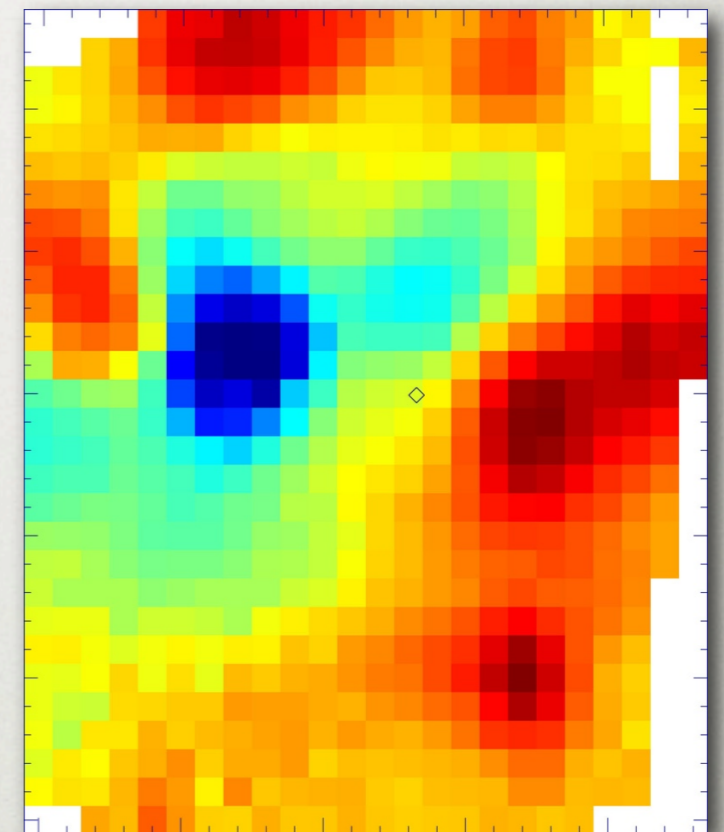
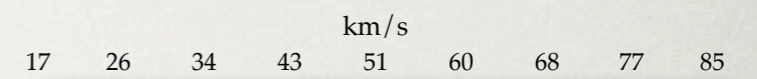
SPECTROSCOPY-ANALYSIS



HST

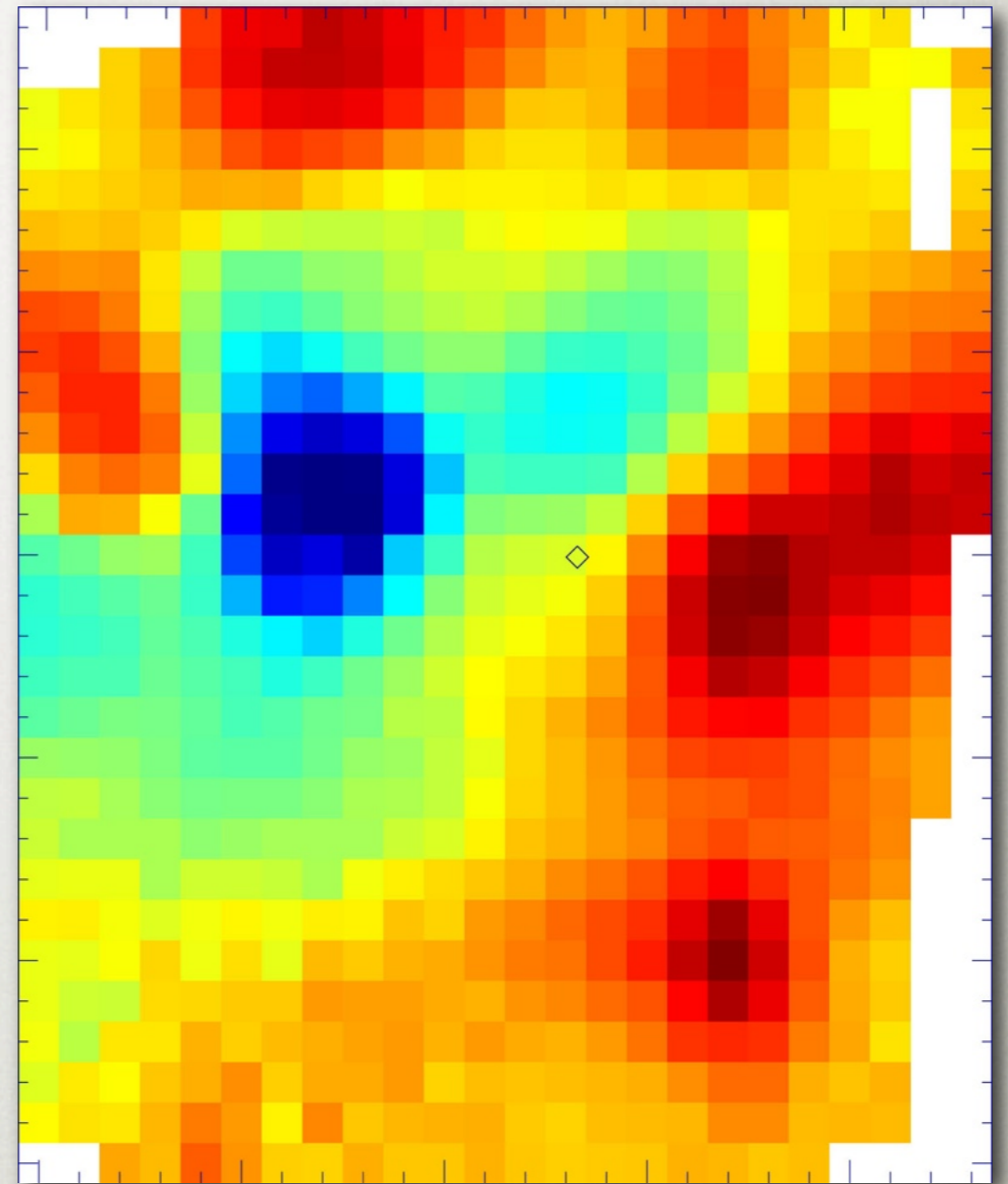


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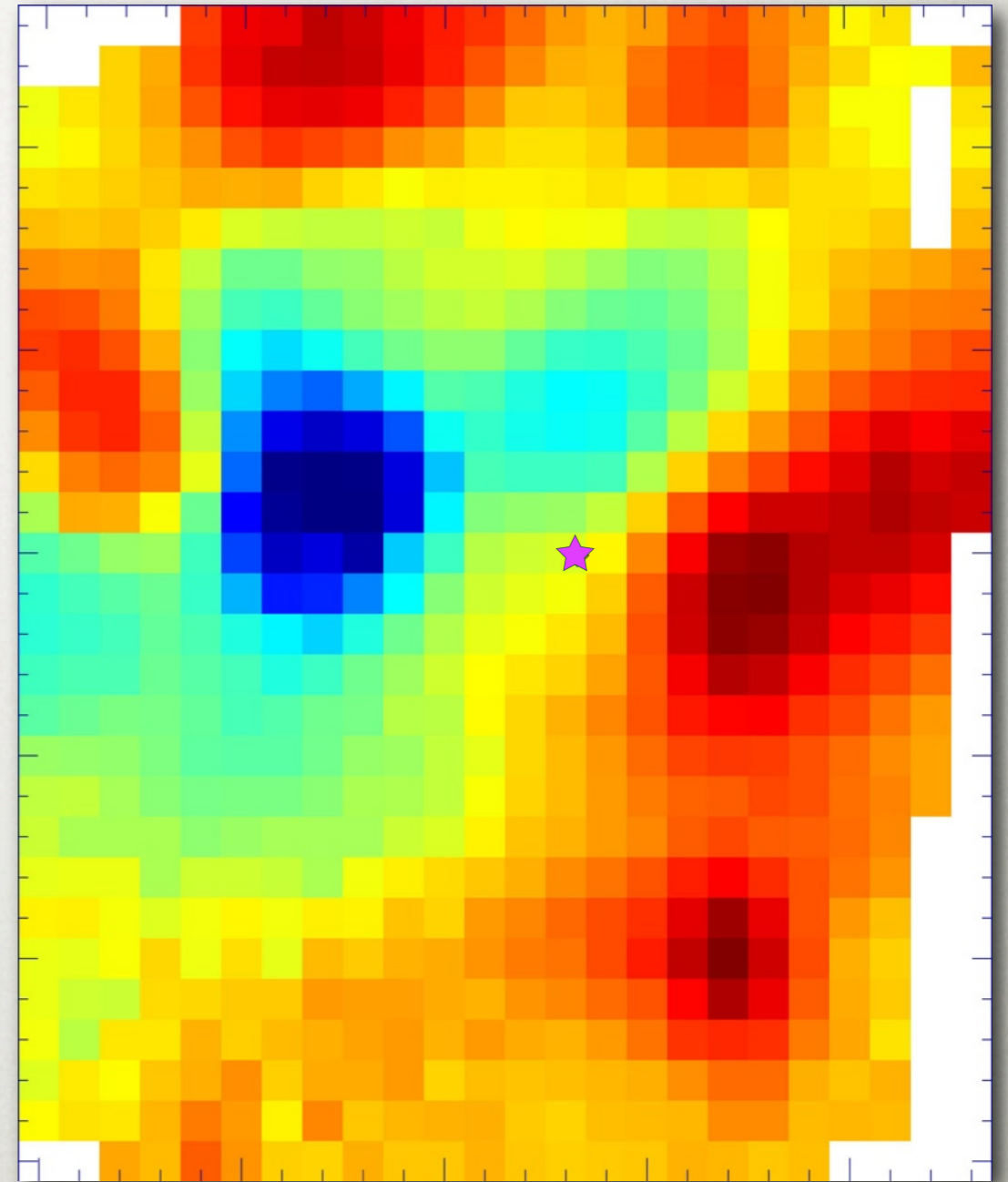


VELOCITY

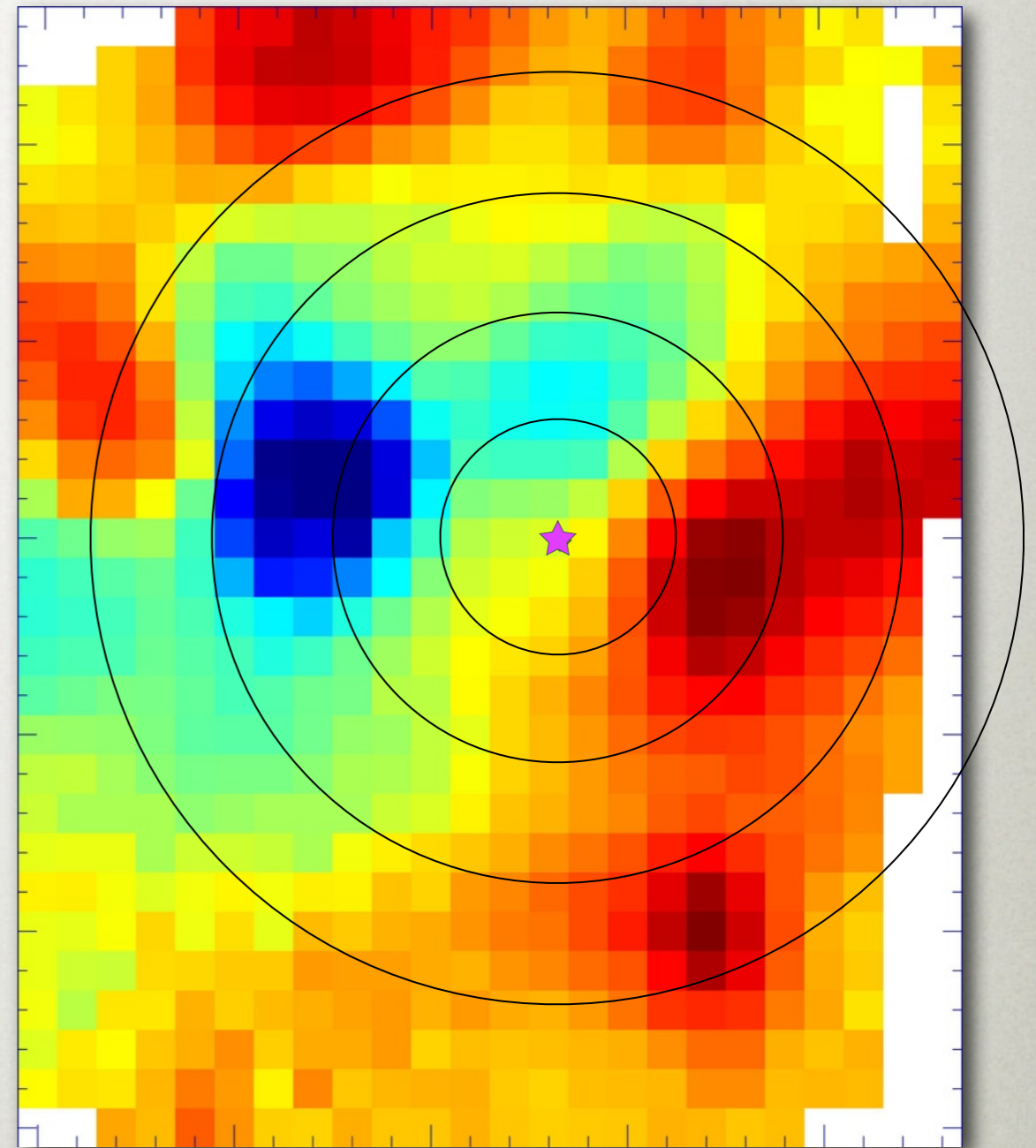
SPECTROSCOPY-ANALYSIS



SPECTROSCOPY-ANALYSIS

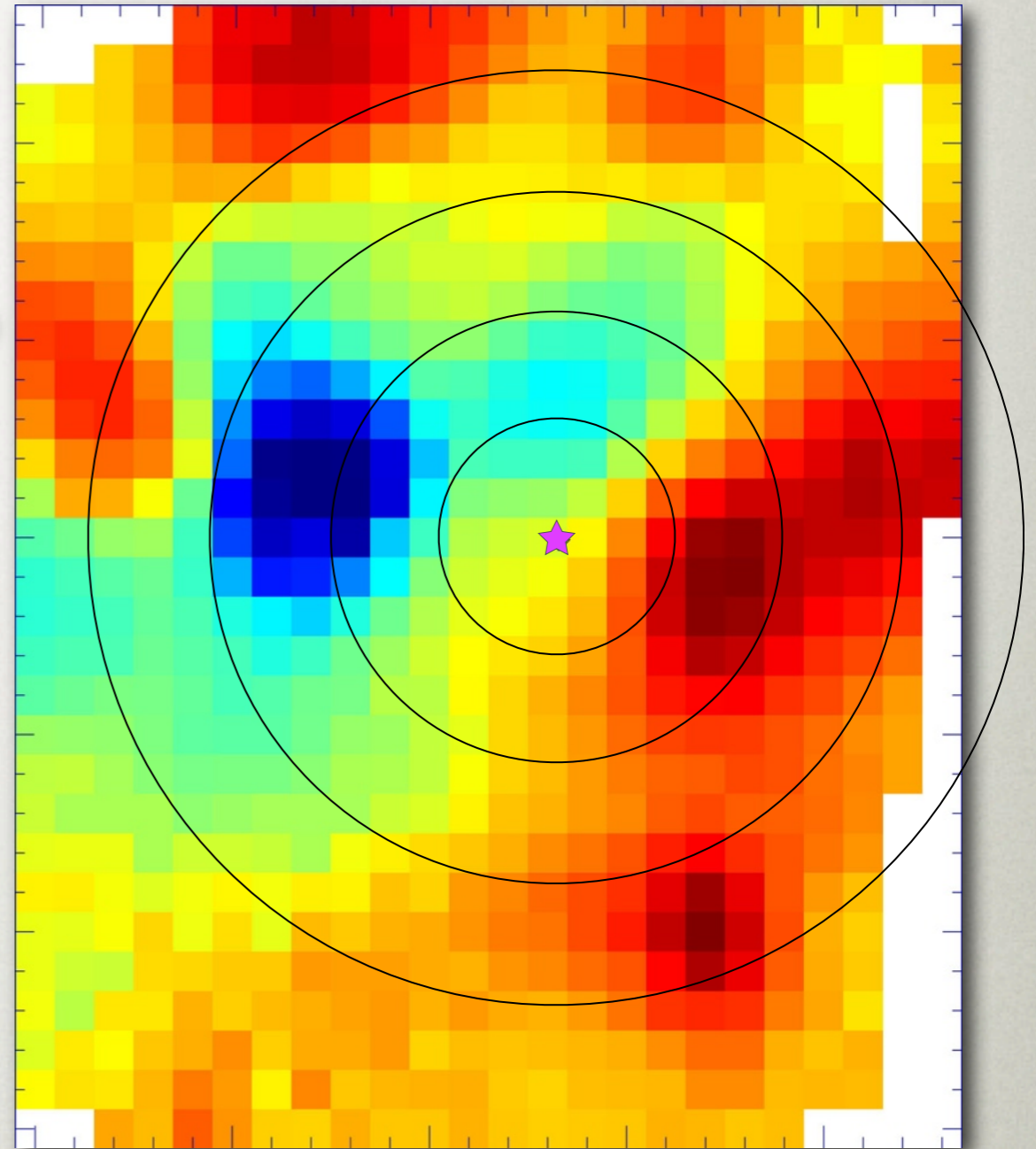
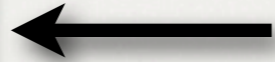
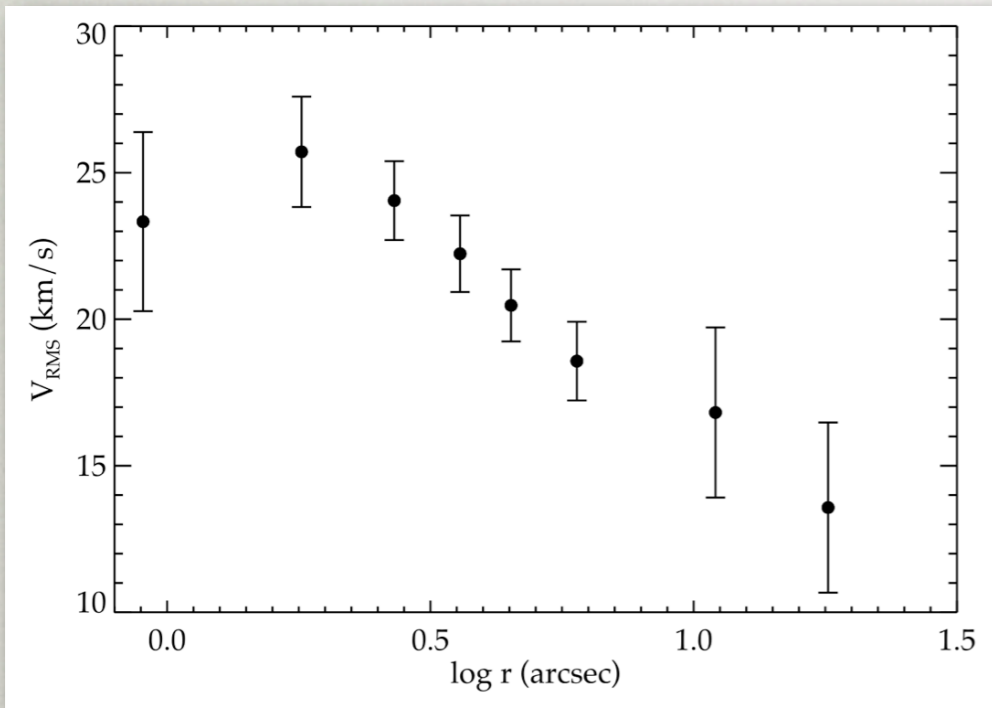


