The estimation of black-hole masses in distant radio galaxies

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Investigations of radio galaxies

By radio galaxies we mean objects with high luminosity in radio, activity is associated with the core and labelled “galaxy” by NED

Selection parameters in NED:

1. $z > 0.3$
2. Galaxies
3. Radio sources

Result: 3364 objects

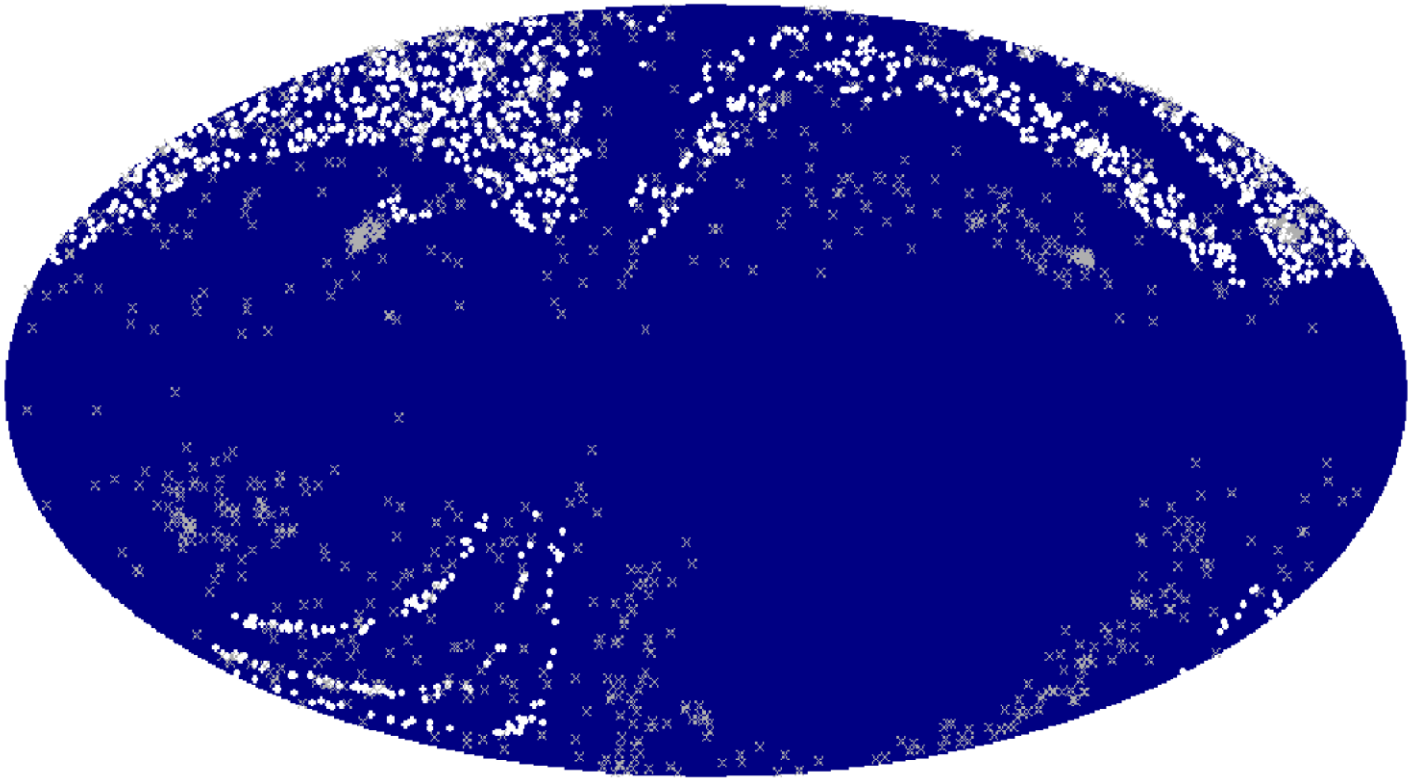
The following objects have been removed:

