M-σ Relation

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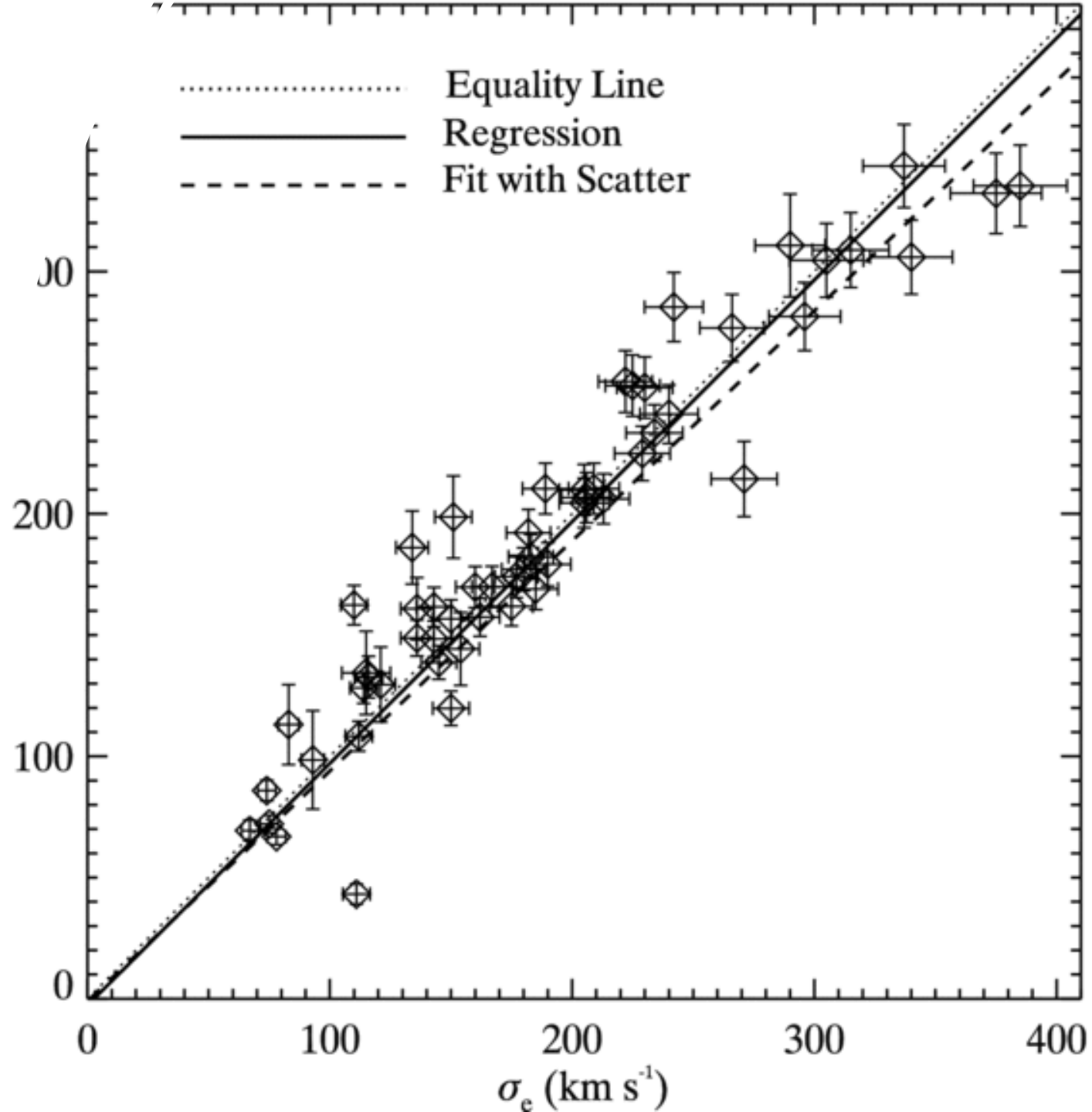
The basics

