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Gemini and HST Evidence for an Intermediate-Mass Black Hole in ω Centauri

Noyola, Eva; Gebhardt, Karl; Bergmann, Marcel
The Astrophysical Journal, 676, 1008-1015, 2008 April 1

ω Centauri

- Globular Cluster
  (a dwarf galaxy stripped of its outer stars??)
- Distance: 5.6 ± 0.3 kpc
- Apparent magnitude (V) 3.7
- Apparent dimensions (V) 36′.3
- Mass ~ 5×10^6 M_{solar}
- Radius 97 ± 6 ly
- Estimated age ~12 Gyr


Omega Cent 25 MAR 2007 vcastro

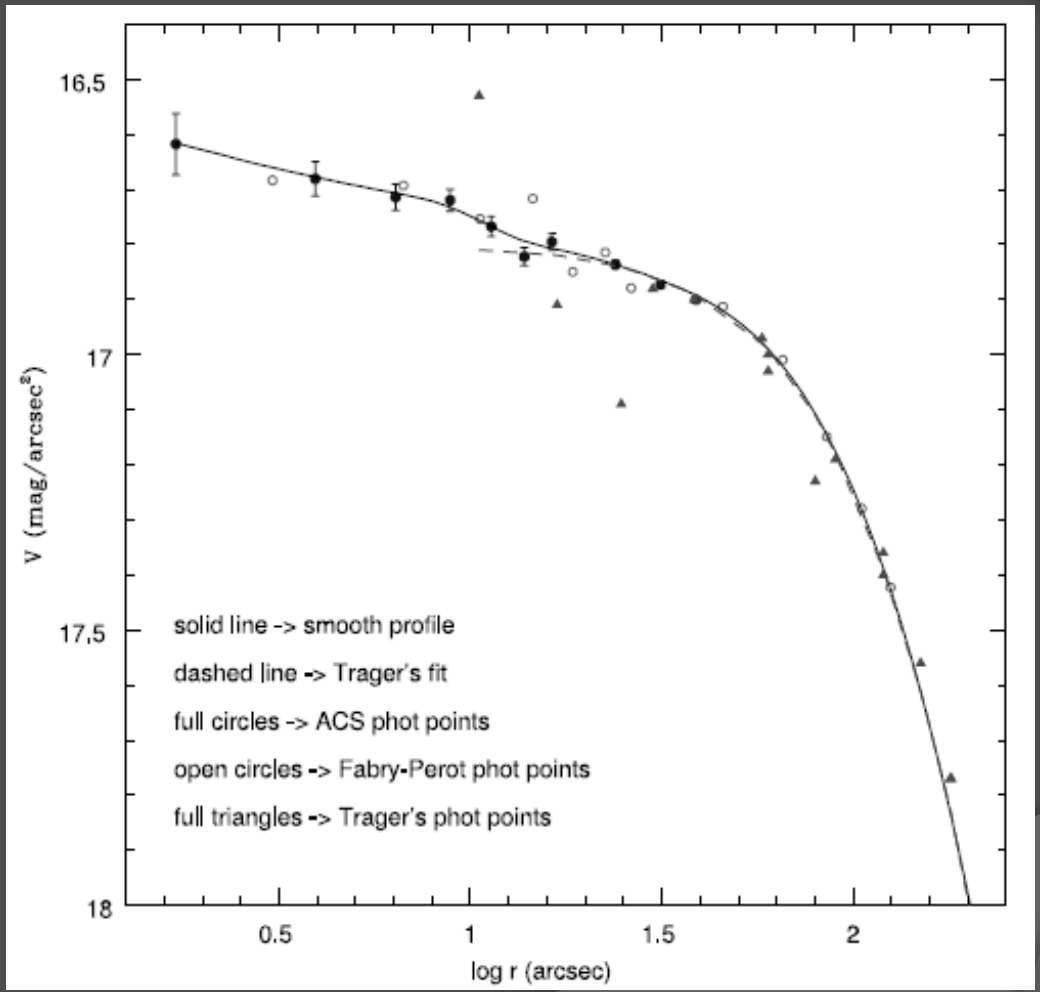
Observation

- HST/ACS
  - Surface brightness profile
- Gemini GMOS-IFU
  - Kinematic data (radial velocity dispersion)