SPECTROSCOPY-ANALYSIS



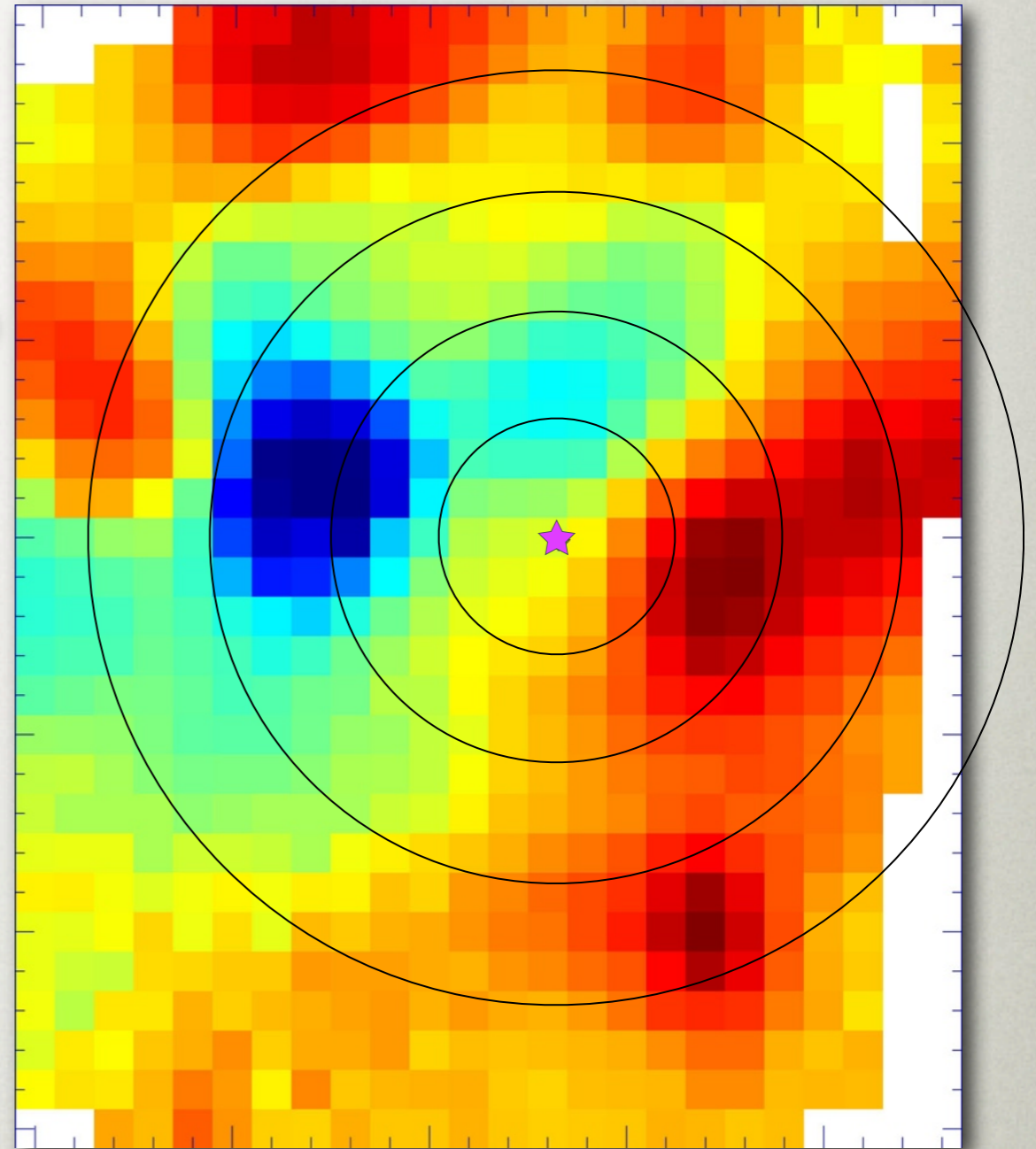
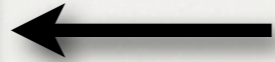
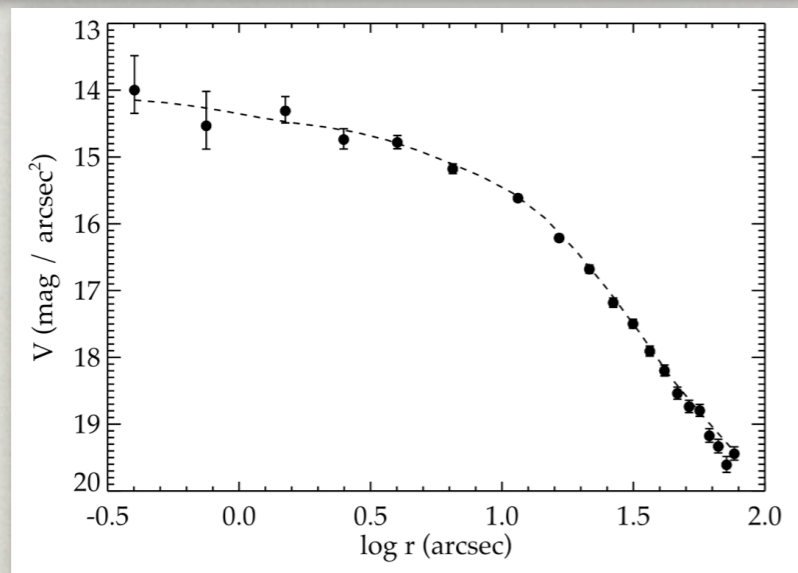
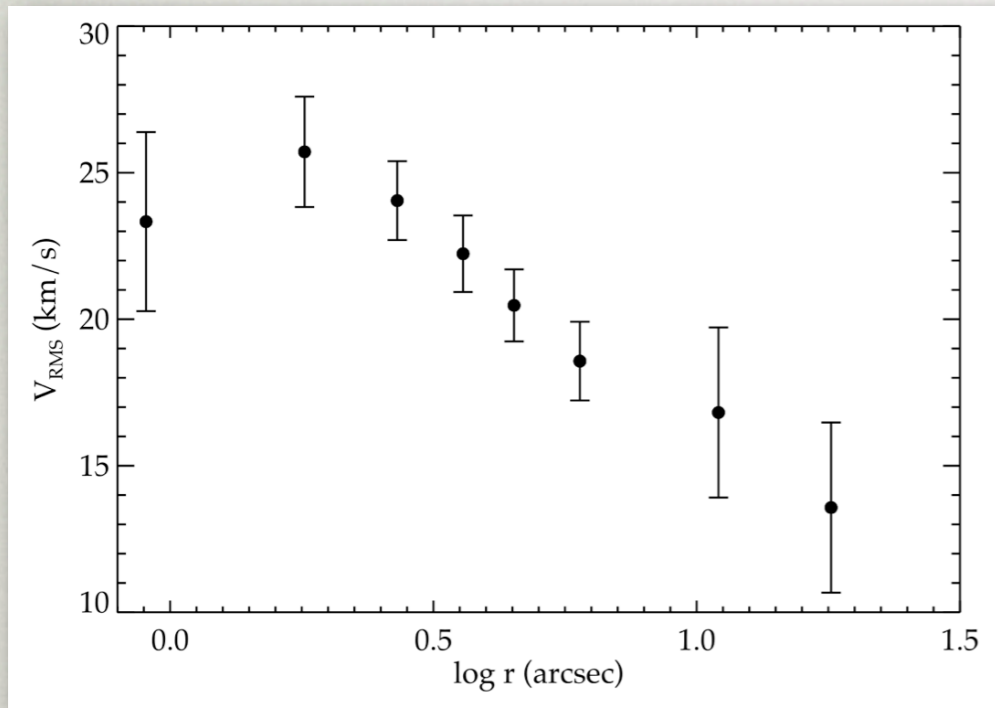
SPECTROSCOPY-ANALYSIS

Lützendorf et al. 2011, submitted



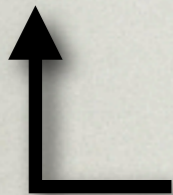
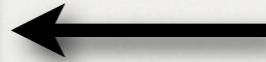
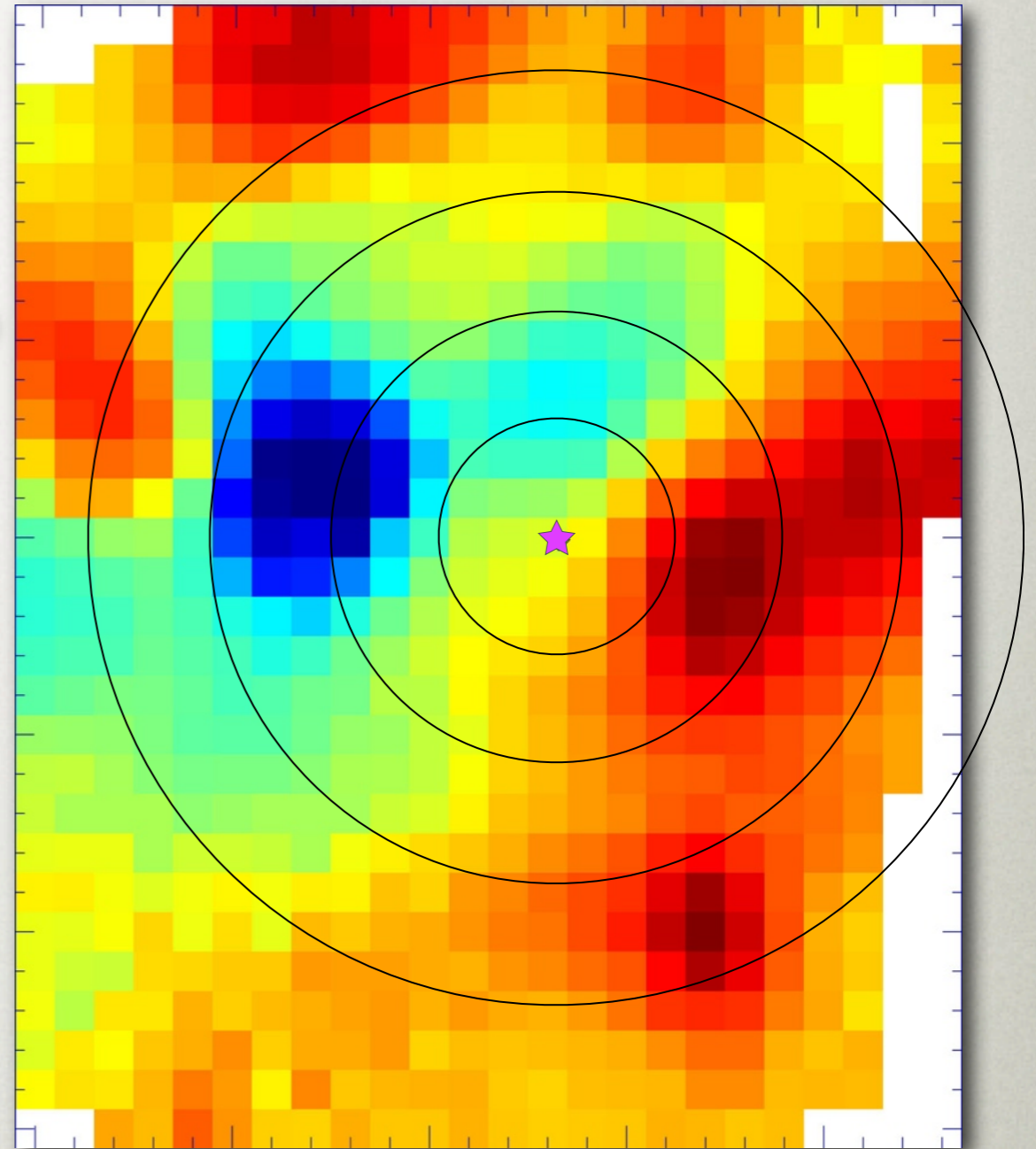
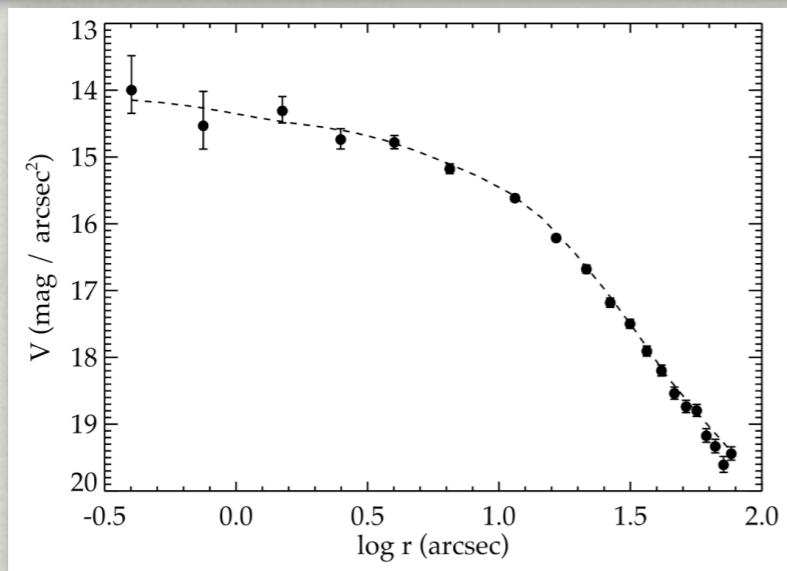
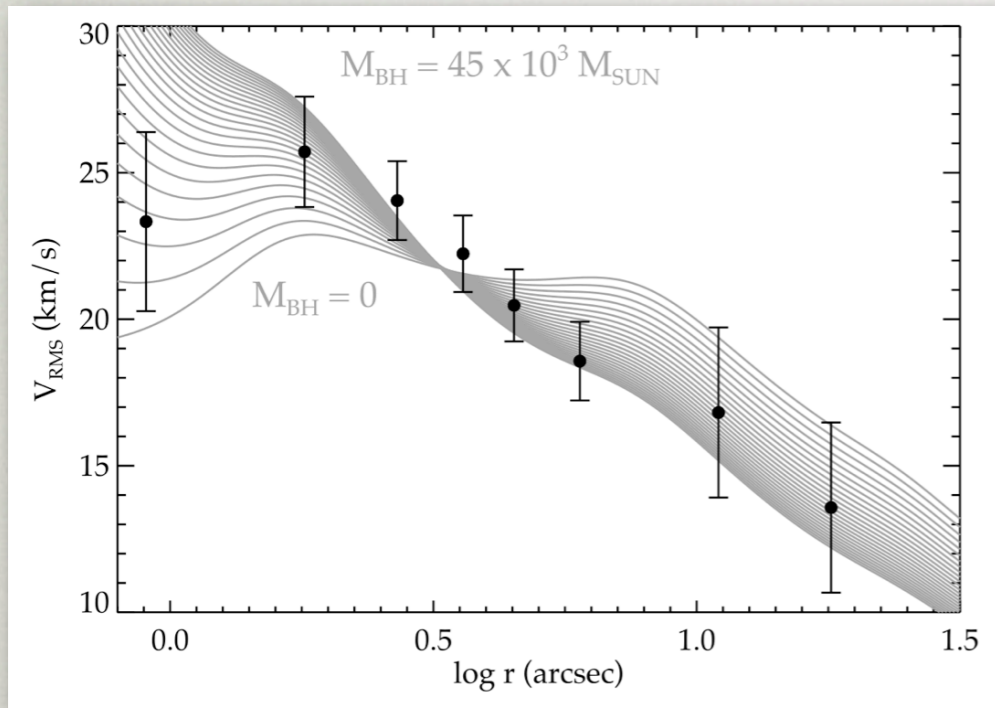
SPECTROSCOPY-ANALYSIS

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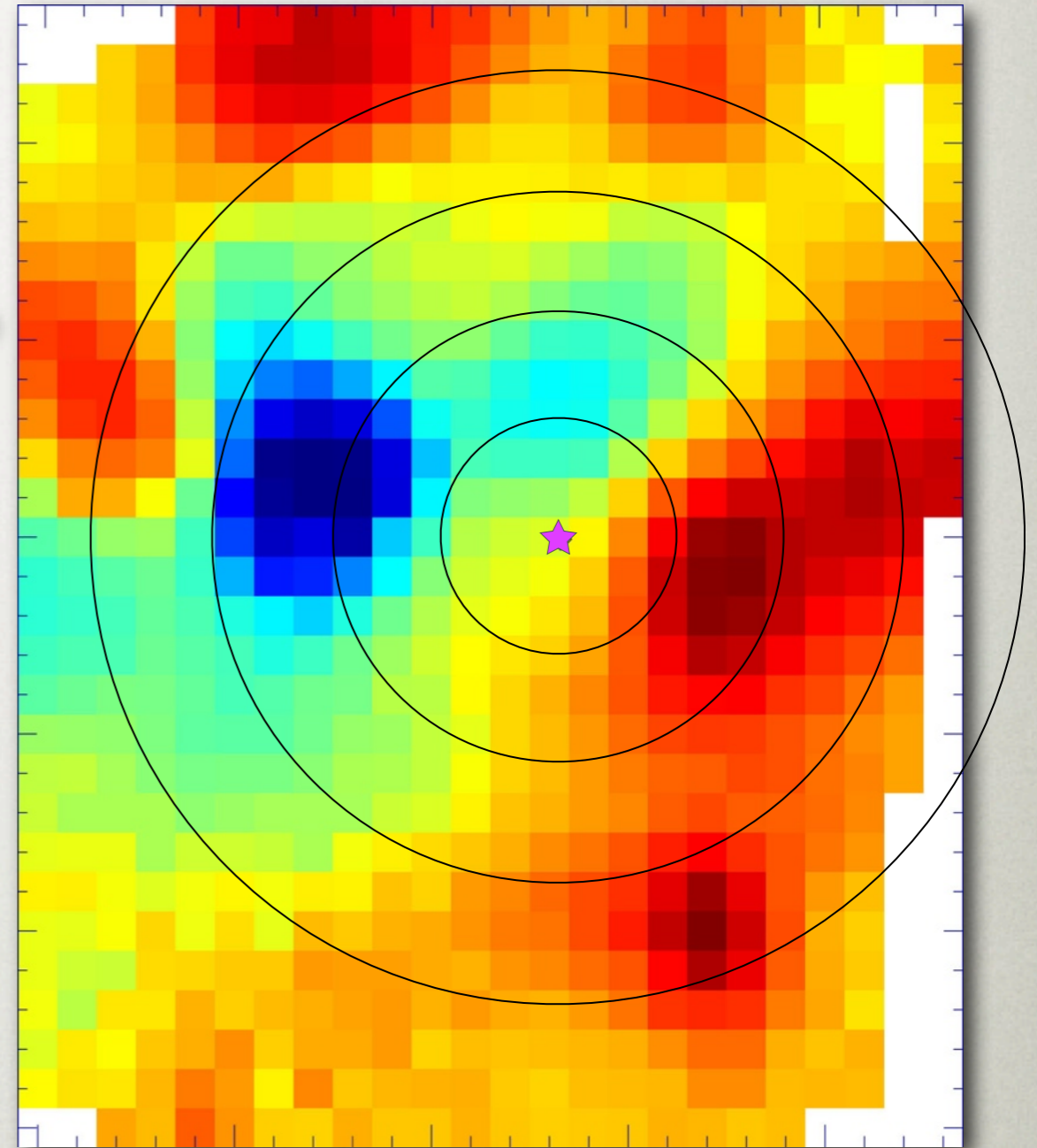
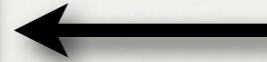
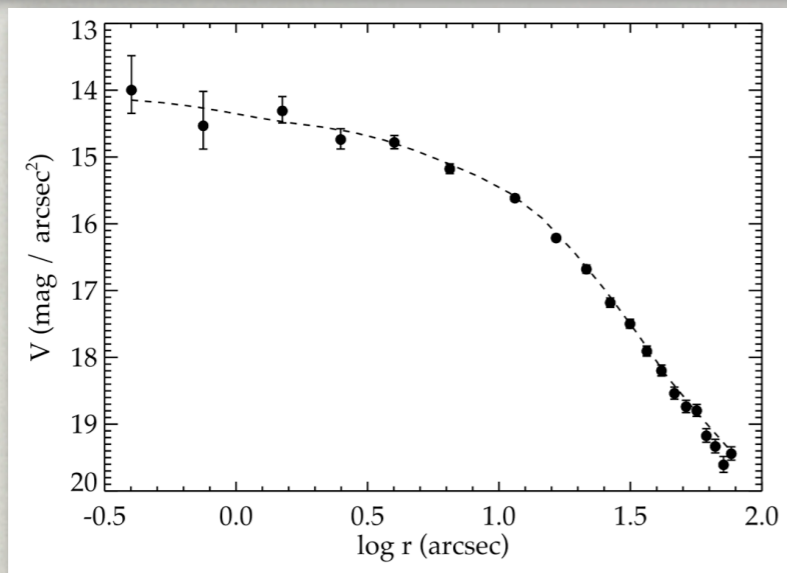
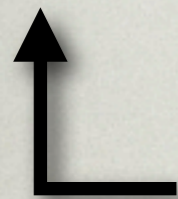
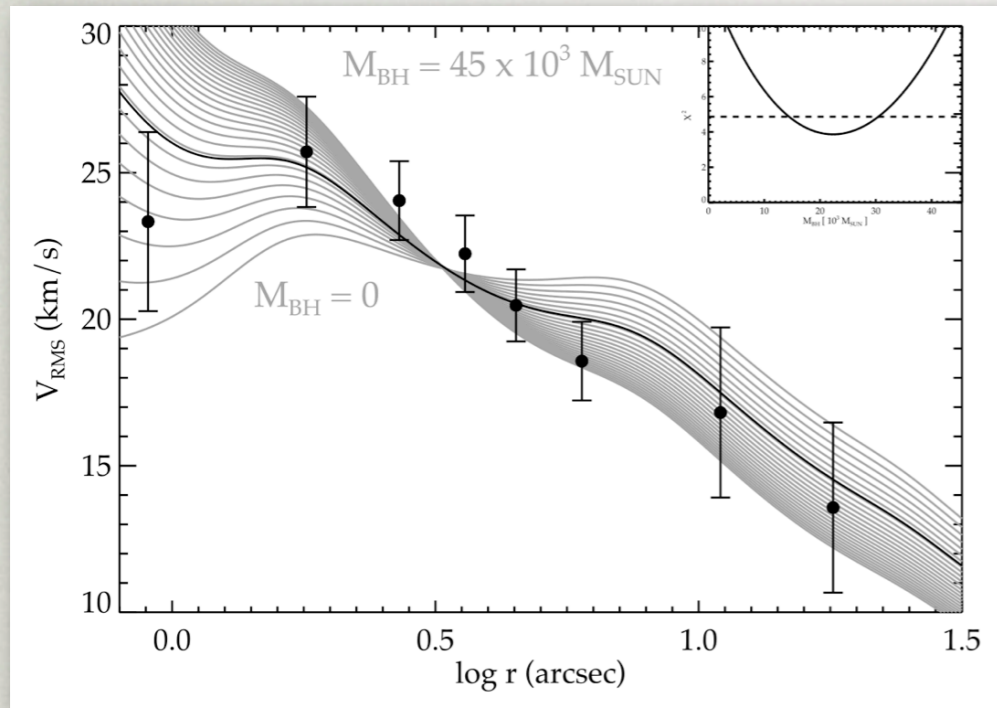
SPECTROSCOPY-ANALYSIS