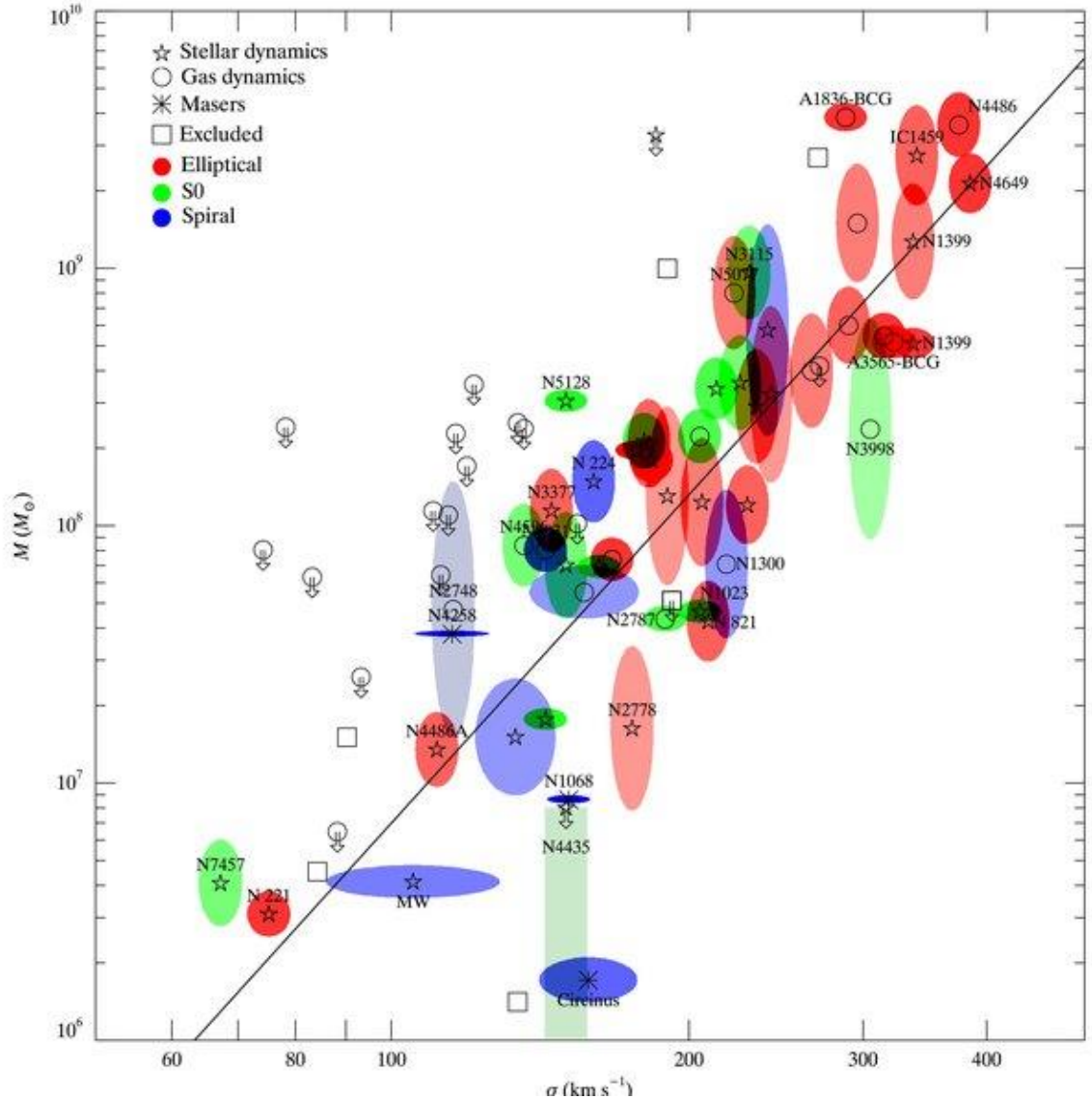
- Mass of black hole and velocity dispersion
- The larger the BH, the greater the velocity dispersion of the stars (for the dynamics in the galaxies centre)
- Feedback mechanism between black hole and bulge mass
- Origin of scatter
- Galactic Feedback
- …

$$\log(M_{BH}) = \alpha \log(\sigma) + \beta$$



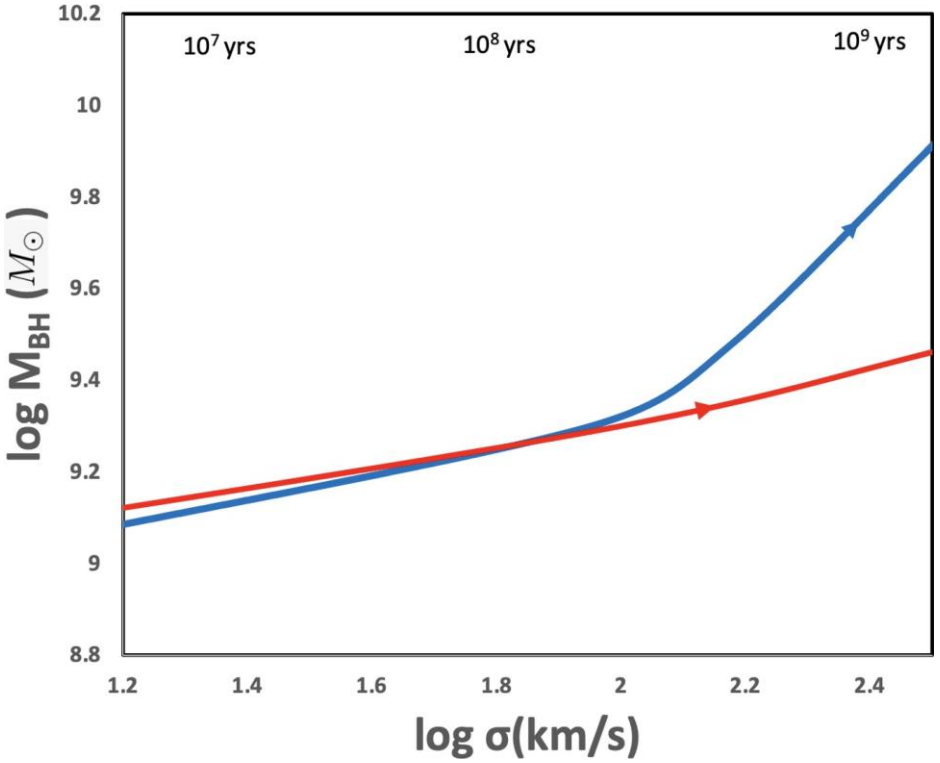
The Data

- 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
- Probaly no connection with dark matter

- BH distributes metals
- Development of BH and Galaxies
- Romulus25 simulation
- 3e9 M < M_stern < 3e11M

Blue line: Radio quiet quasars (RQQ)
Red path: Radio loud quasars (RLQ).

Literatur source

- 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