

Black Holes in Star Clusters

Dr. Renuka Pechetti

My Research Work

- Acquiring kinematics for star clusters or dwarf galaxies
- Analysing IFU spectra or individual stellar spectra, dynamical modeling, analysing gas dynamics
- Recent research has been focused on finding IMBHs
- Past research involved analysis of NSCs, BHs and their dynamics

Omega Centauri's black hole

Article

Fast-moving stars around an intermediate-mass black hole in ω Centauri

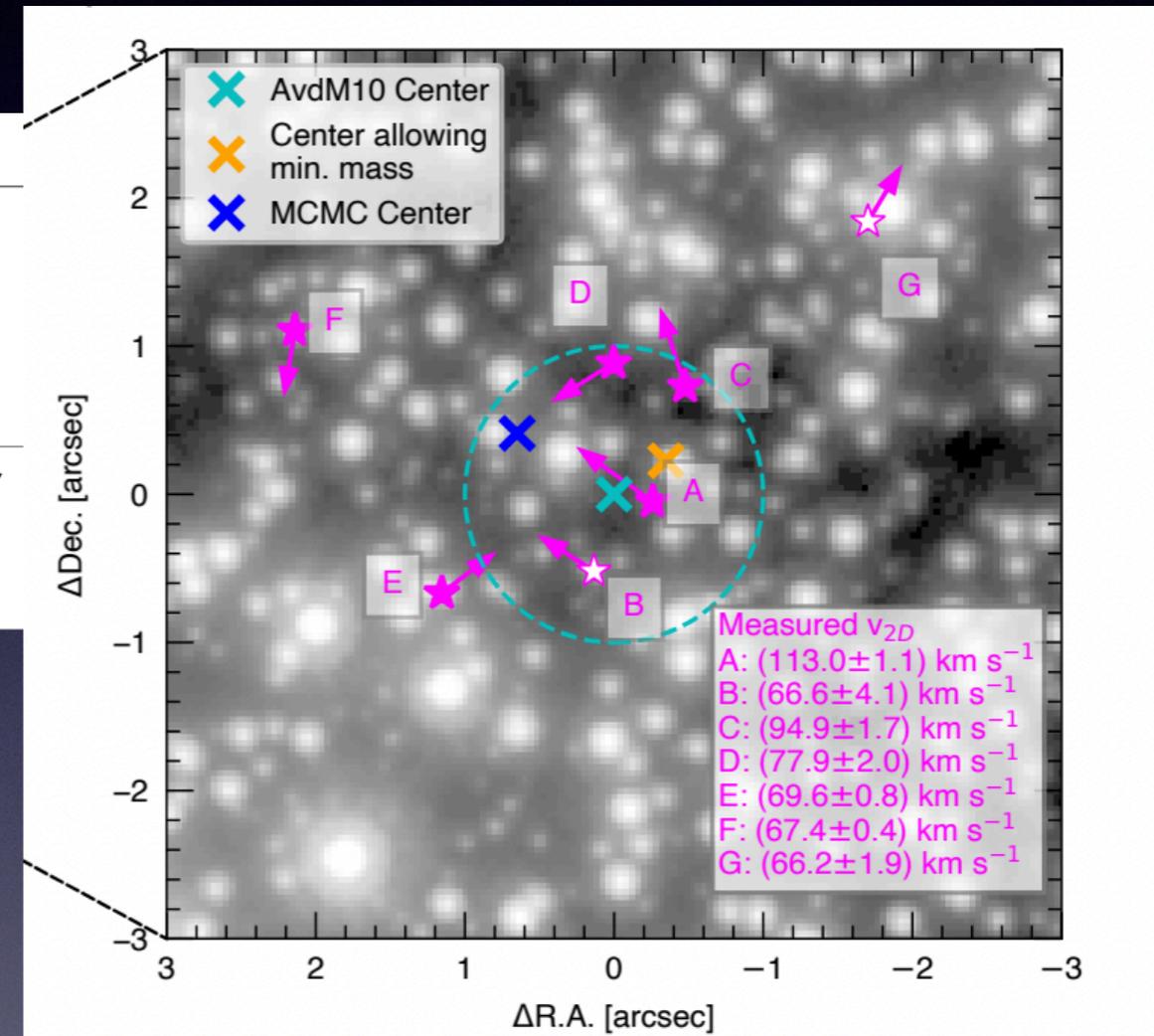
<https://doi.org/10.1038/s41586-024-07511-z>

