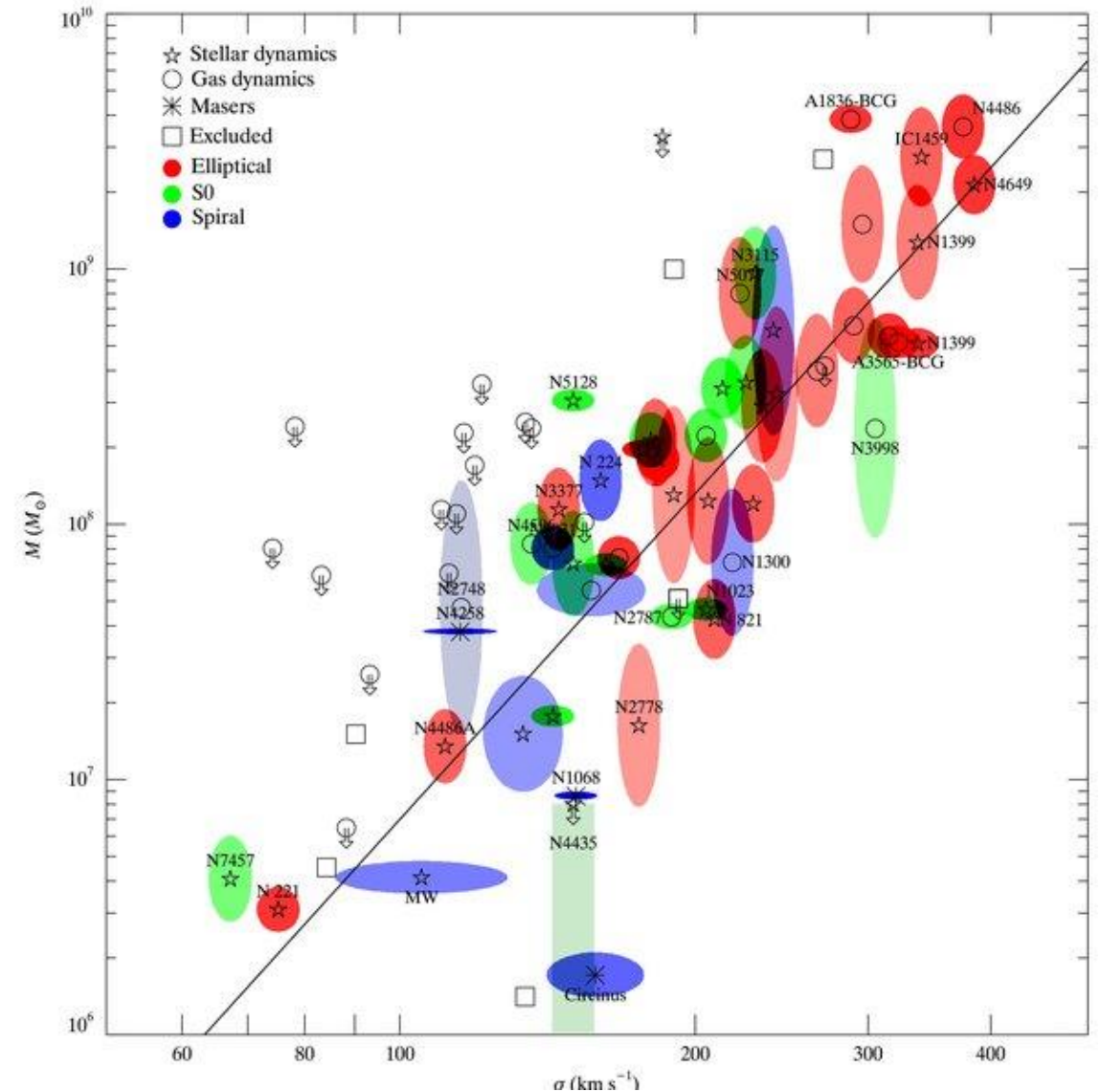


M- σ Relation

By Alexander Risy, Christian Bauer, Jürgen Kapeller, Arthur Völkerer

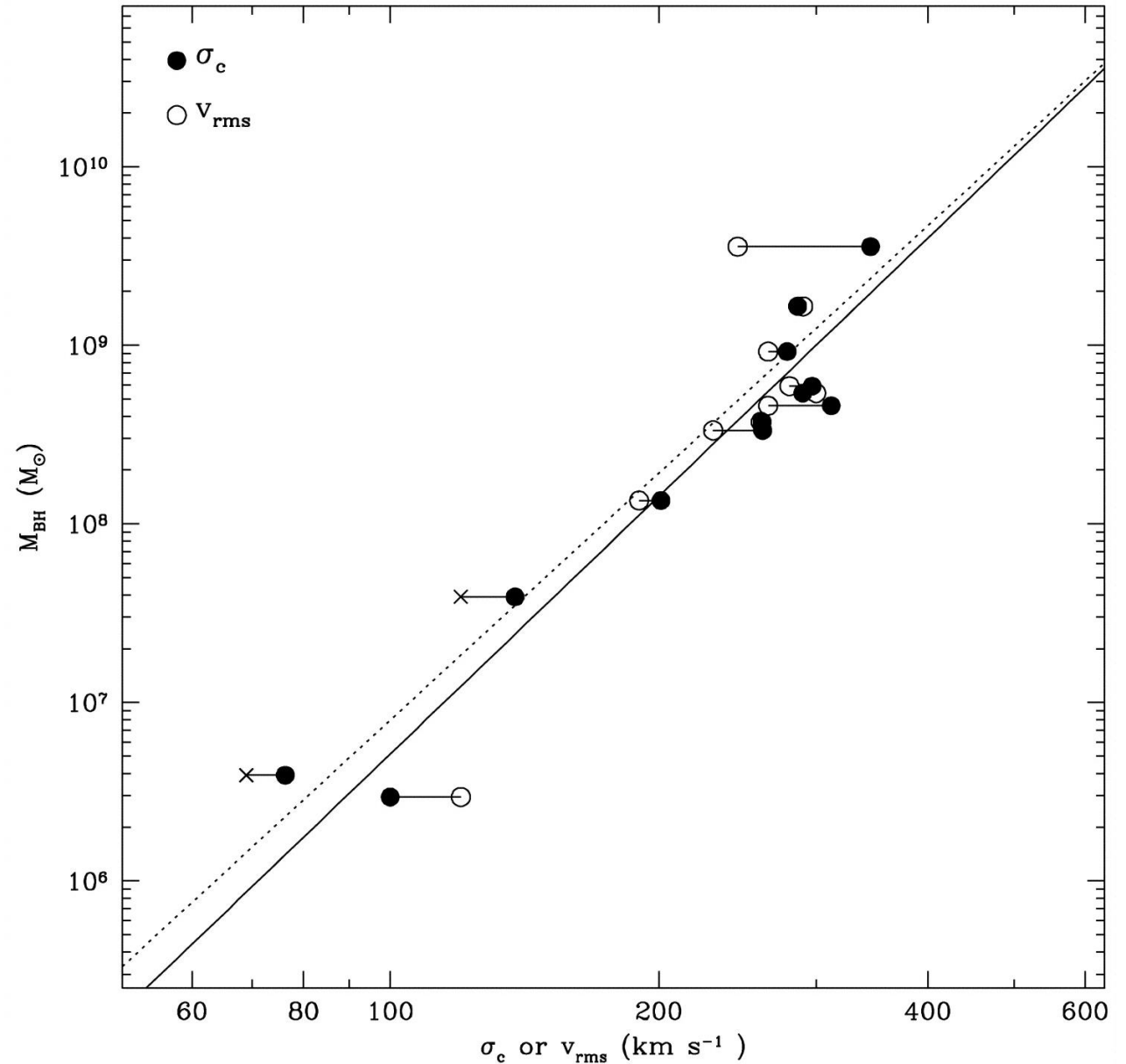
The basics

- Mass of black hole and velocity dispersion
- The larger the BH, the greater the velocity dispersion of the stars (for the dynamics in the galaxies centre)
- Feedback mechanism between black hole and bulge mass
- Origin of scatter
- Galactic Feedback
- $\log(M_{BH}) = \alpha \log(\sigma) + \beta$
- ...