1. objects with photometrically determined z
2. objects with quasar properties

Result: 2442 objects

arXiv:0911.3741, arXiv:0911.3747, arXiv:0911.3752

Catalog of radio galaxies whith z > 0.3

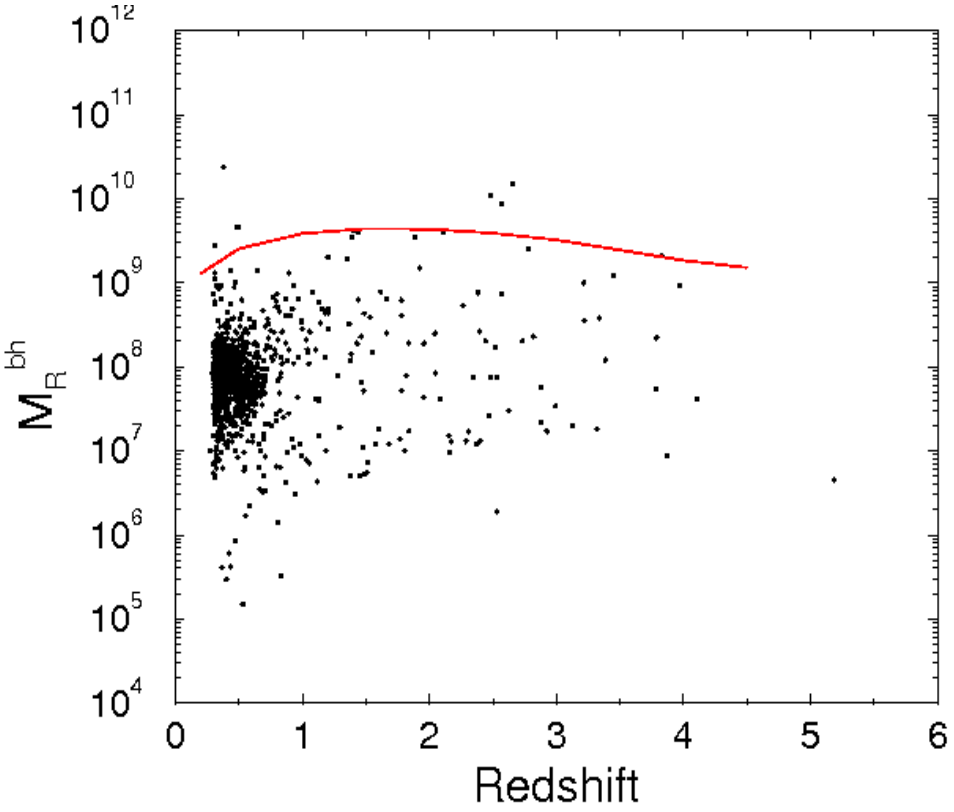


Sky positions of the selected radio sources in Galactic coordinates.The white circles and gray crosses indicate the SDSS objects and all other sources, respectively.