Lützendorf et al. 2011, submitted



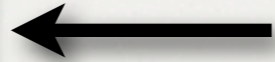
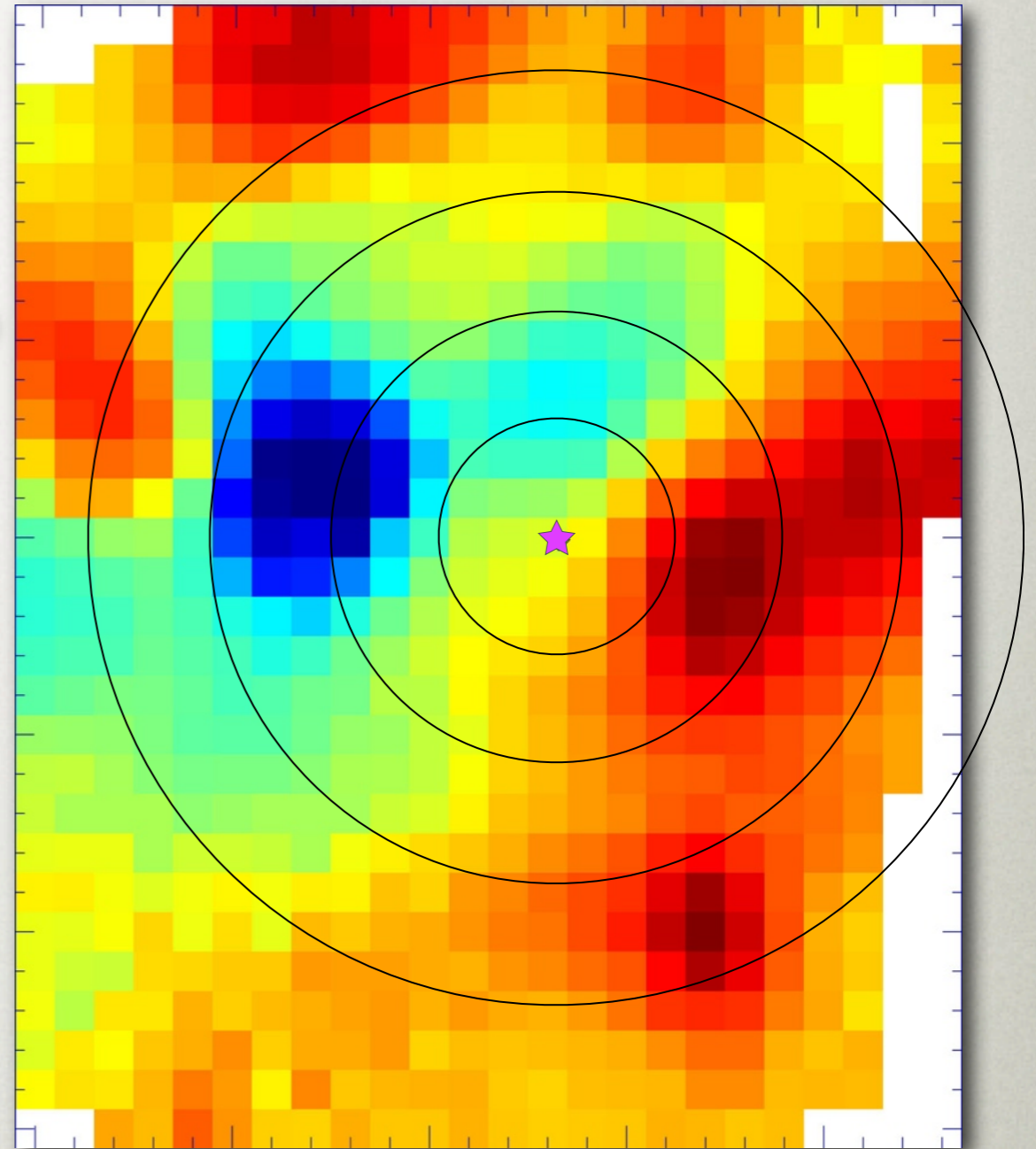
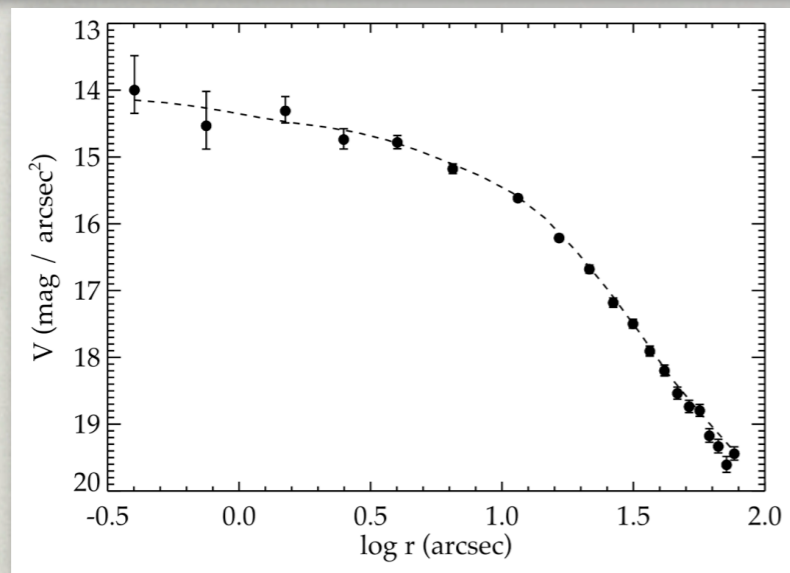
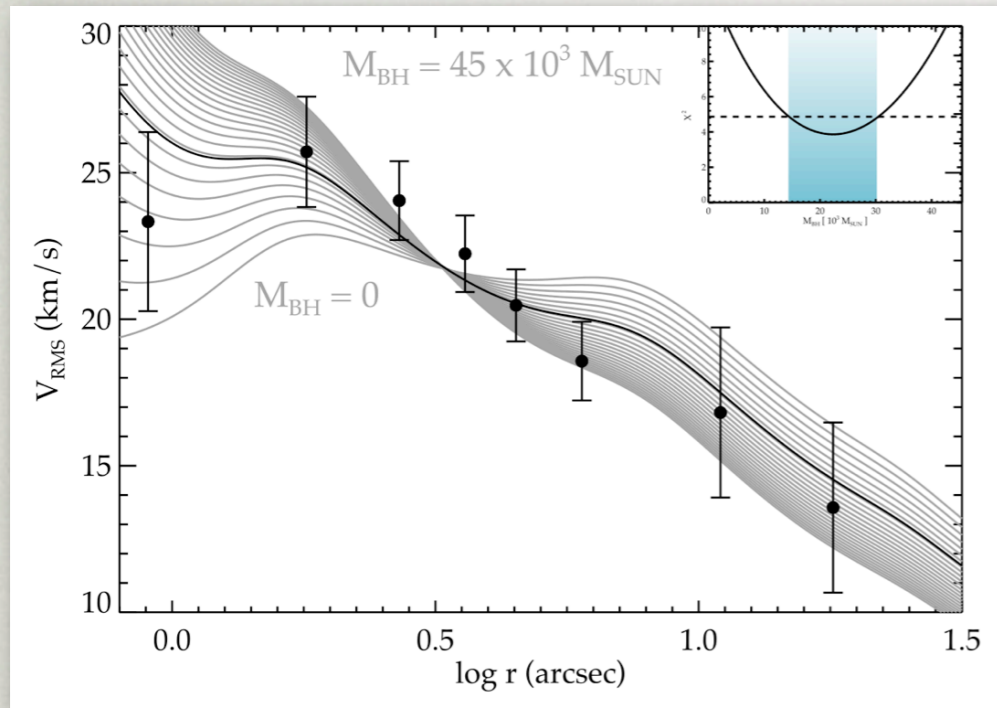
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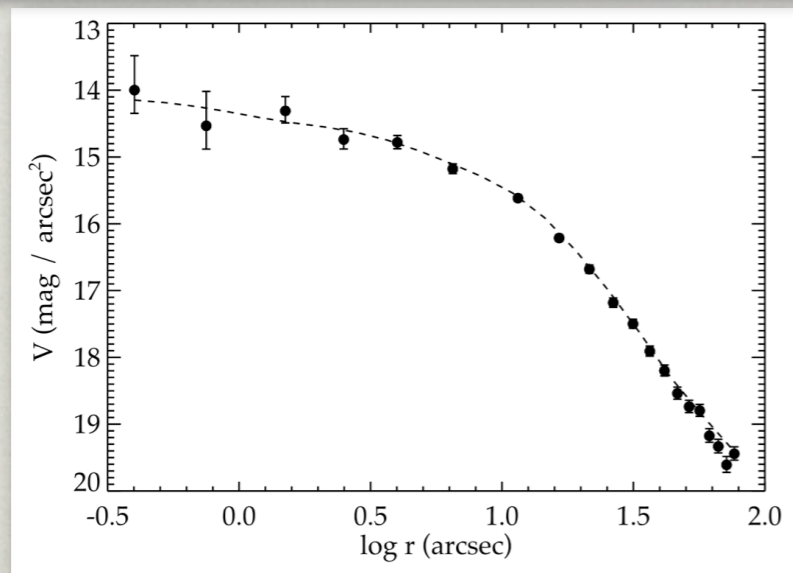
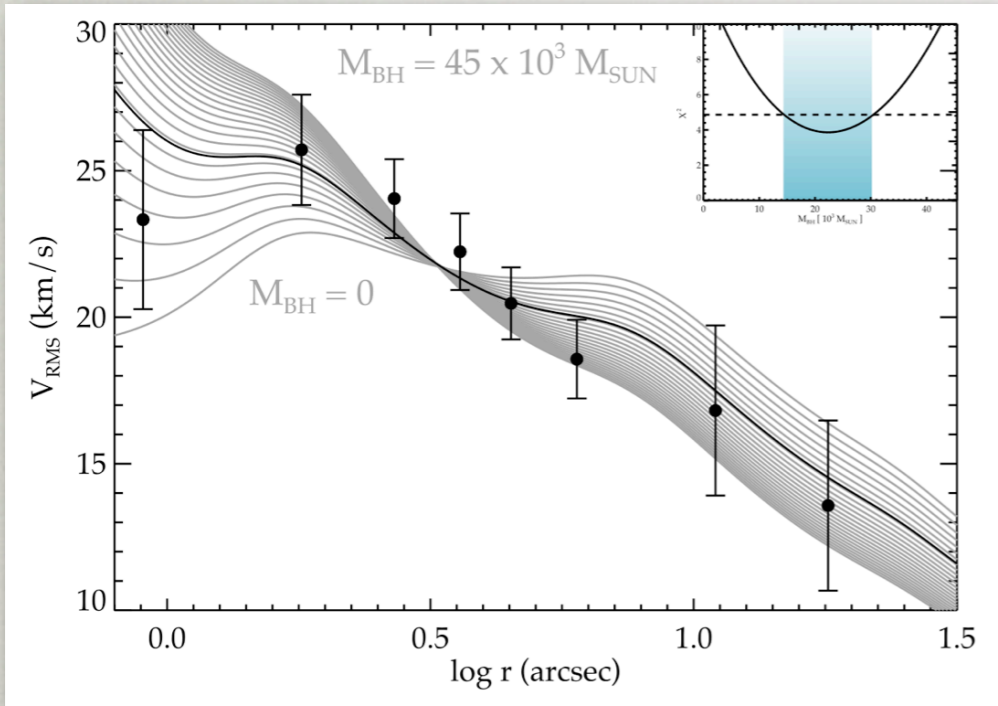
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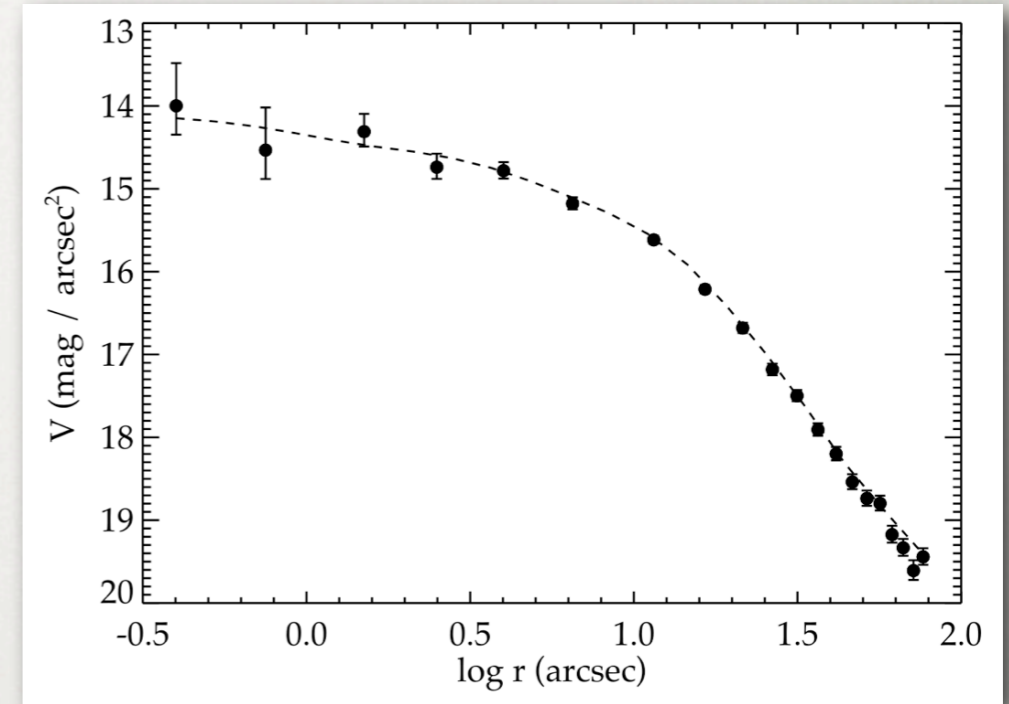
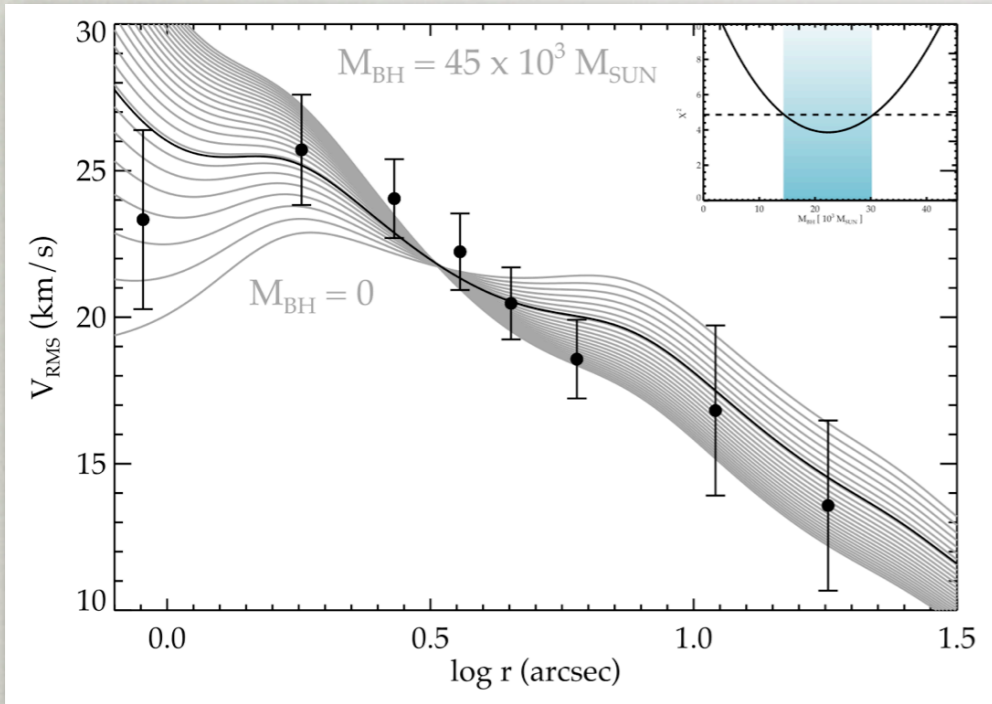