Original Data

- 12 galaxies with secure BH mass estimates are sample A
- sample A BH masses determined by gas/stellar kinematics, in MW case with proper motion, in NGC 4258 case with kinematics of water maser clumps
- these methods are dependent on distance, distances obtained with surface brightness fluctuation, redshift, proper motion
- a sample B with less secure BH mass estimates was also used, the M-sigma relation for this sample had a different fit than sample A

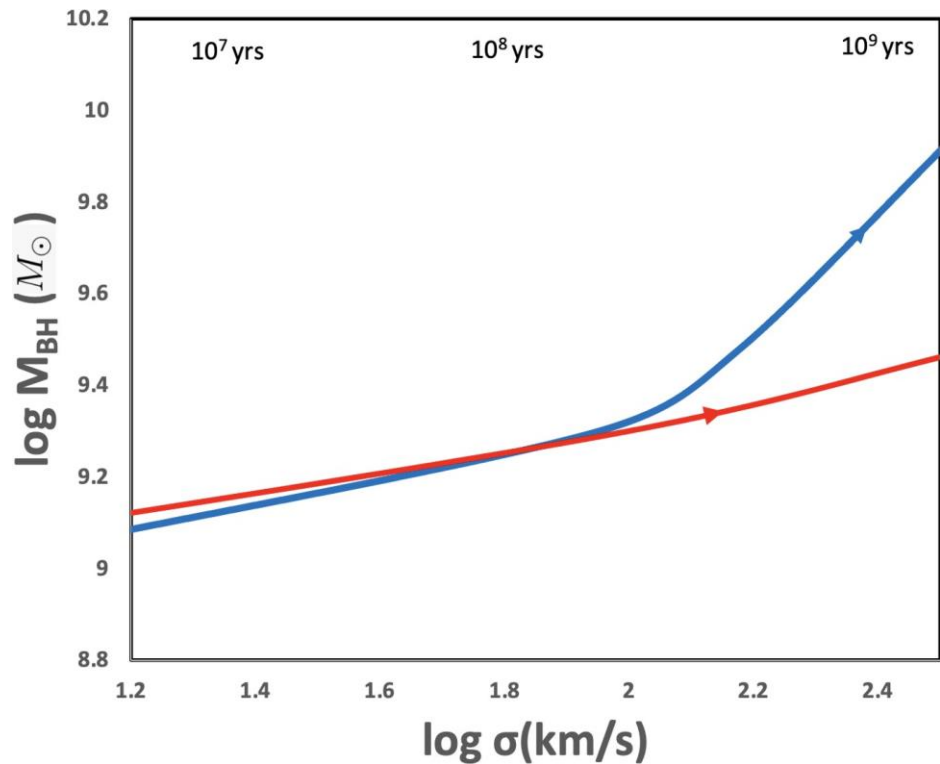


Recent studies

- Difference between active nucleus (AGN) with and without jets:

- Theoretical basis
- Probably no connection with dark matter

- BH distributes metals
- Development of BH and Galaxies
- Romulus25 simulation
- $3e9 M_{Sun} < M_{BH} < 3e11 M_{Sun}$



Blue line: Radio quiet quasars
Red line: Radio loud quasars

Literatur

- Data set: <https://iopscience.iop.org/article/10.1088/0004-637X/698/1/198>
- Original paper: <https://ui.adsabs.harvard.edu/abs/2000ApJ...539L...9F/abstract>
- Review 1: <https://ui.adsabs.harvard.edu/abs/2019GReGr..51...65Z/abstract>
- Review 2: <https://ui.adsabs.harvard.edu/abs/2020FrP.....8...61M/abstract>
- New 1: <https://ui.adsabs.harvard.edu/abs/2024ApJ...967..100S/abstract>
- New 2: <https://ui.adsabs.harvard.edu/abs/2022Galax..10...73G/abstract>
- New 3: <https://ui.adsabs.harvard.edu/abs/2023OJAp....6E..27G/abstract>