Estimating the SMBH Masses

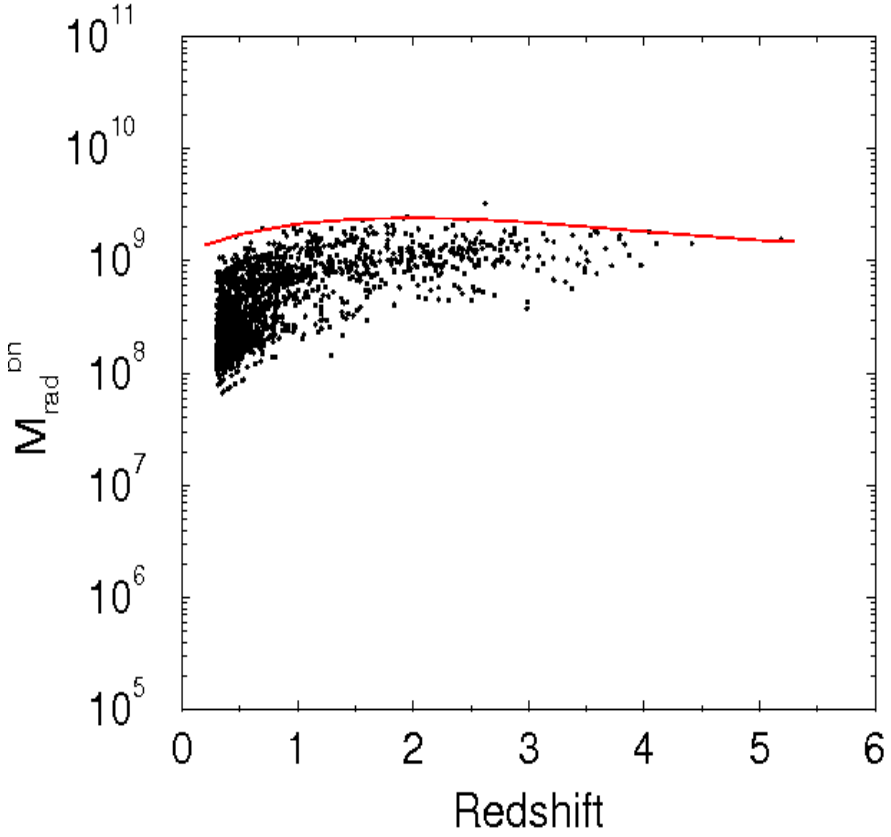
optic

$$\log \frac{M_{bh}}{M_\odot} = -0.50(\pm 0.02) M_R - 2.27(\pm 0.48)$$



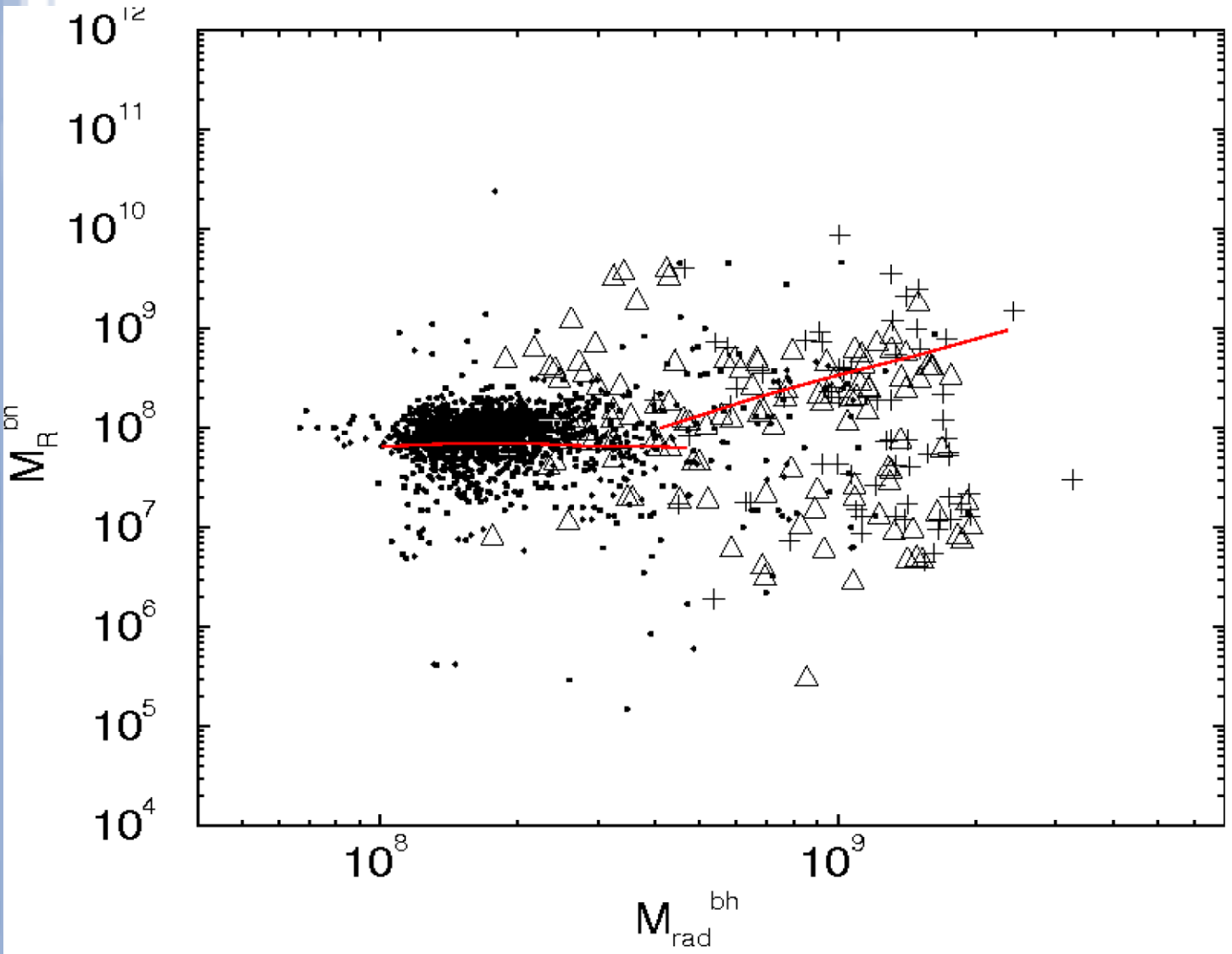
radio

$$P_{5\,\mathrm{GHz}} \propto \left(\frac{M_{bh}}{M_\odot}\right)^{2.2-3.0}$$



In spite of the difference in the dispersion of the mass estimates, the positions and amplitudes of the maxima of both upper envelopes are similar: the peak is at $z_p = 1.78$ and $\log M_p^{bh} = 9.67$ for the optical data, and at $z_p = 1.92$ and $\log M_p^{bh} = 9.38$ for the radio data.

arXiv:1108.4506



0.3 < z < 0.7 (points)
0.7 < z < 1.5 (crosses)
1.5 < z (triangles)

Plot of M^{bh}_{opt} versus M^{bh}_{rad} for R-band and 5-GHz data fits were obtained for two regions where the points are concentrated

Conclusions

- We have carried out a comparative analysis of estimates of the central black-hole masses of 2442 radio galaxies with $z > 0.3$, derived from relations between the black-hole mass and the R luminosity and between the black-hole mass and the radio power. Appreciable differences between these two estimates are observed for many of the radio galaxies.

- Diagram of M^{bh}_{opt} versus M^{bh}_{rad} reveals a region where these two mass estimates are correlated. This zone is formed primarily by the distant radio galaxies in our sample.

- The upper envelopes constructed using the maxima of the two mass estimates show similar behavior and have very similar positions ($z_p \sim 1.9$) and amplitudes ($\log M_p^{bh} = 9.4$)

- The $M^{bh}_{rad}(z)$ diagram displays comparatively narrow scatter, and should be preferred for use in estimating galactic black-hole masses.