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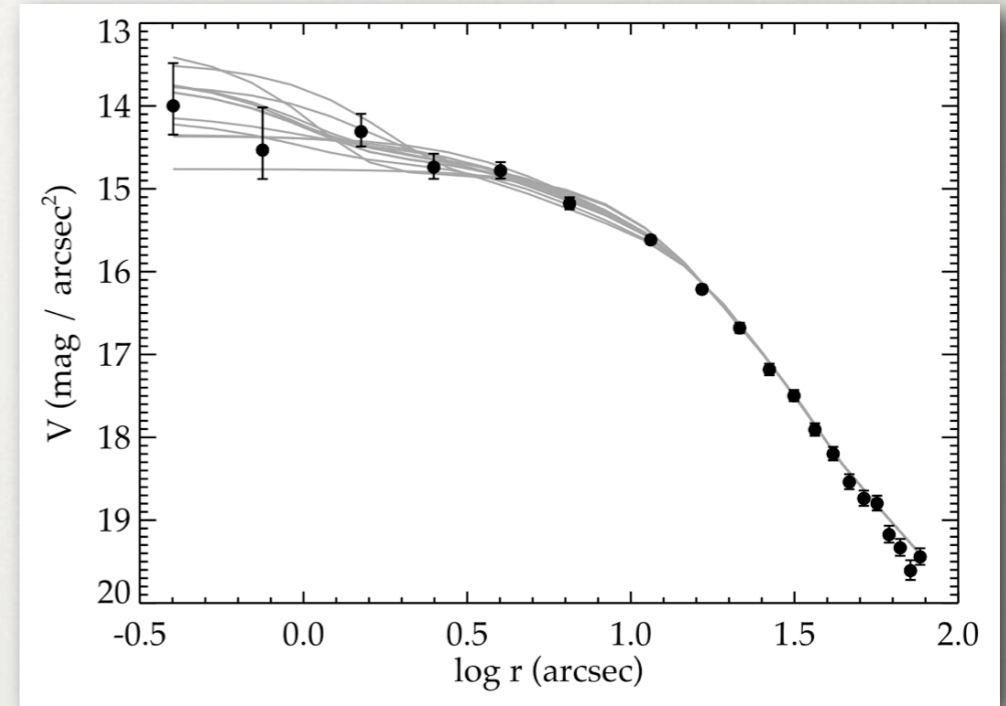
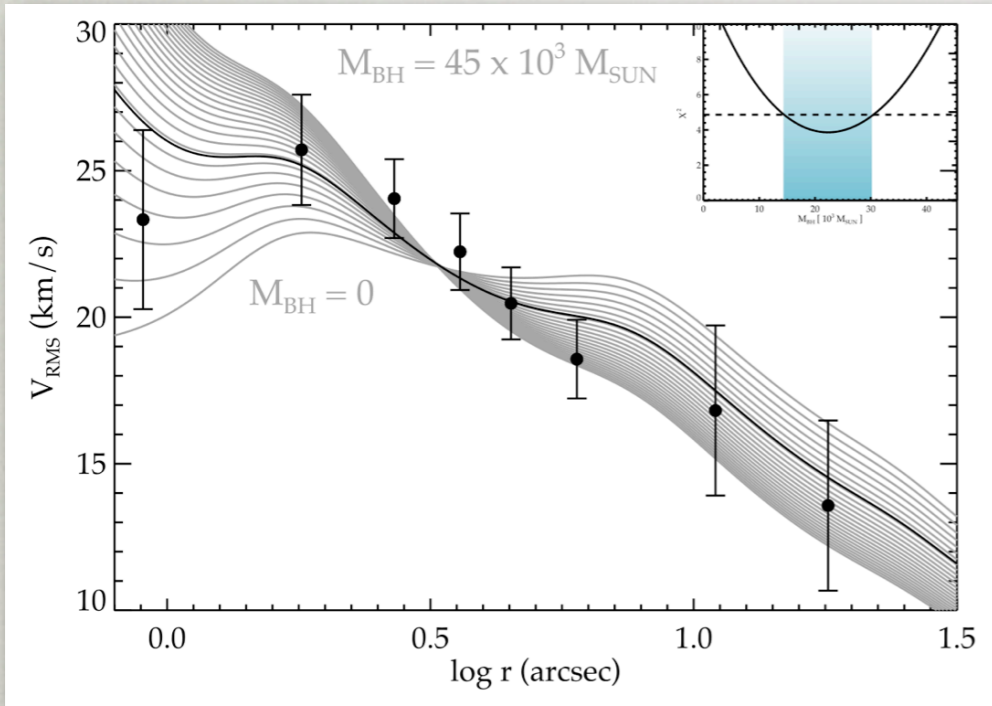
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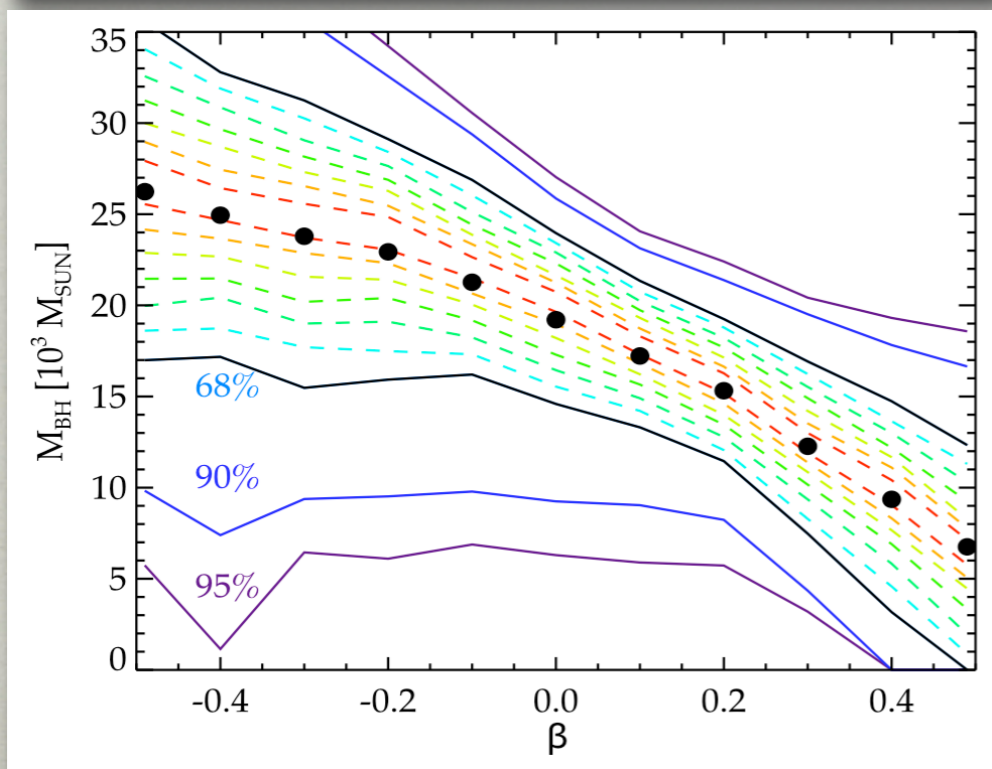
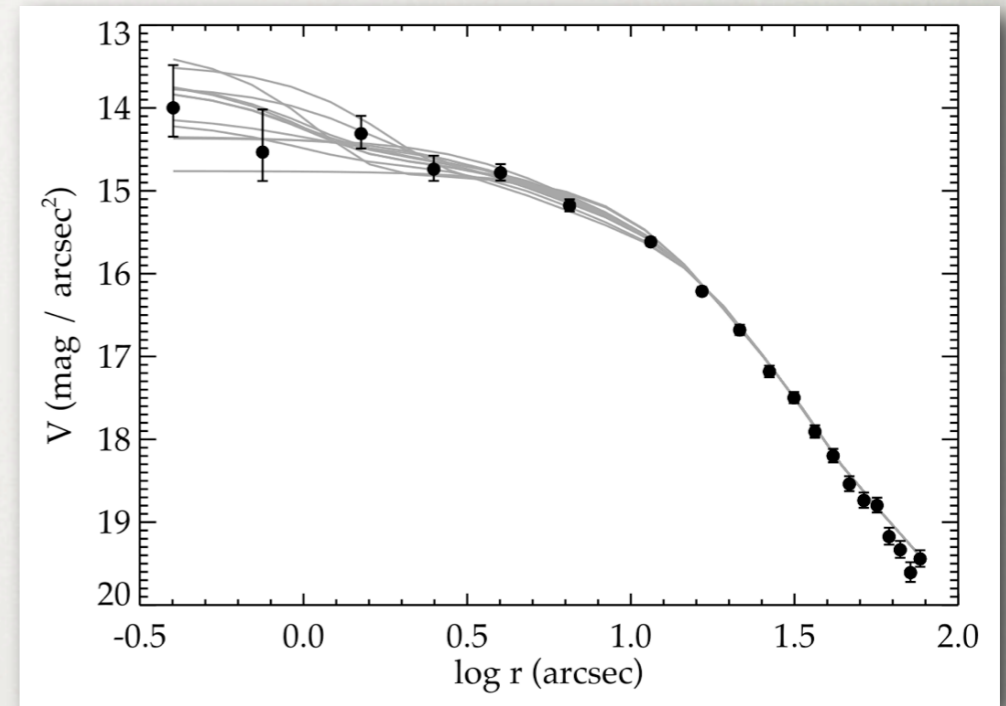
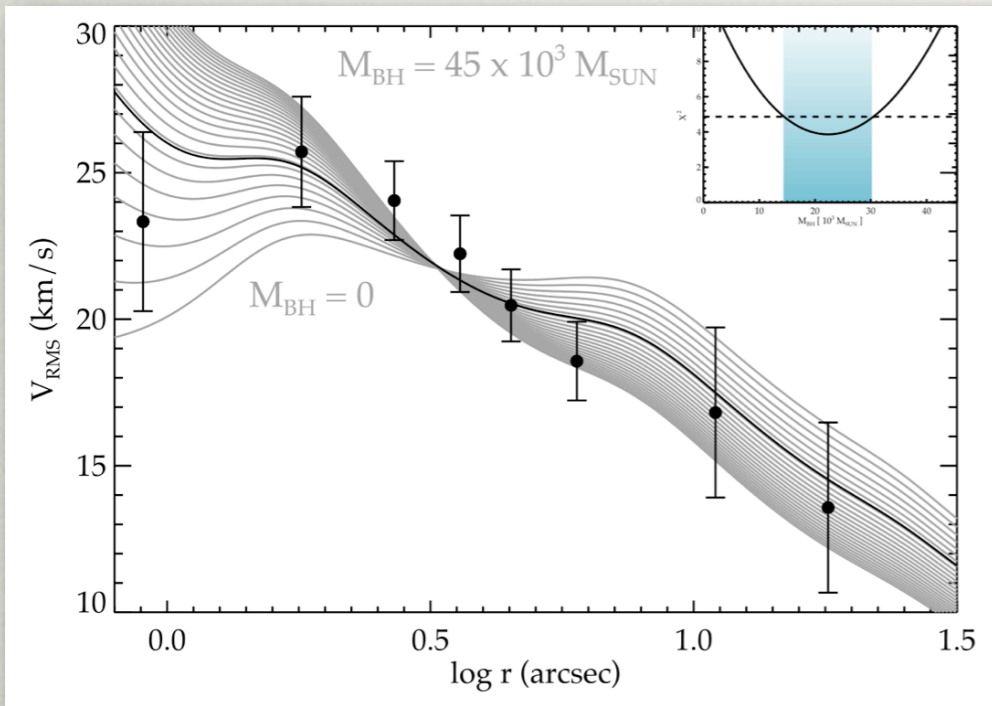
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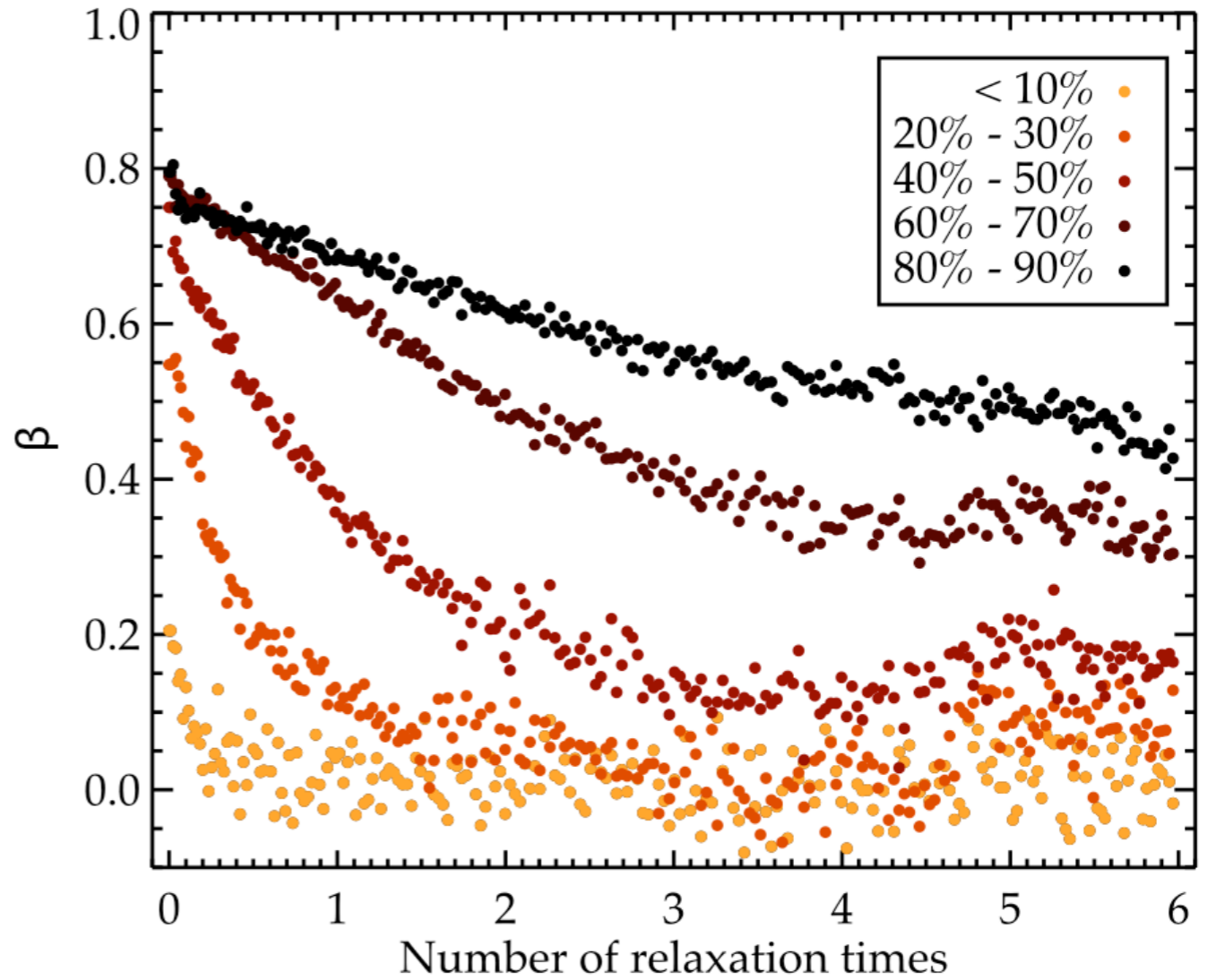
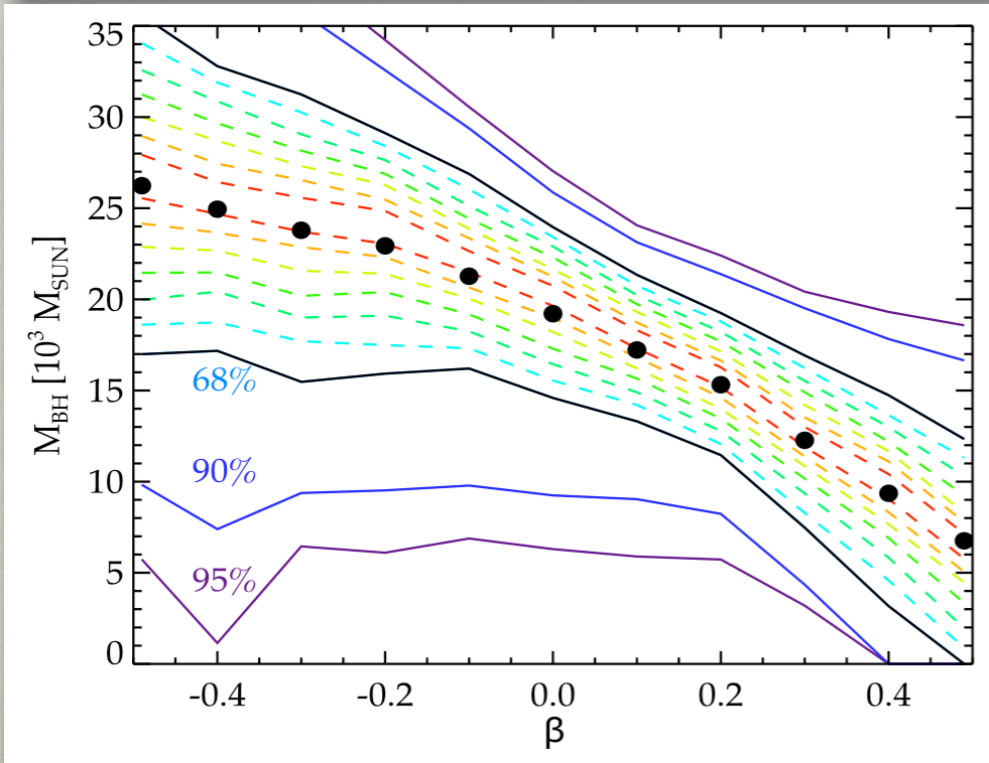
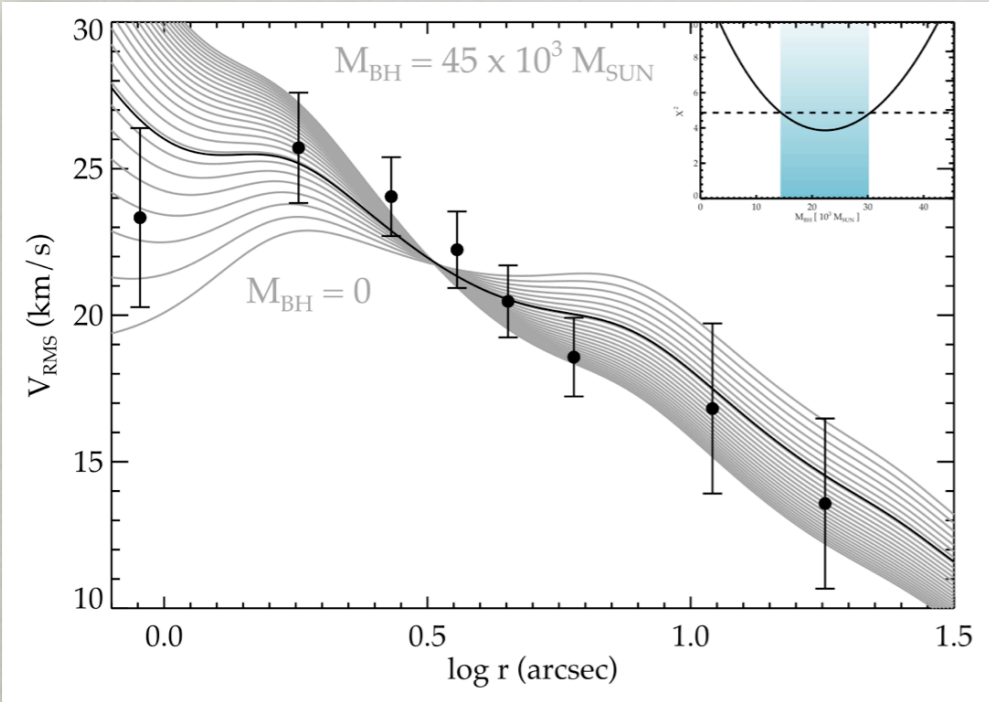
Lützendorf et al. 2011, submitted