Received: 15 December 2023

Accepted: 2 May 2024

Maximilian Häberle¹, Nadine Neumayer¹, Anil Seth², Andrea Bellini³, Mattia Libralato^{4,5}, Holger Baumgardt⁶, Matthew Whitaker², Antoine Dumont¹, Mayte Alfaro Cuello^{3,7}, Jay Anderson³, Callie Clontz^{1,2}, Nikolay Kacharov⁸, Sebastian Kamann⁹, Anja Feldmeier-Krause^{1,10}, Antonino Milone¹¹, Maria Selina Nitschai¹, Renuka Pechetti⁹ & Glenn van de Ven¹⁰

Lower limit - 8200 Msun
HÄBERLE et al. 2024 (Nature)

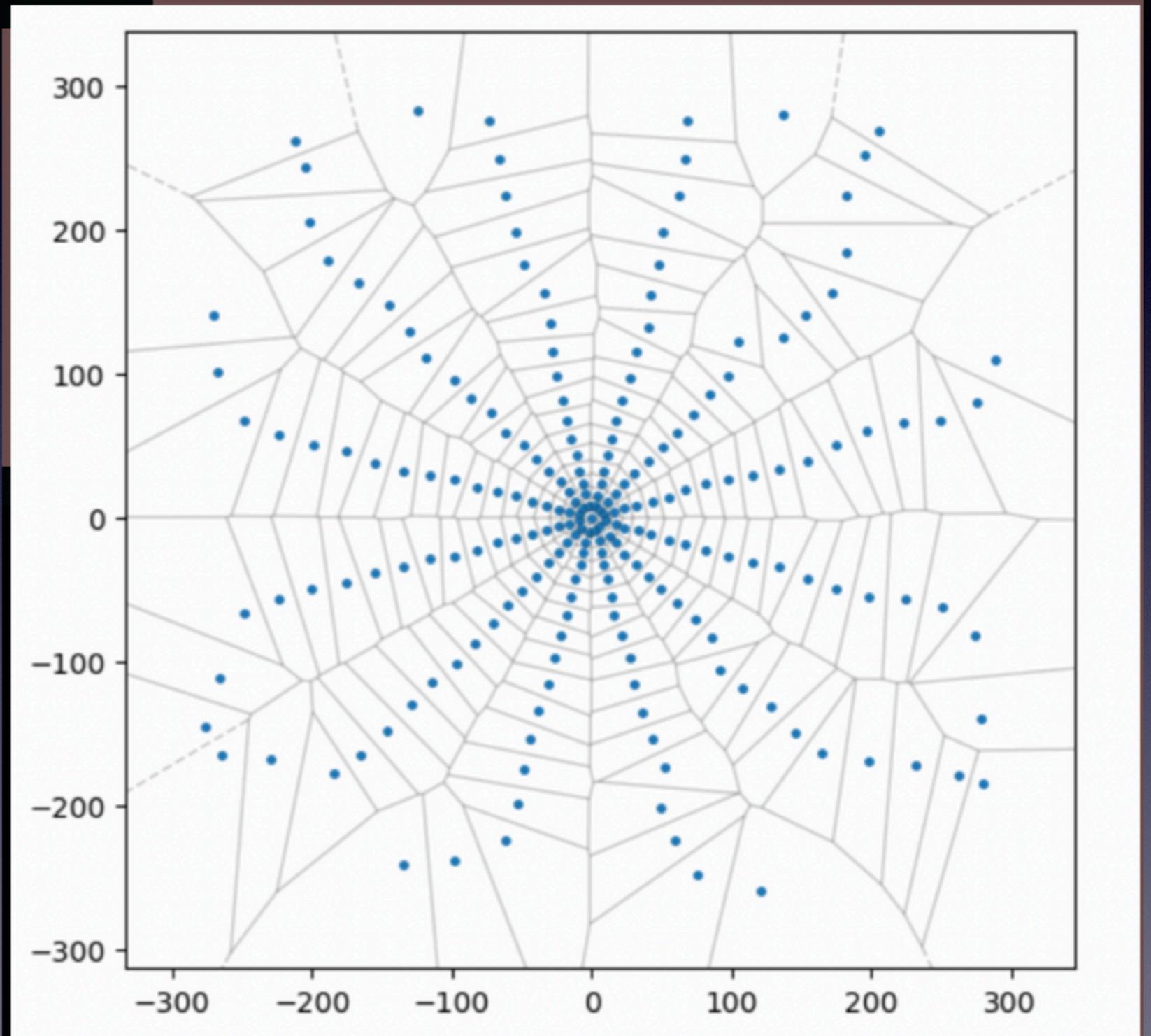


