

The mass function of black holes

Speaker:

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13.05.2011

COST

**WG 4 Supermassive
Black Holes**

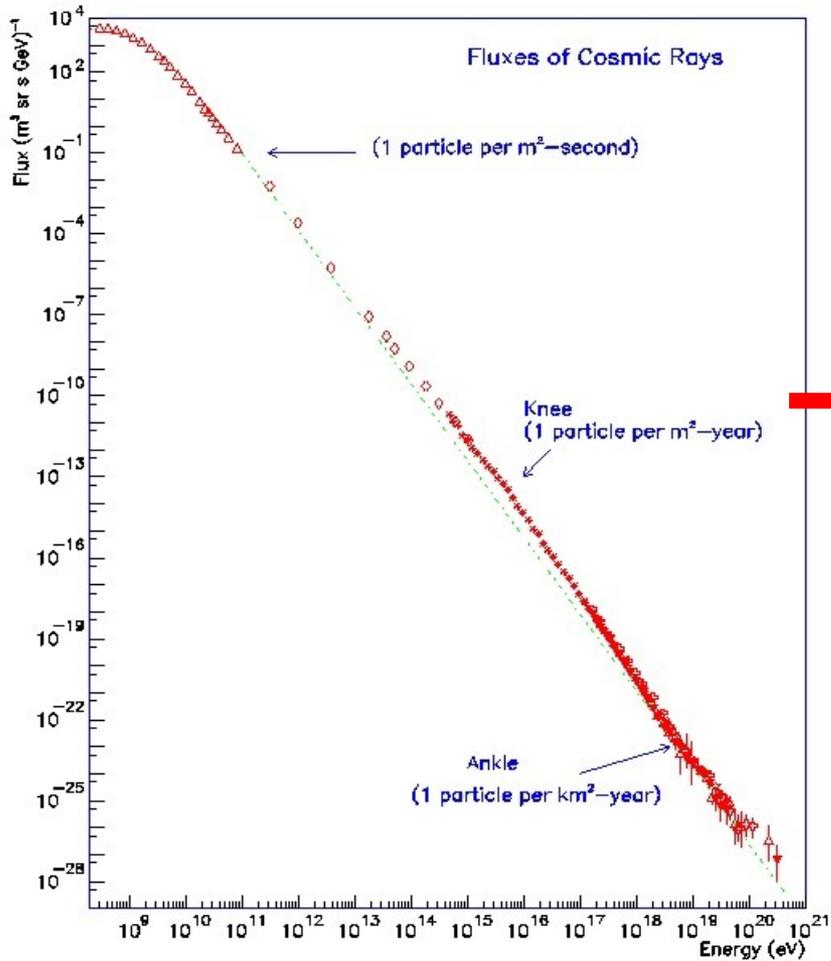


**Institute for Space Sciences (ISS) in Bucharest-
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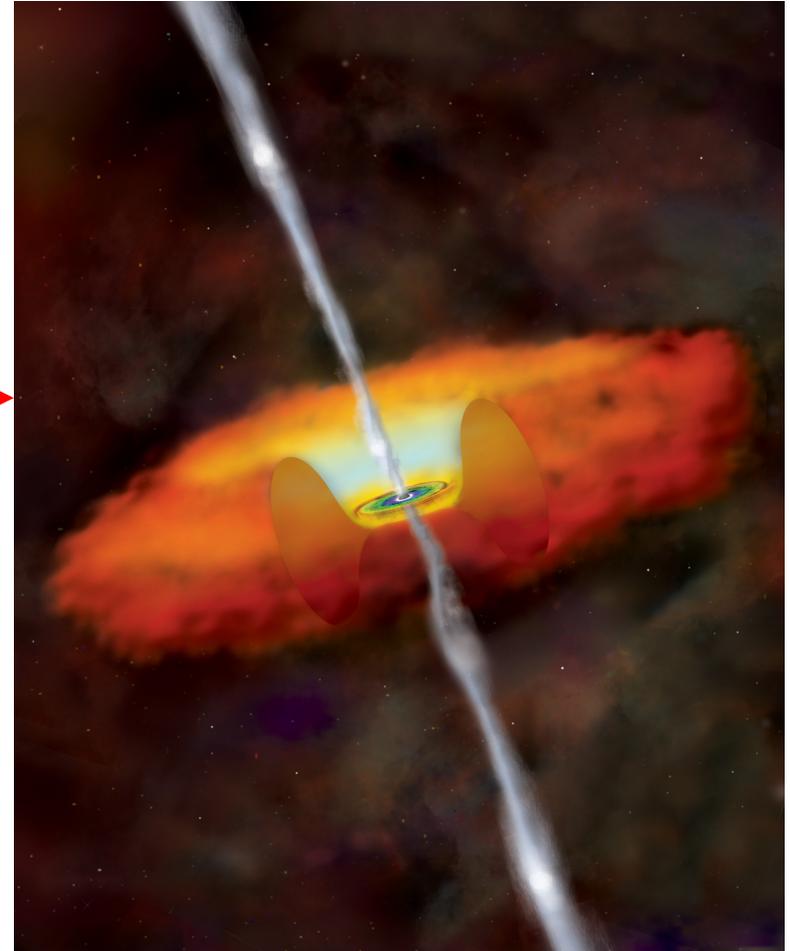
Contents

- From Cosmic Rays to Black Holes
 - Massive Black Holes Catalog
 - Model fitting
 - Formation simulation
 - Monte-Carlo Distribution Simulation
 - Conclusions&Discussions
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• UHECR – Sources