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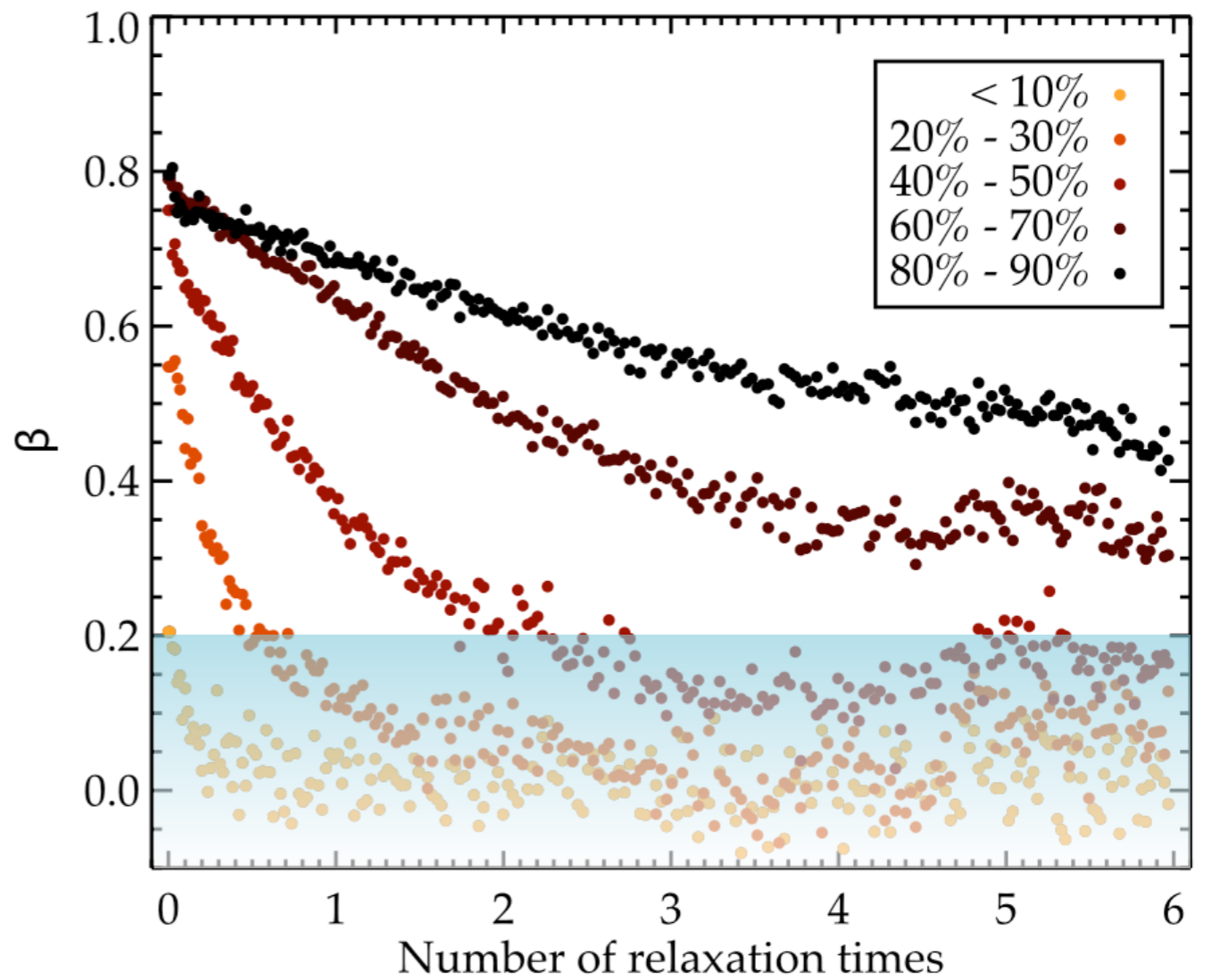
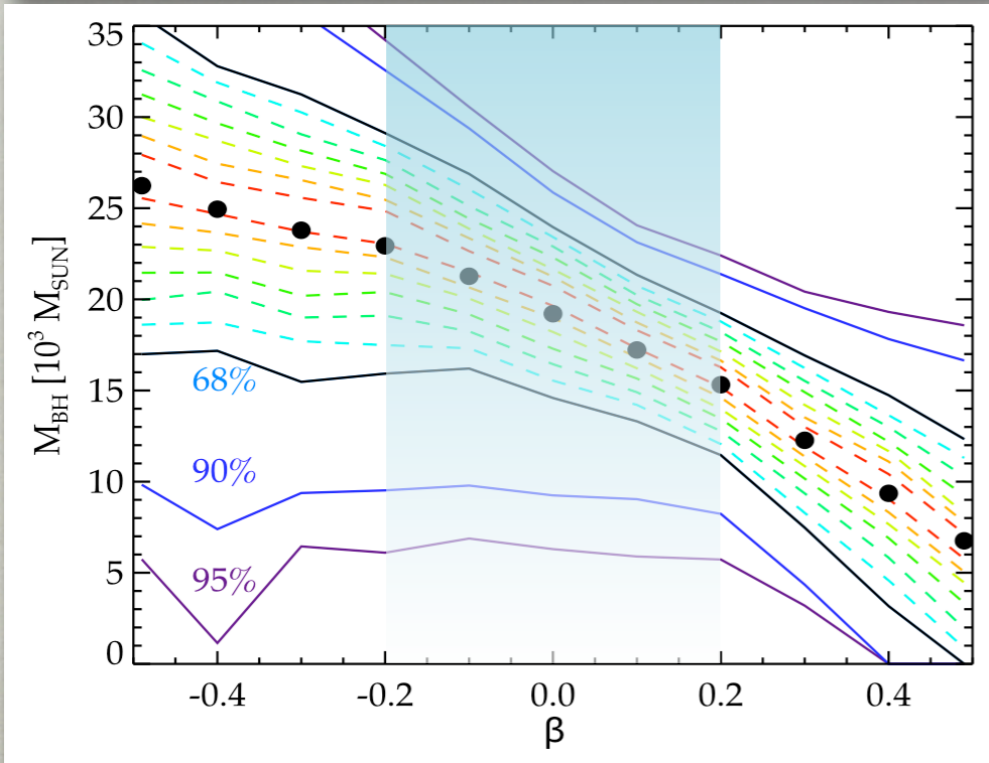
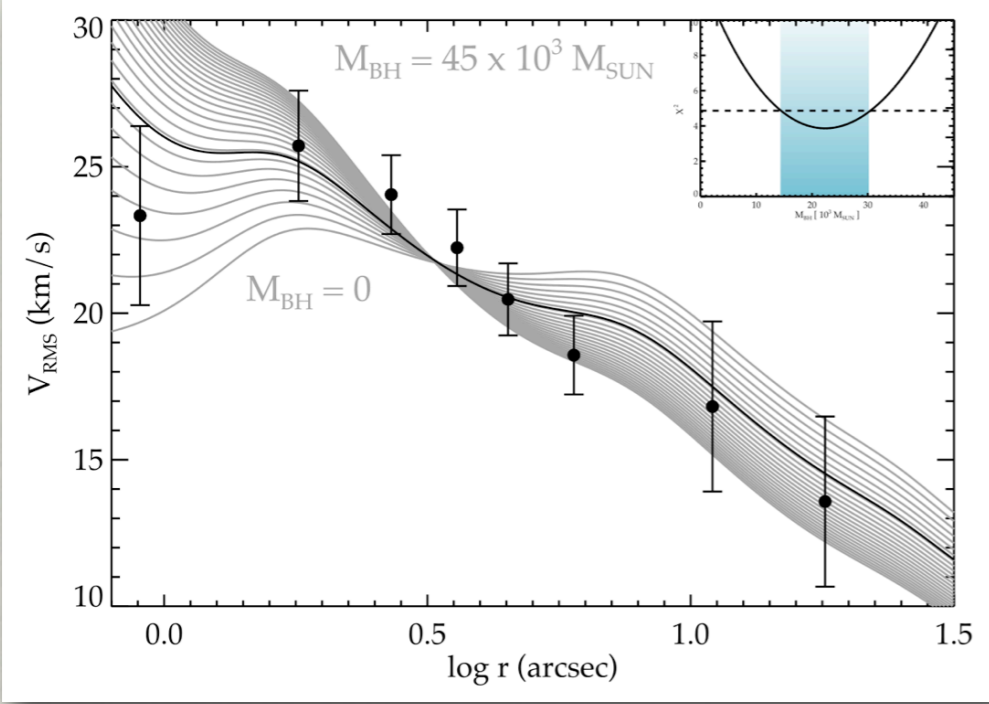
ANISOTROPY VS. BH

Lützendorf et al. 2011, submitted



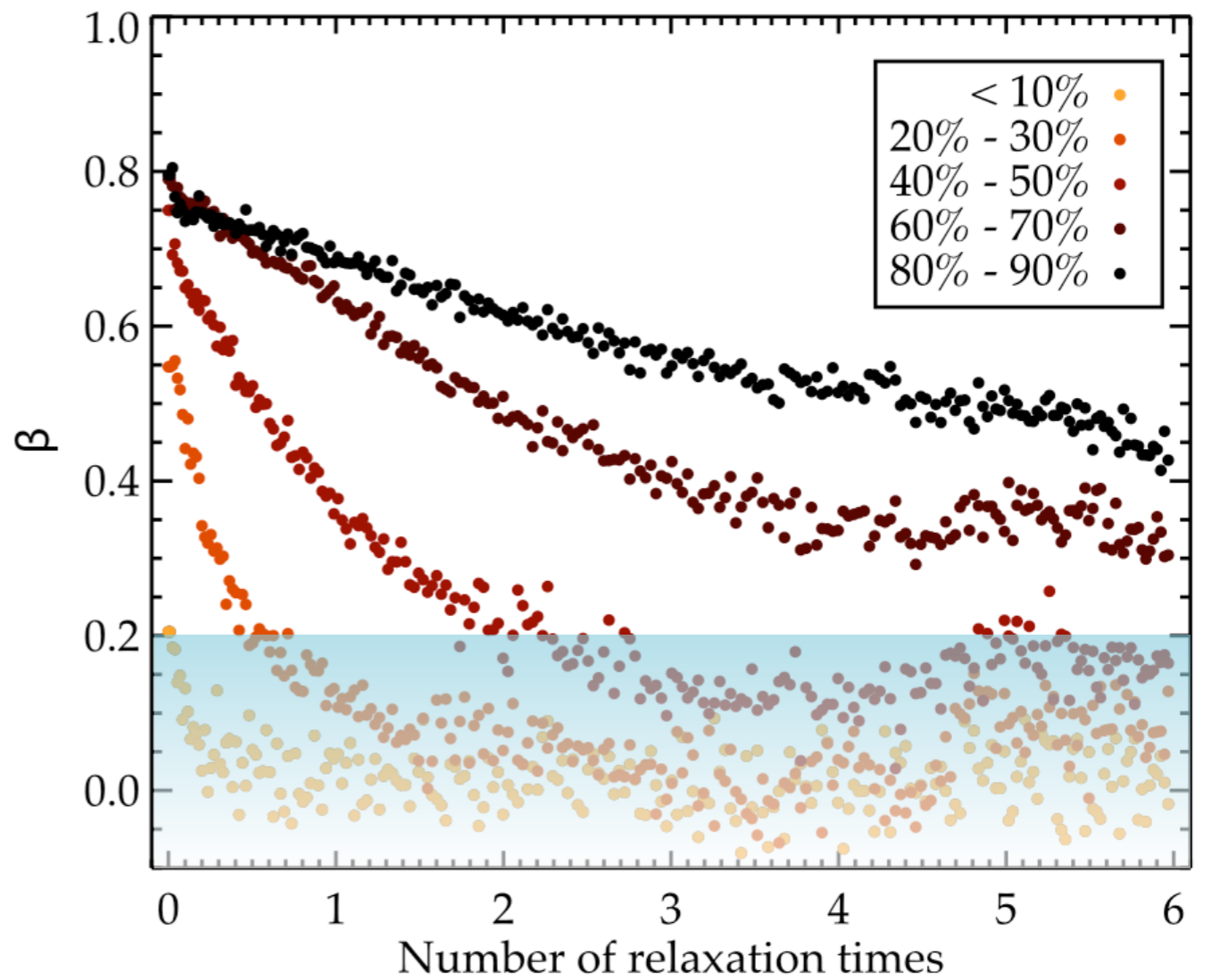
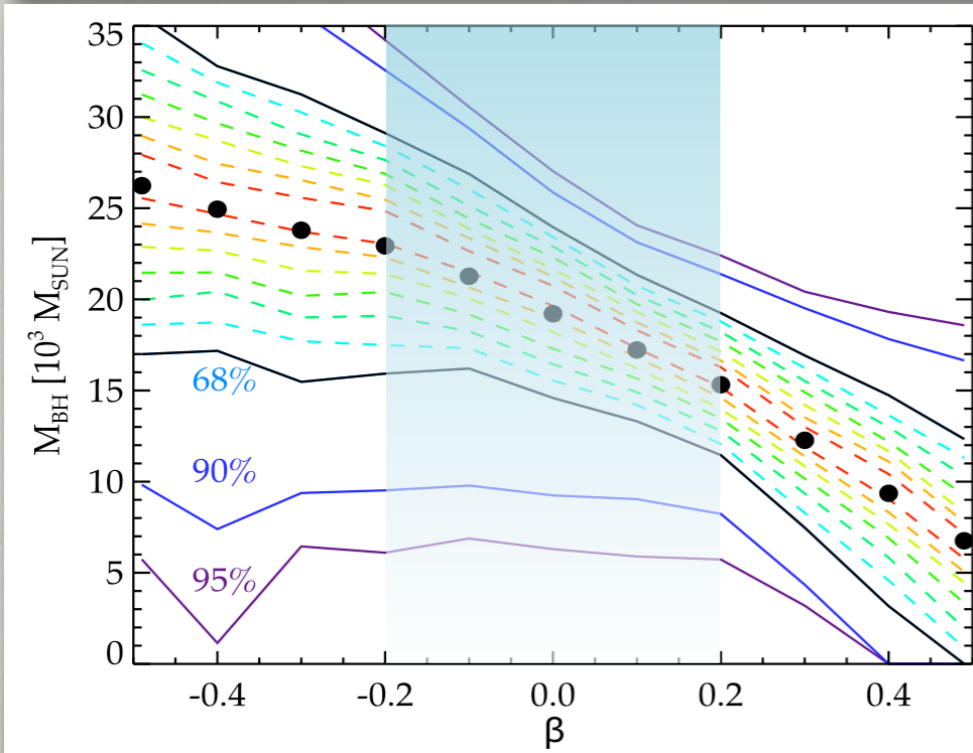
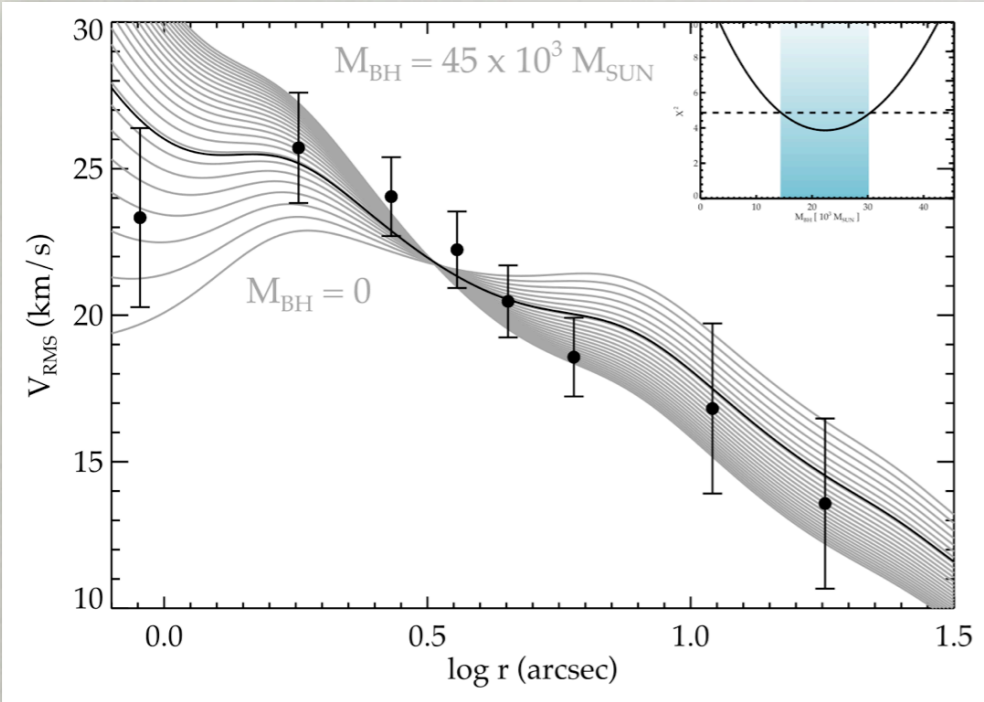
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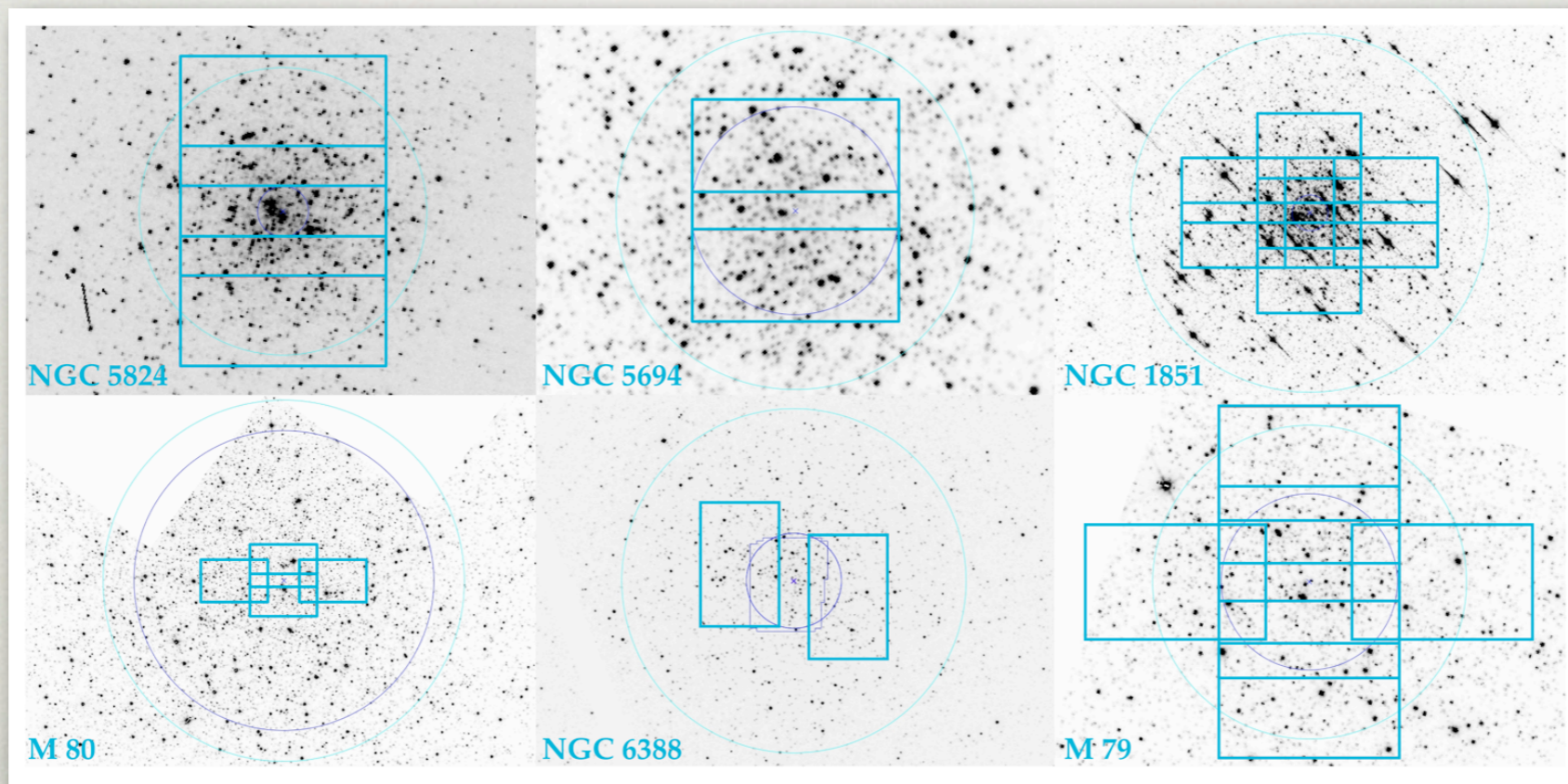
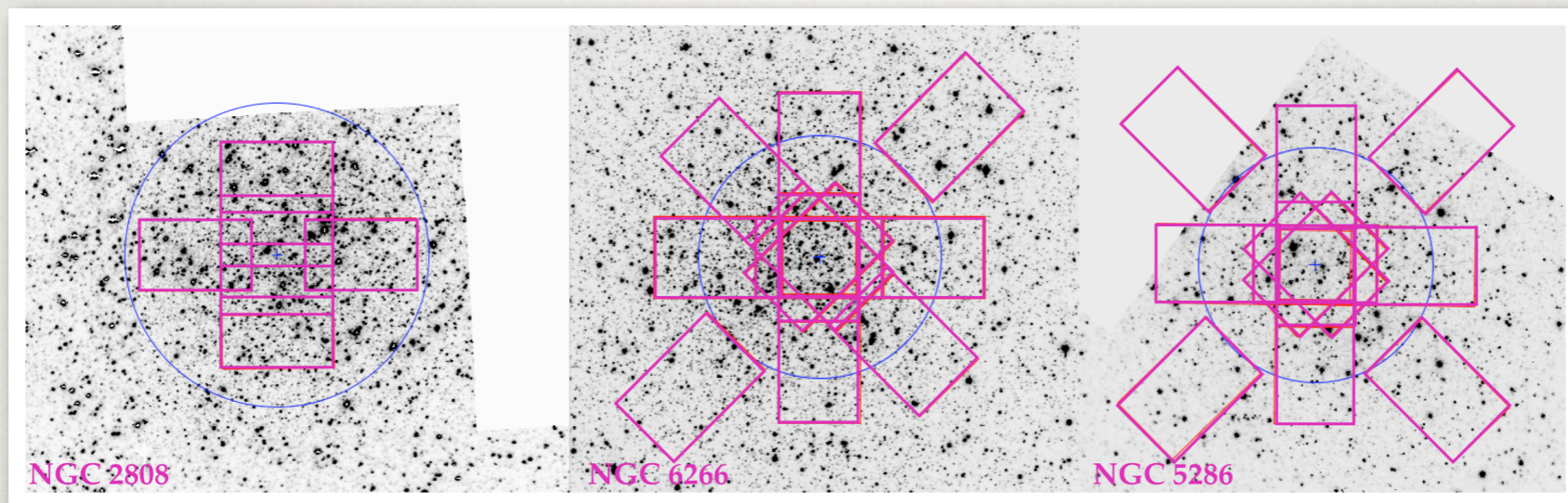
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Lützendorf et al. 2011, submitted