OMEGACAT - 3-D Velocities

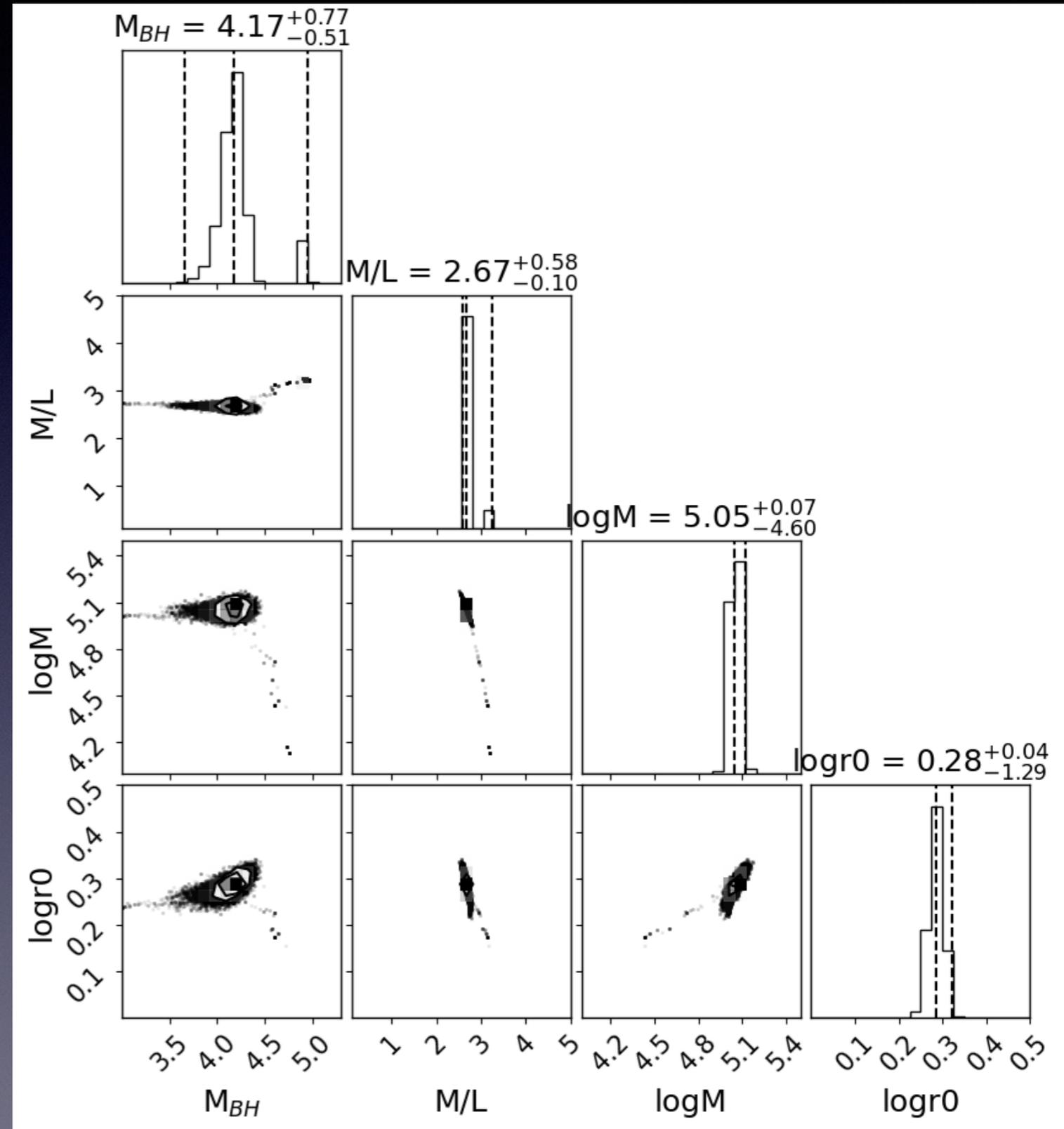
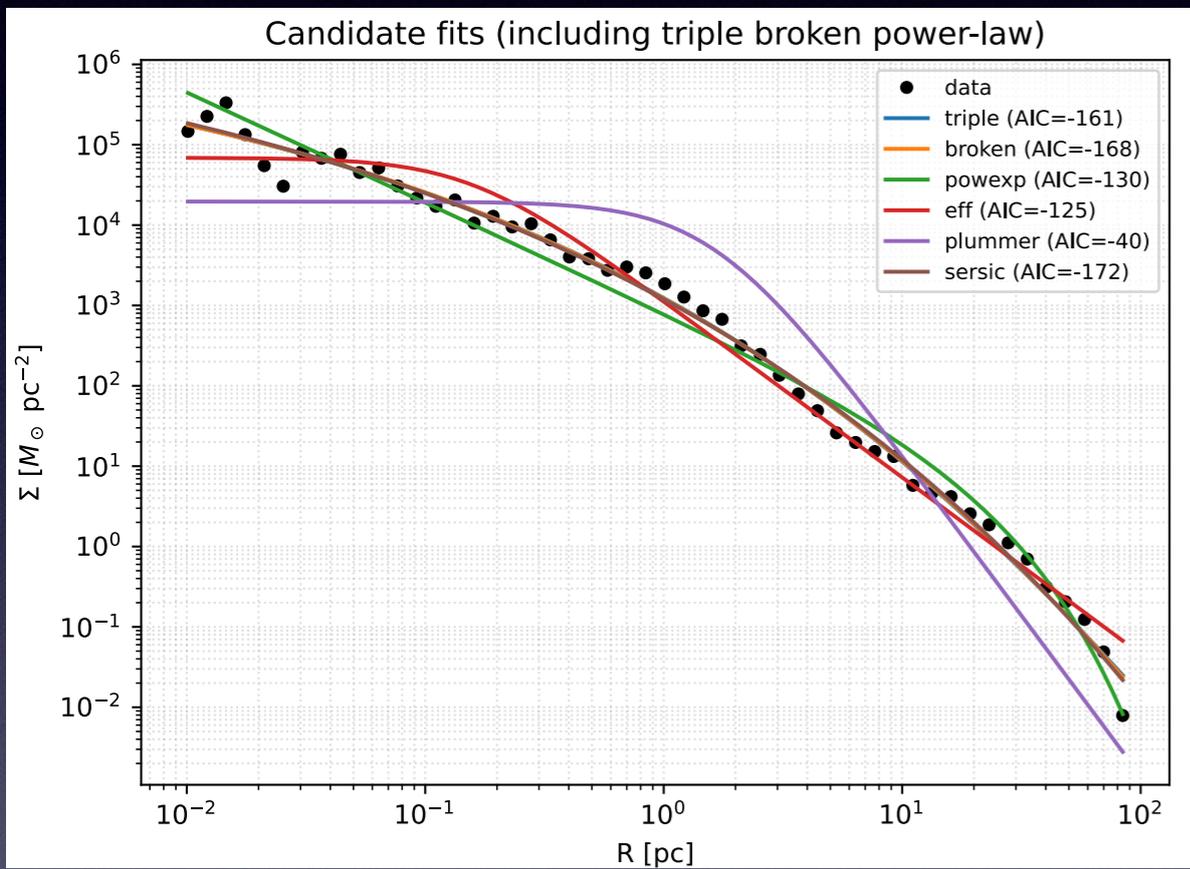
Combining the proper motions from HST catalogue with the line of sight velocities from MUSE GTO/GO data (Häberle +2024)