Flat surface brightness profile

Continuous rise toward the center with logarithmic slope -0.08 ±0.03

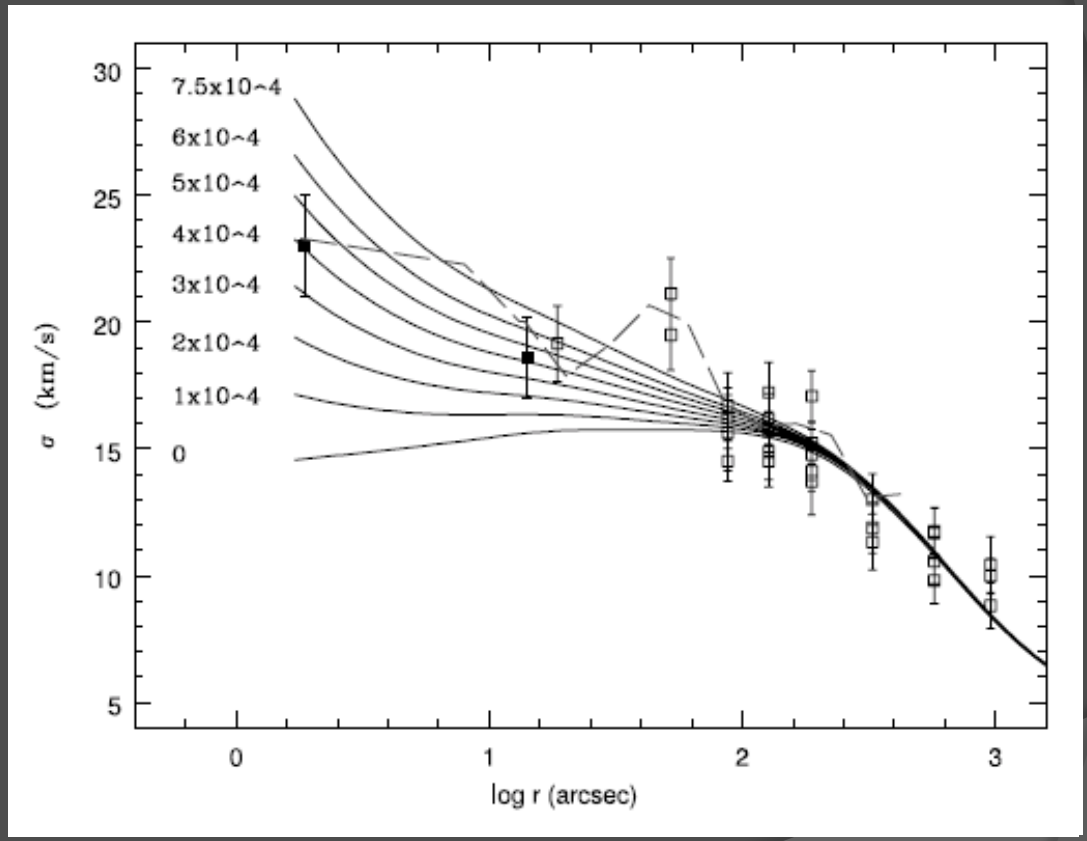
Similar to shape of numerical models of star clusters containing black holes in their center



Velocity dispersion

They detect a rise from 18.6 km/s to 23 km/s toward the center

A set of isotropic spherical models of varying black hole masses

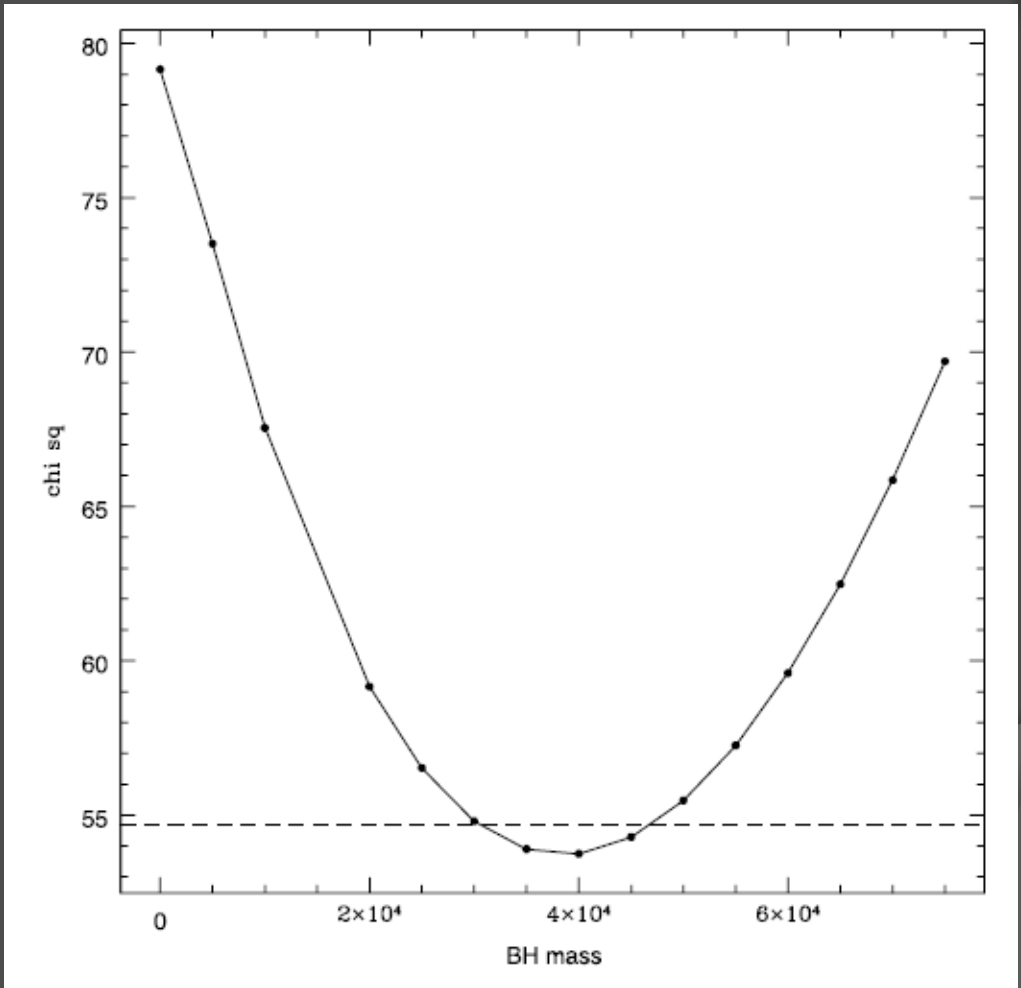


Fit velocity dispersion profile with models

Best fit :

4×10^4 M_{solar} black hole

No black hole model is excluded at grater than 99% confidence



Alternative explanations

- The M/L rise could be explained with Extended component composed of dark remnants such as neutron stars or faint white dwarfs
  - Stability argument : stellar remnants can be ruled out due to evaporation
- The velocity dispersion rise toward the center can also occur if a degree of anisotropy is present (more radial orbits)
  - Highly unstable in dense systems

THANK YOU