$$M_{\bullet} = 1.9^{+0.8}_{-1.3} \times 10^4 M_{\odot} [95\%]$$

NEW OBSERVATIONS



SUMMARY/CONCLUSIONS



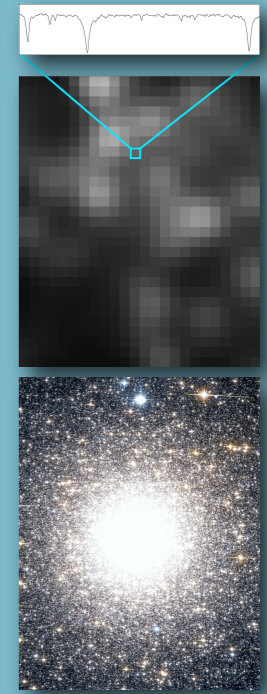
SUMMARY/CONCLUSIONS

- High quality of observational datasets
 - ➔ **Detection of IMBHs possible**



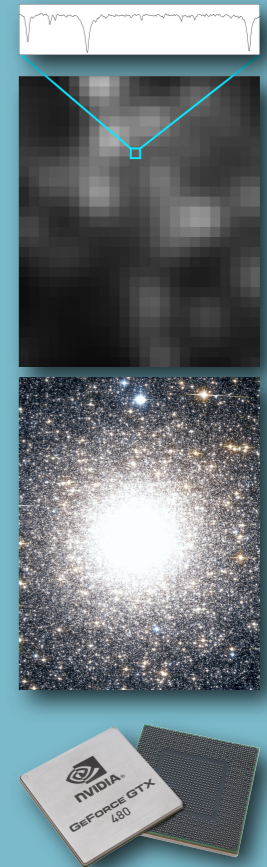
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- Signatures for an **IMBH in NGC 6388**
 $\sim 2 \times 10^4 M_{\odot}$



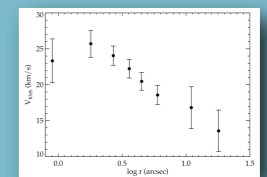
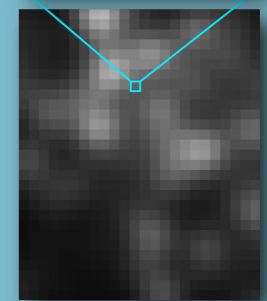
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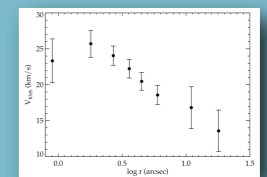
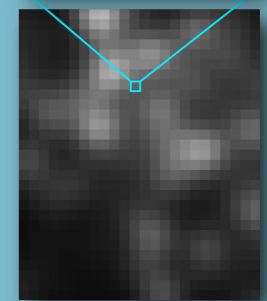
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- Largest error: **SHOT NOISE**



SUMMARY/CONCLUSIONS

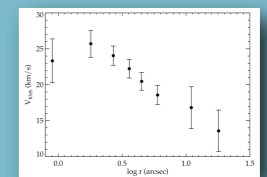
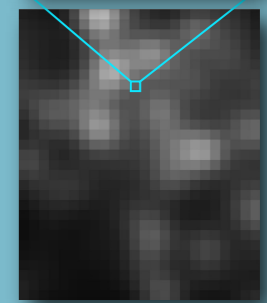
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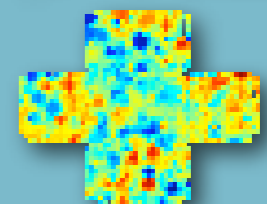
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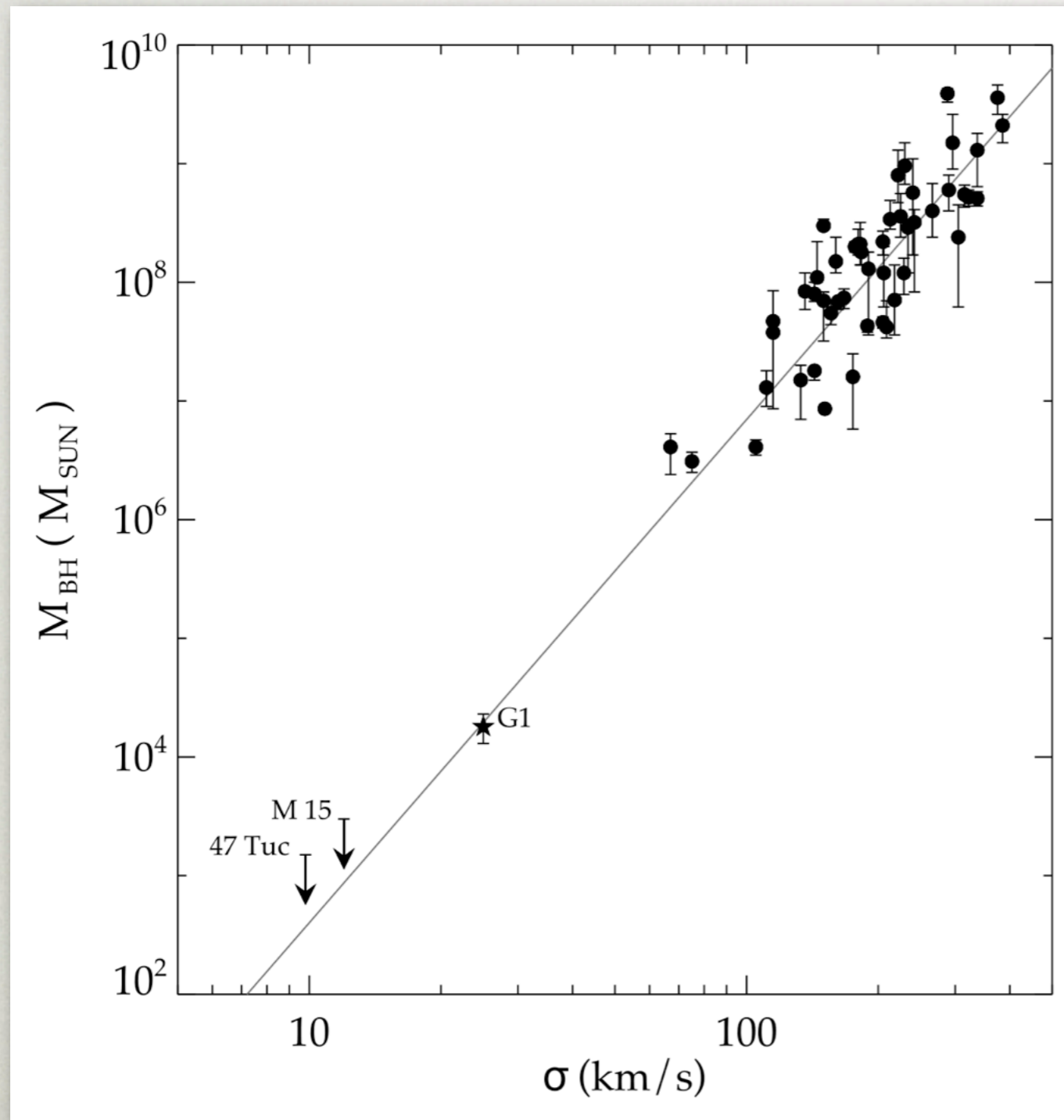
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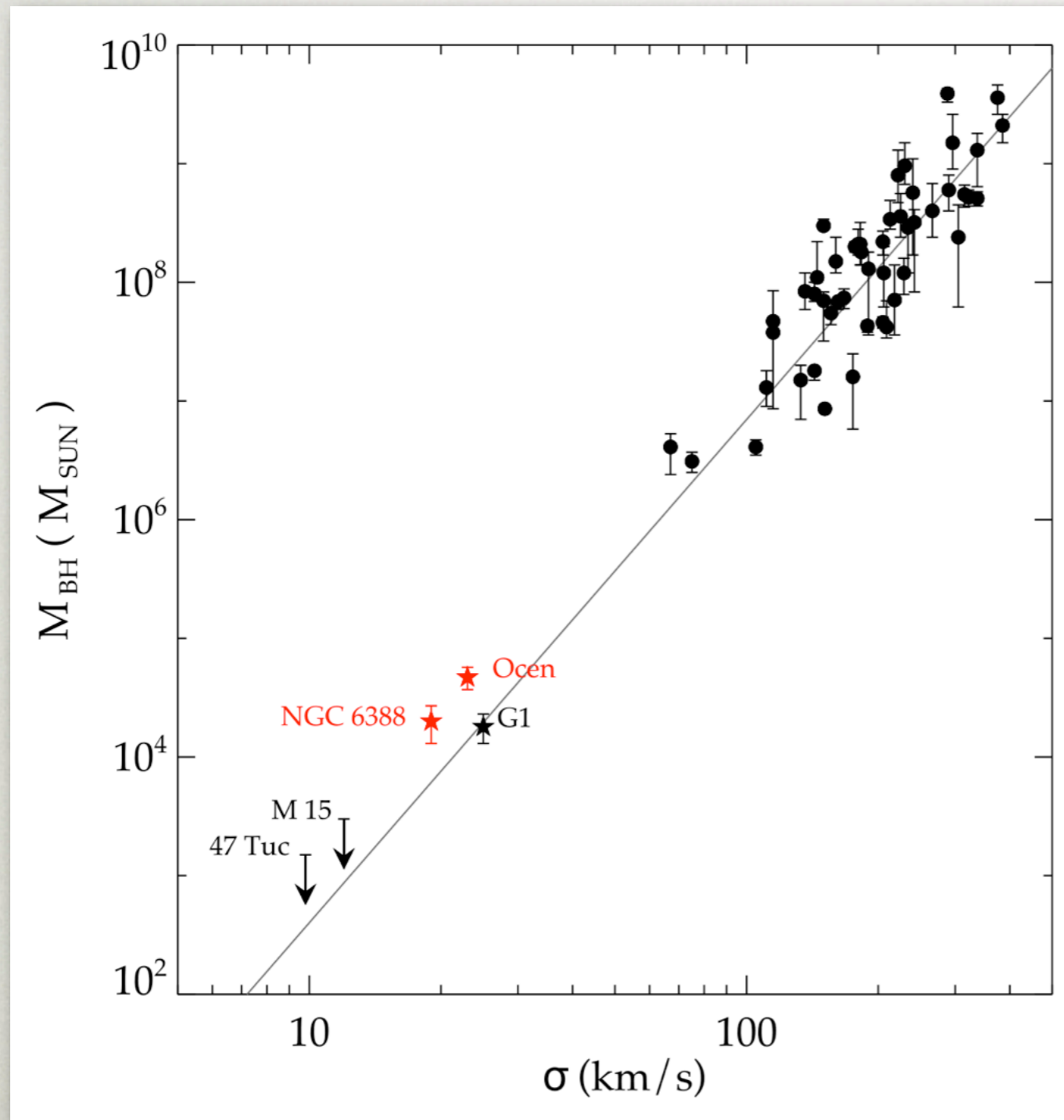
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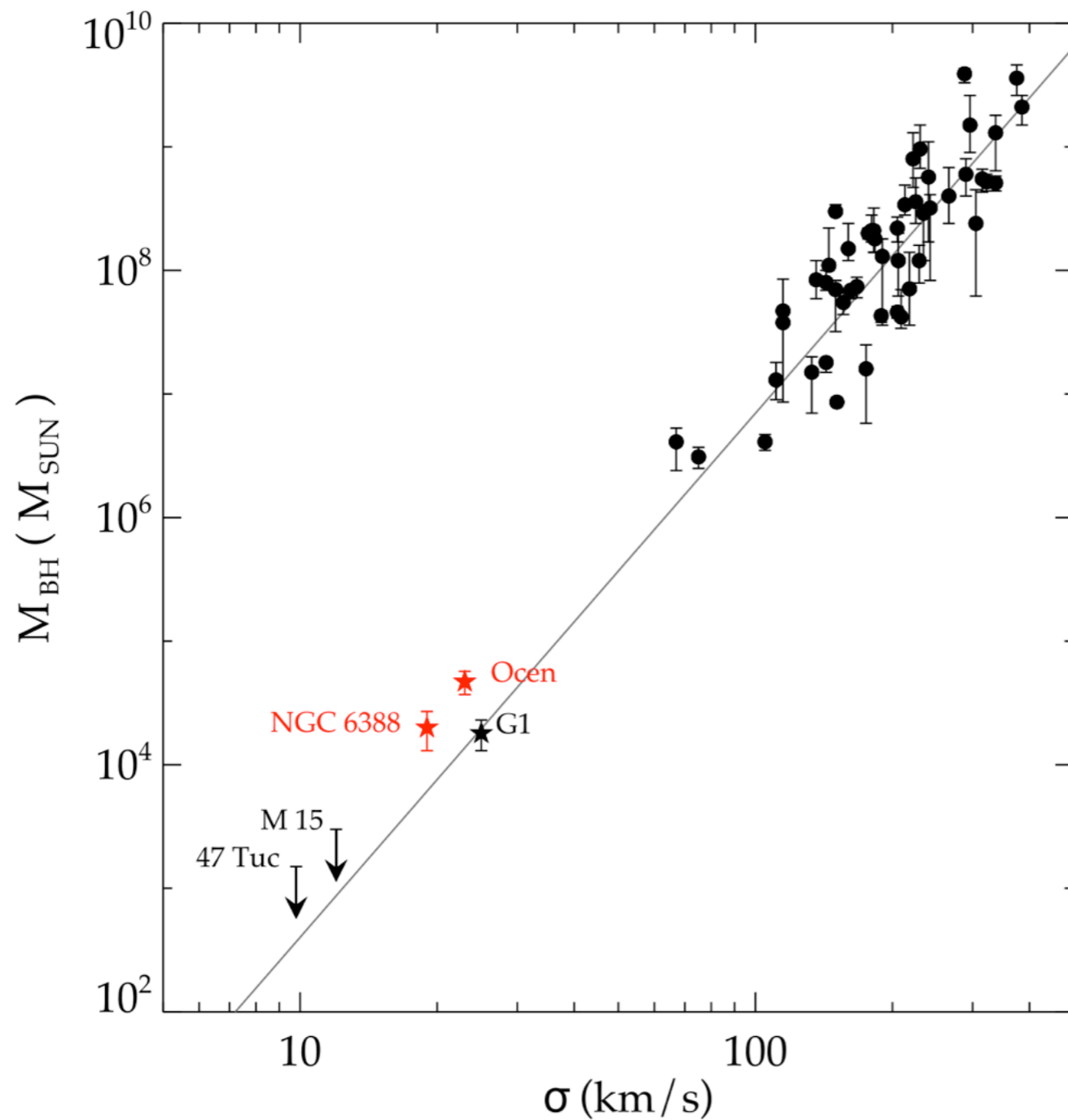
OUTLOOK