> 1 Million stars containing the velocities

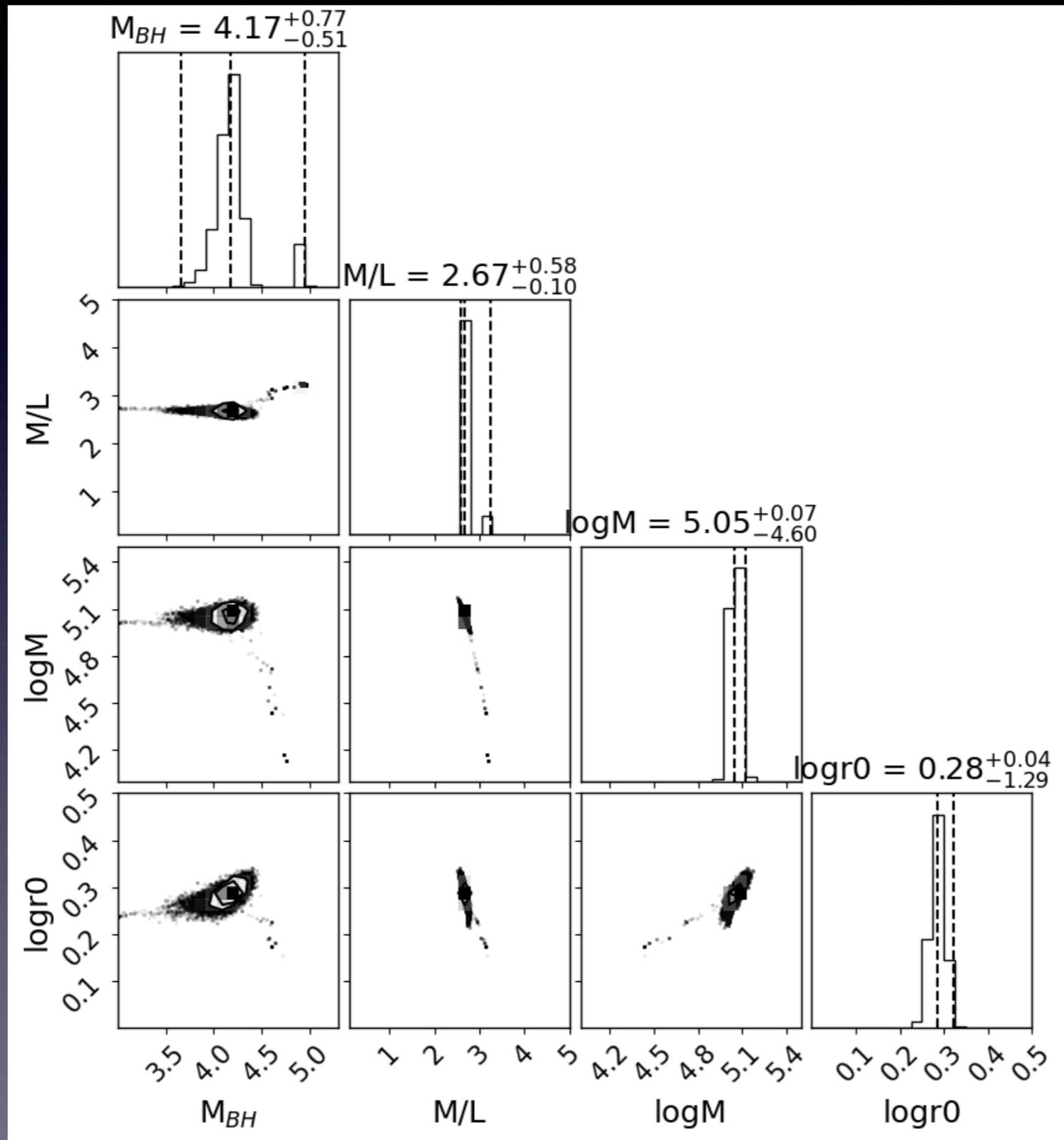
We use a high selection quality criteria for proper motions ~ 640,000 stars