OUTLOOK

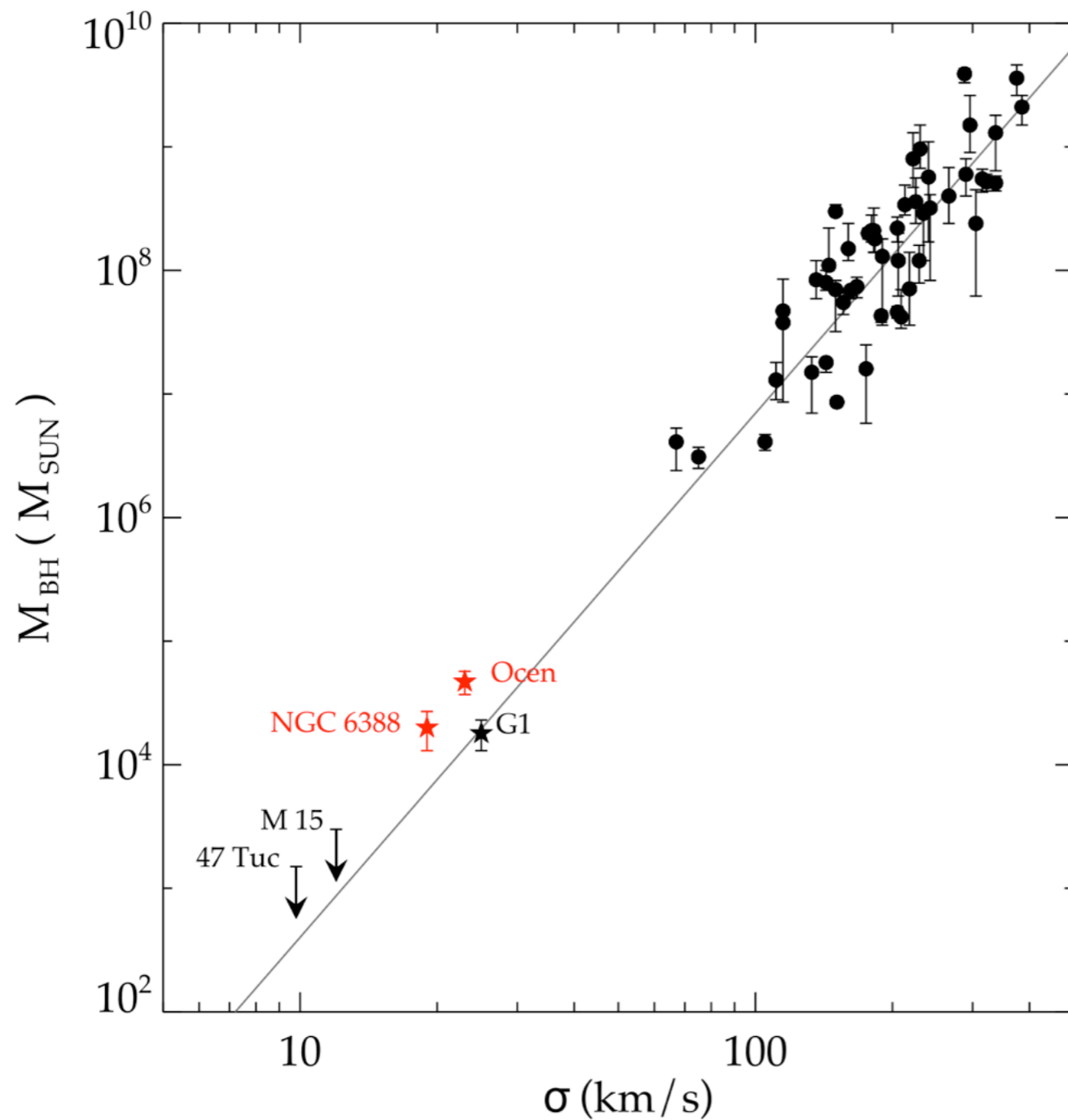


OUTLOOK



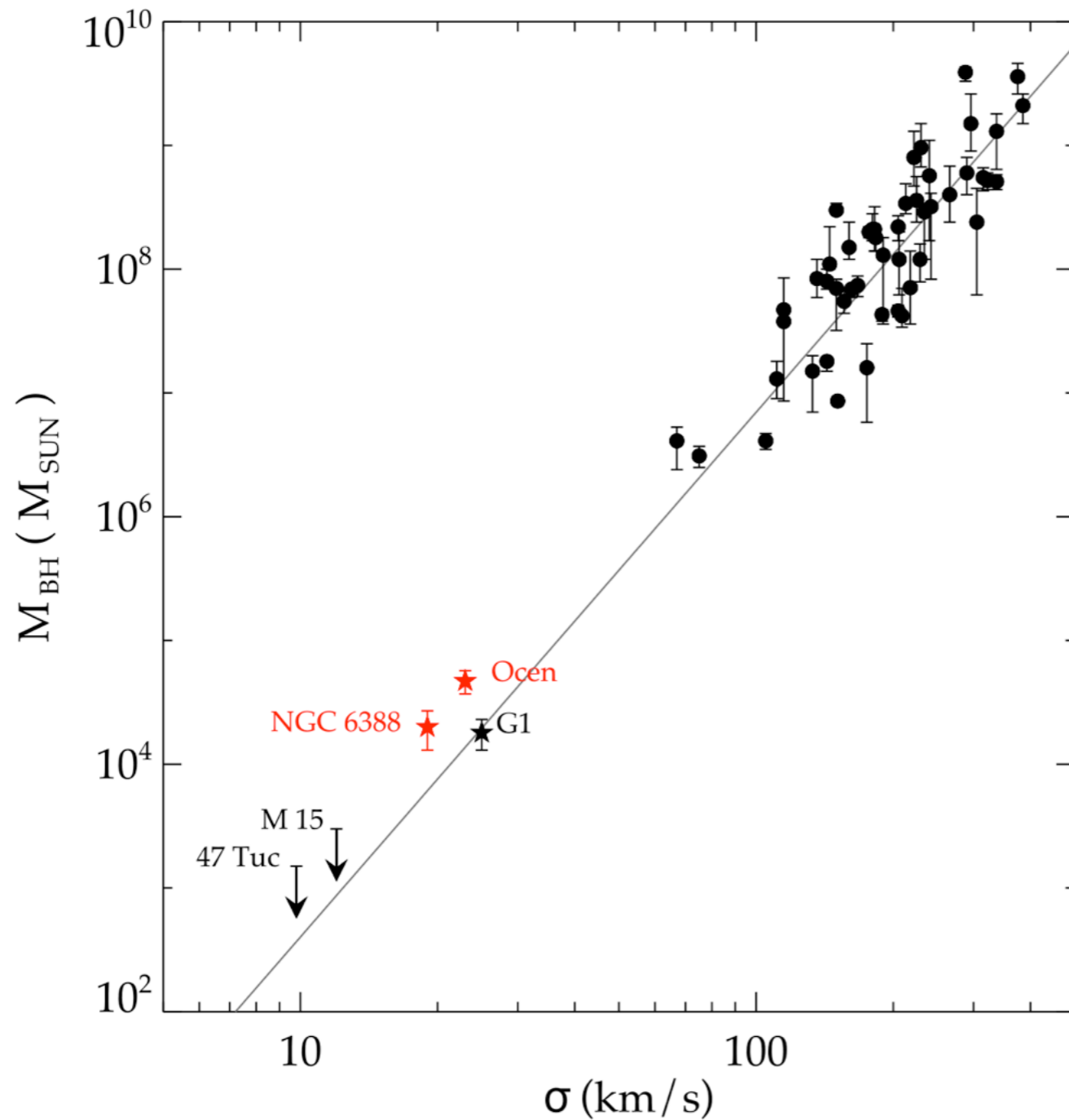
LARGER sample of globular clusters:

OUTLOOK



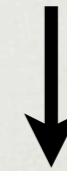
LARGER sample of
globular clusters:
'WHETHER...'

OUTLOOK

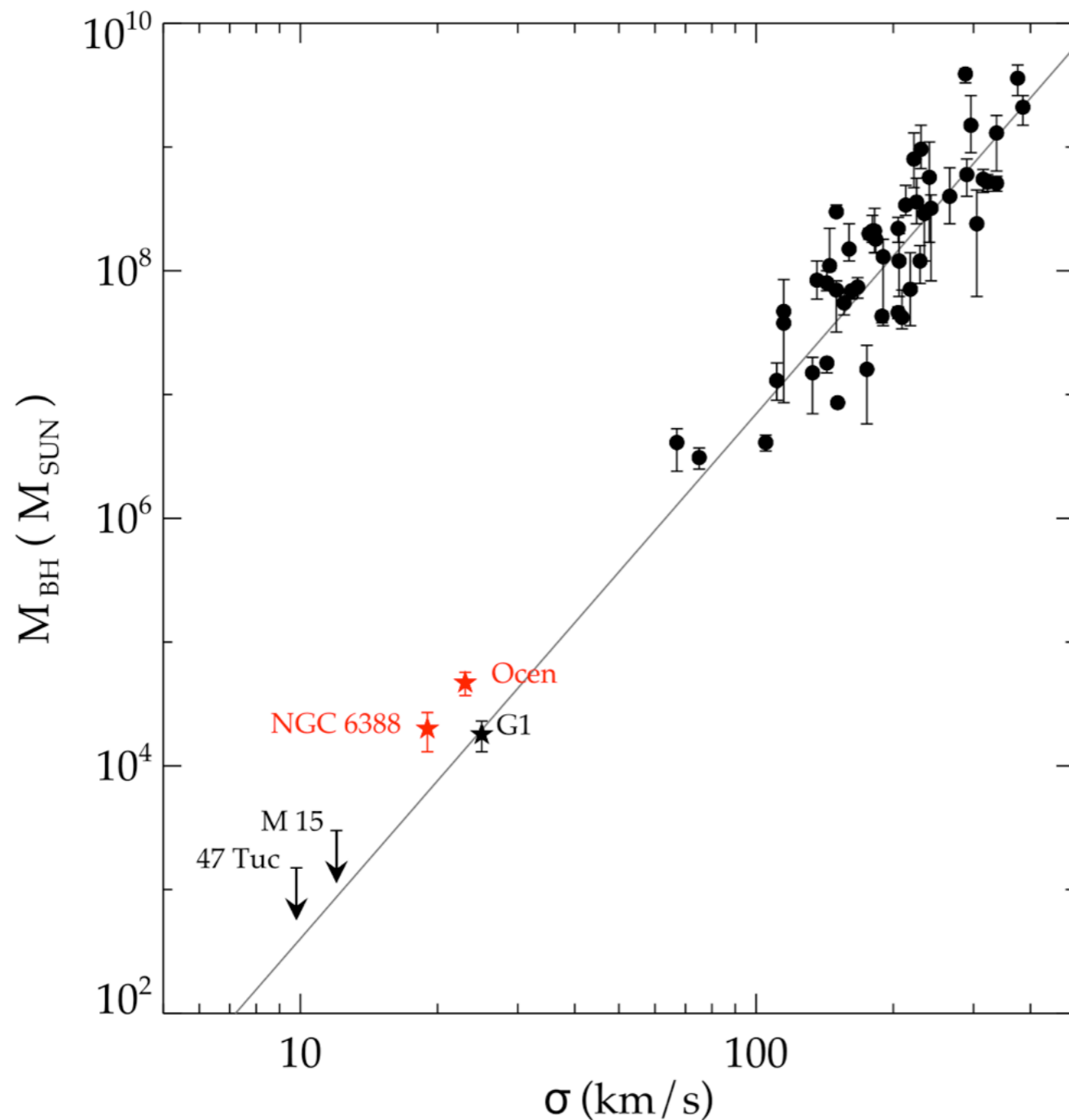


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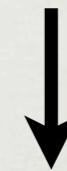


OUTLOOK



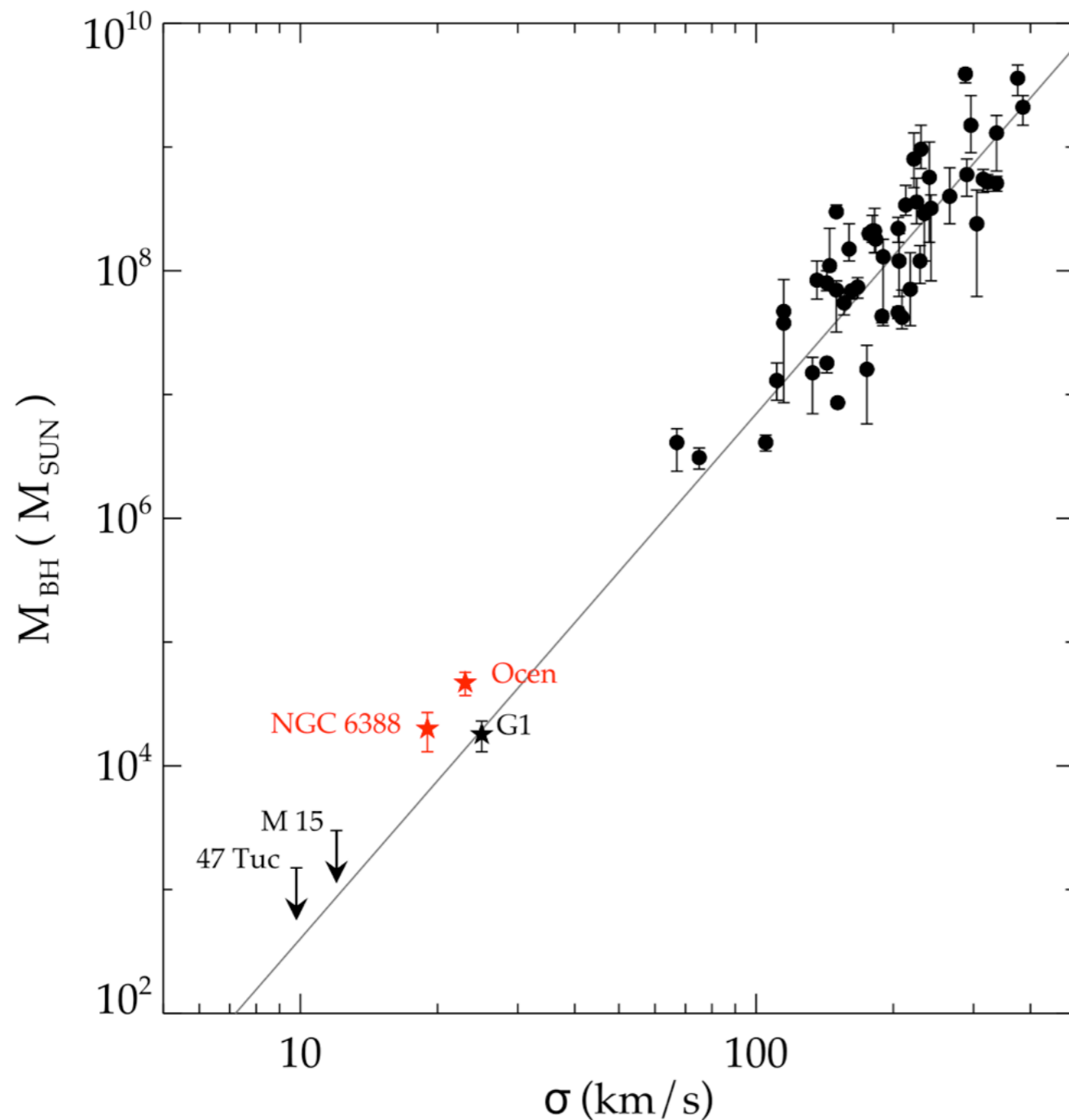
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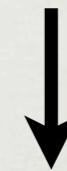
'UNDER WHICH
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OUTLOOK



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'UNDER WHICH
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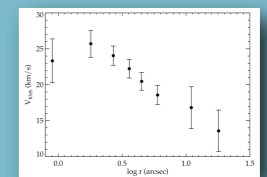
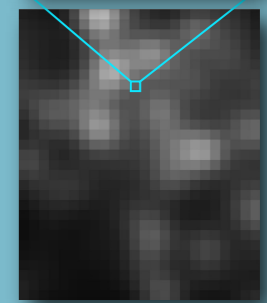
... GCs host IMBHs?

A magnifying glass is positioned over a vast, colorful galaxy. The lens of the magnifying glass is centered on a bright, glowing star, which is the focal point of the image. The text "THANK YOU!" is written in a bold, white, serif font across the center of the lens. The galaxy's colors range from deep blues and purples to bright oranges and yellows, with numerous smaller stars scattered throughout. The magnifying glass has a silver frame and a black handle.

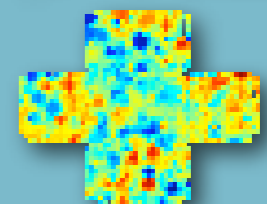
THANK YOU!

SUMMARY/CONCLUSIONS

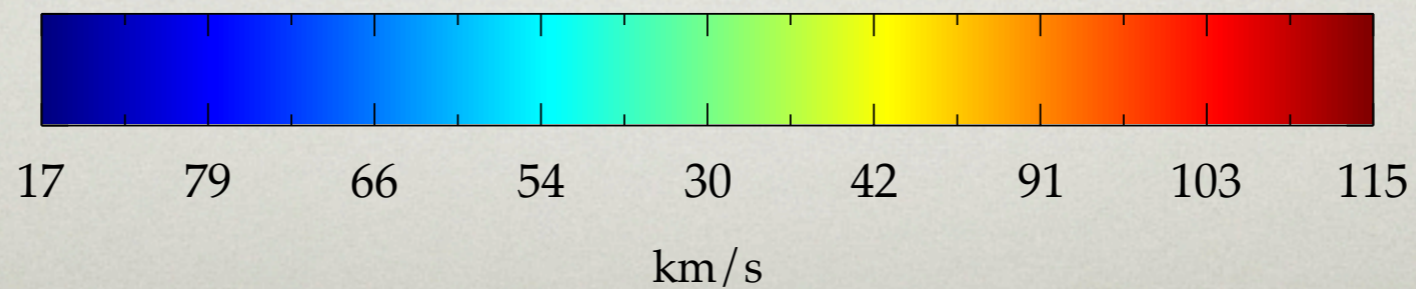
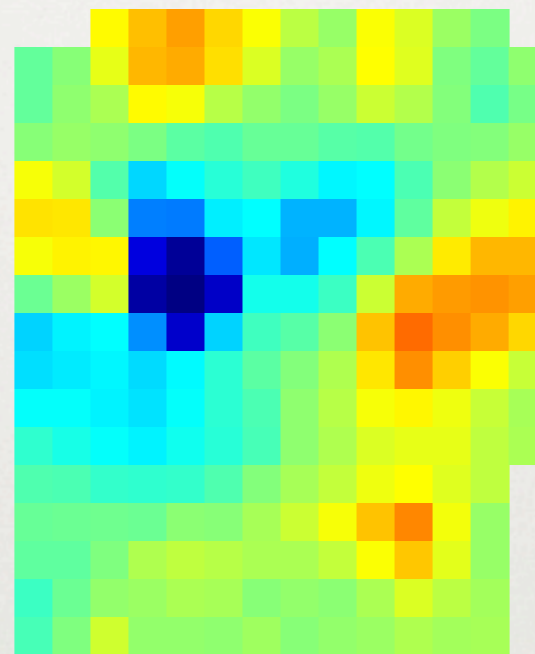
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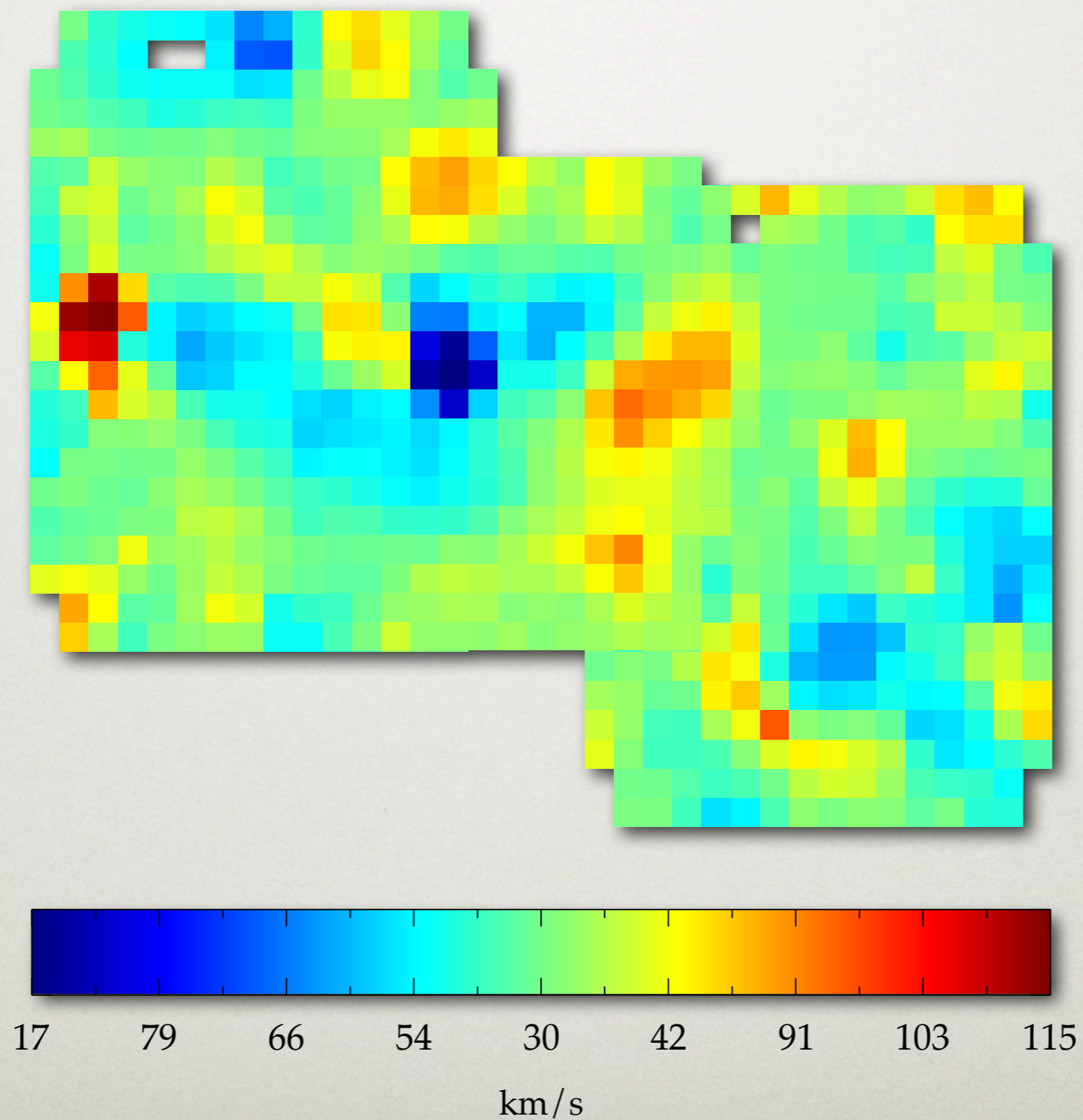
$$\beta < 0.2$$



NEW OBSERVATIONS



NEW OBSERVATIONS



JEANS MODELS

$$\frac{d(\overline{\nu v_r^2})}{dr} + \frac{2\beta \overline{\nu v_r^2}}{r} = -\nu \frac{d\Phi}{dr}$$

JEANS MODELS

Velocity Dispersion



$$\frac{d(\nu\overline{v_r^2})}{dr} + \frac{2\beta\nu\overline{v_r^2}}{r} = -\nu\frac{d\Phi}{dr}$$

JEANS MODELS

Velocity Dispersion

Surface Brightness Profile

$$\frac{d(\nu \overline{v_r^2})}{dr} + \frac{2\beta \nu \overline{v_r^2}}{r} = -\nu \frac{d\Phi}{dr}$$

JEANS MODELS

Surface Brightness Profile

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Anisotropy
($\beta = 1 - \overline{v_\theta^2} / \overline{v_r^2}$)

JEANS MODELS

Velocity Dispersion

Surface Brightness Profile

Potential+BH

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SURFACE BRIGHTNESS PROFILE

JEANS MODELS

Velocity Dispersion

Surface Brightness Profile

Potential+BH

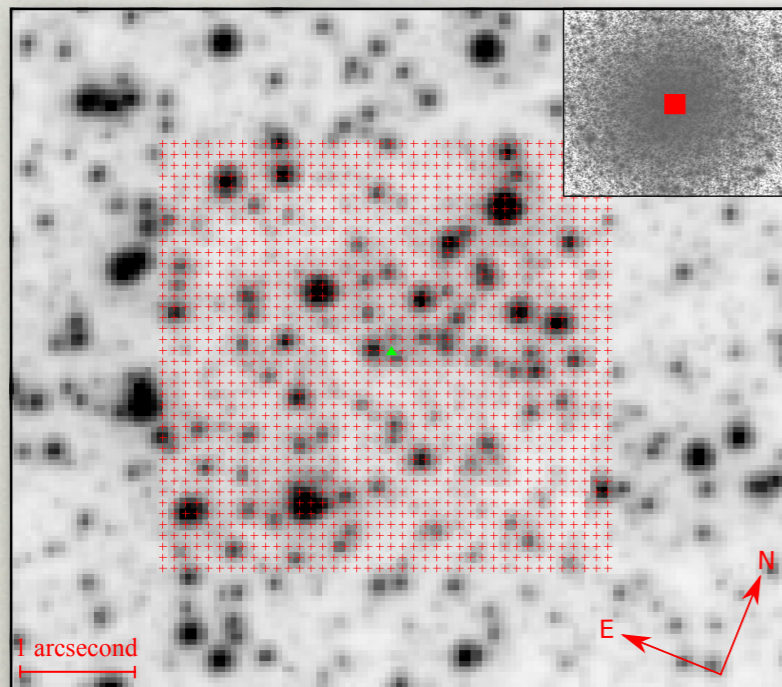
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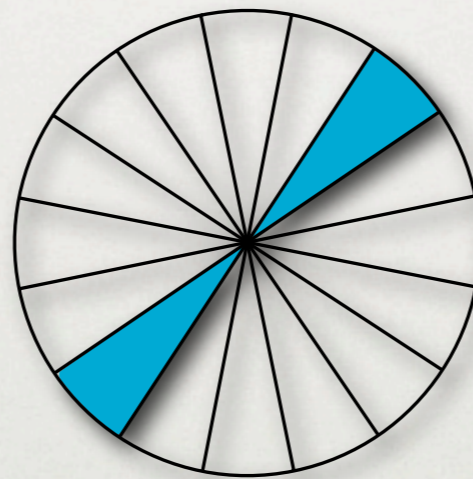
SURFACE BRIGHTNESS PROFILE
VELOCITY DISPERSION PROFILE

PHOTOMETRY

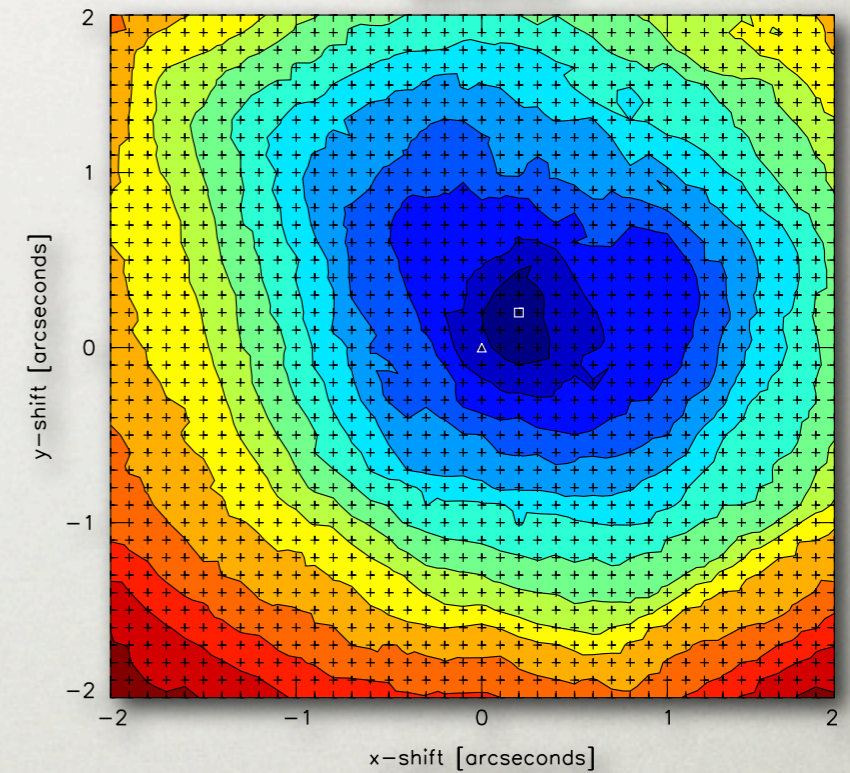
TRIAL CENTERS



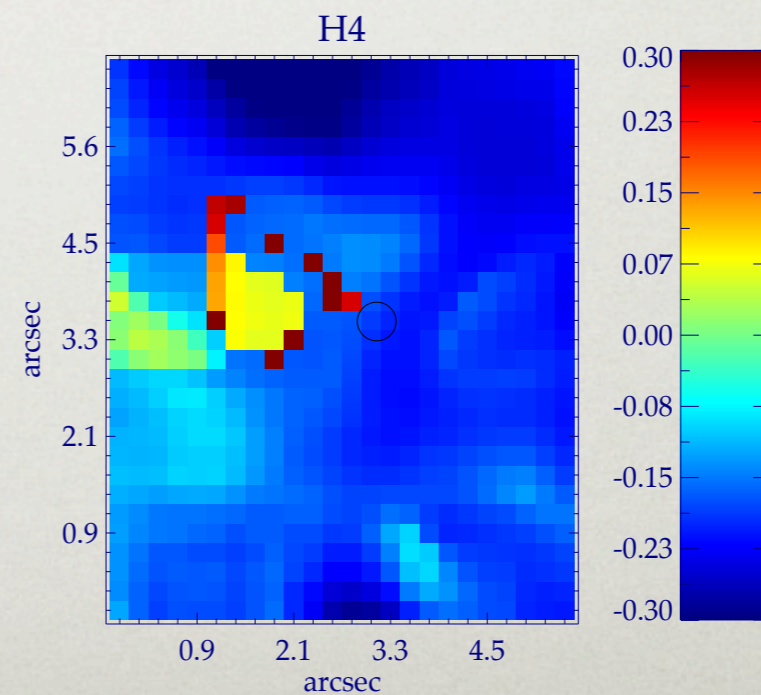
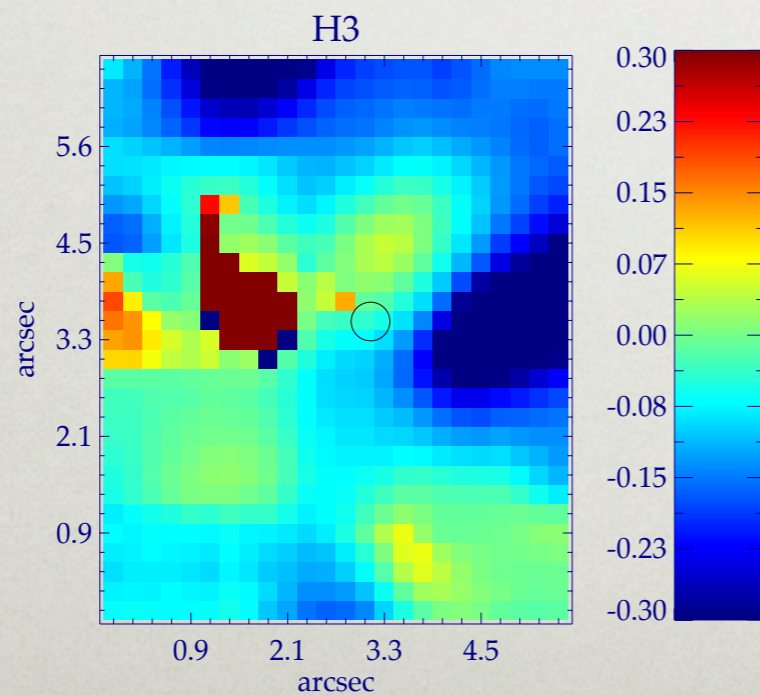
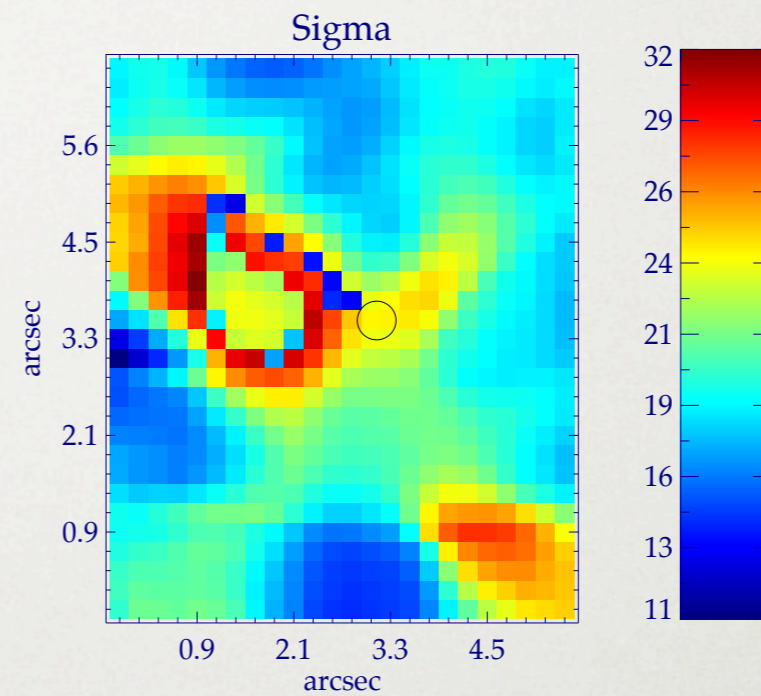
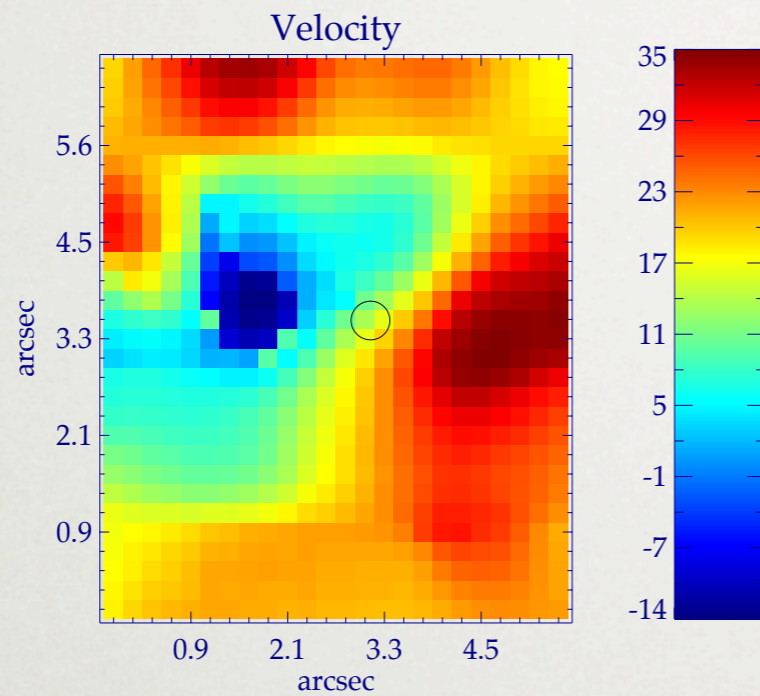
METHOD



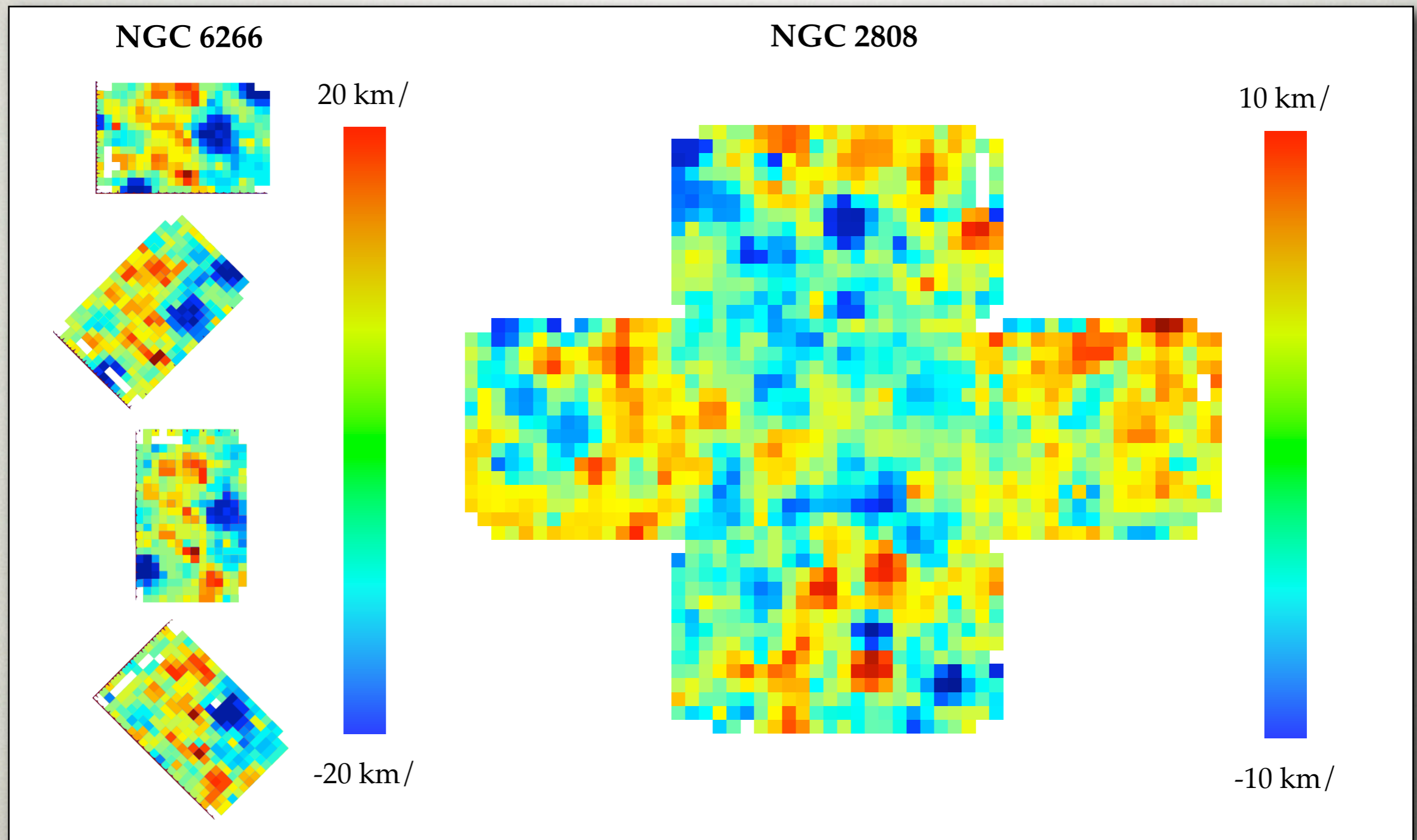
RESULT



NGC 6388 - KINEMATIC MAPS

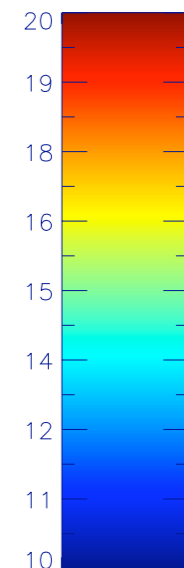
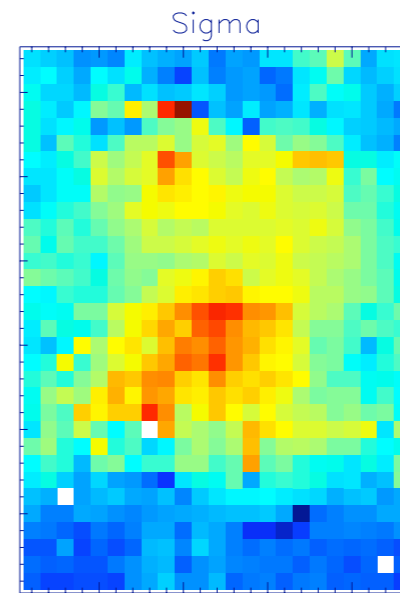
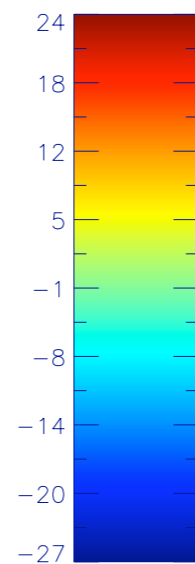
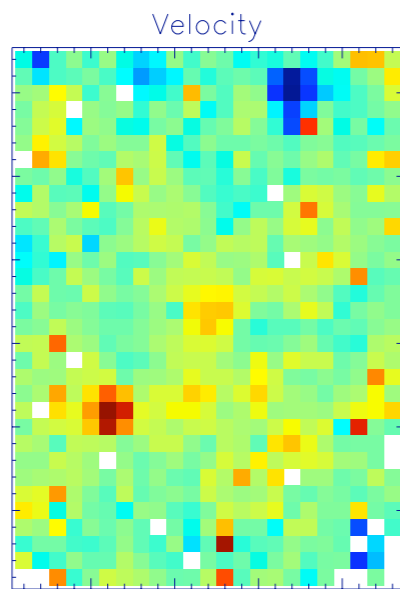


OBSERVED CLUSTERS



OBSERVED CLUSTERS

NGC 5824



NGC 1851