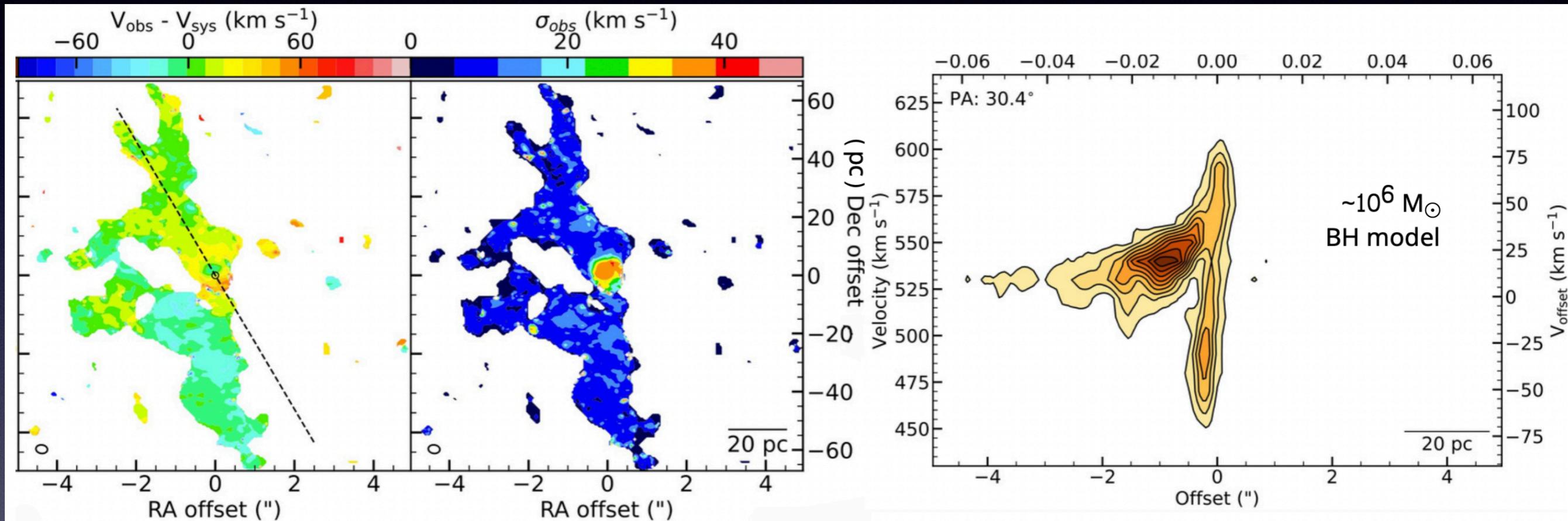
DARK-MASS PROFILE FROM SIMULATIONS



JEAN'S IMBH & DARK-MASS MODELS



Modelling the kinematics in a low-mass galaxy



ESO274-1 galaxy mas $\sim 3 \times 10^8 M_{\odot}$

Future Research Plans - Bridging Observations and Simulations

- Synthetic Spectroscopy - Building IFU datacubes for direct comparisons, generating mock line of sight velocities and dispersion profiles
- Finding more of the clusters that can have hidden IMBHs in them based on the kinematic signatures
- Use synthetic observations to test whether cluster scale dynamics explain nuclear star cluster or SMBH seeds