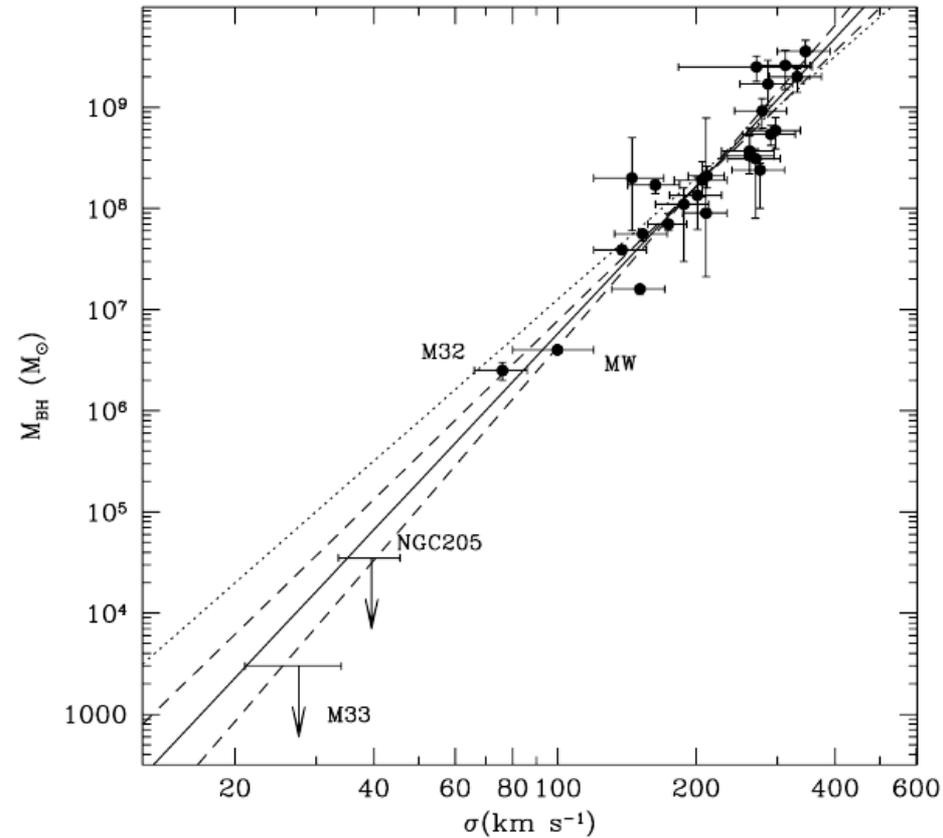
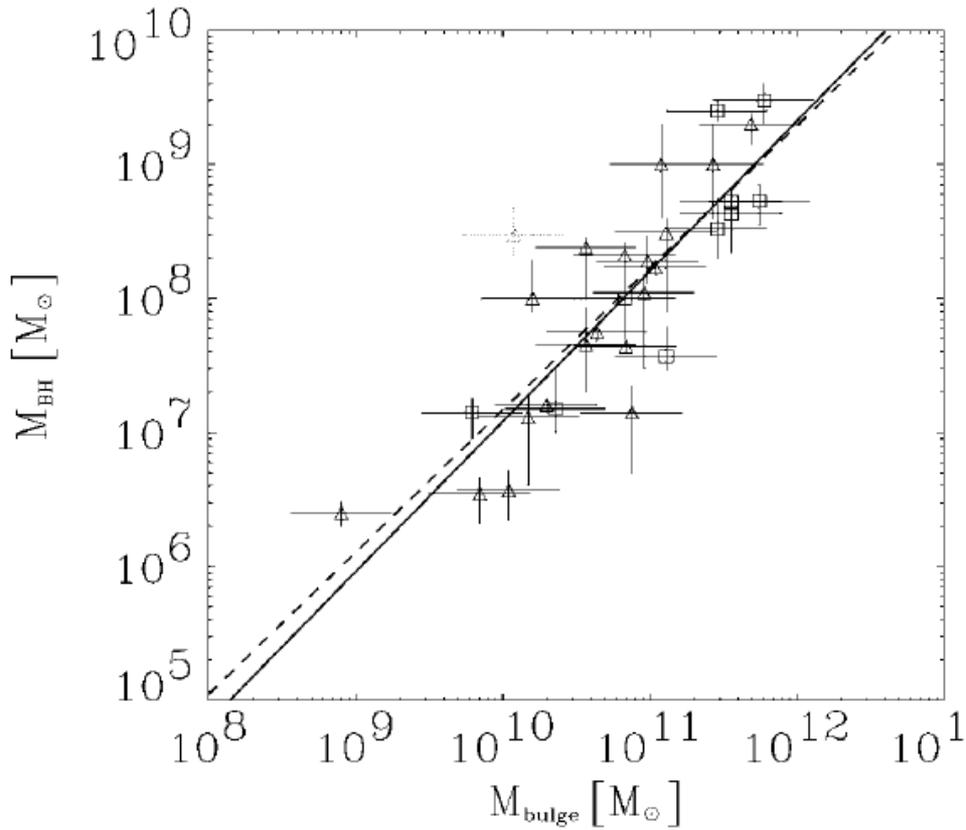


Cosmic Ray Flux vs. Energy (S. Swordy)



Black Hole with Accretion Disk and Torus
(Illustration: NASA/CXC/M.Weiss)

• Black Hole Mass – Scaling Relations



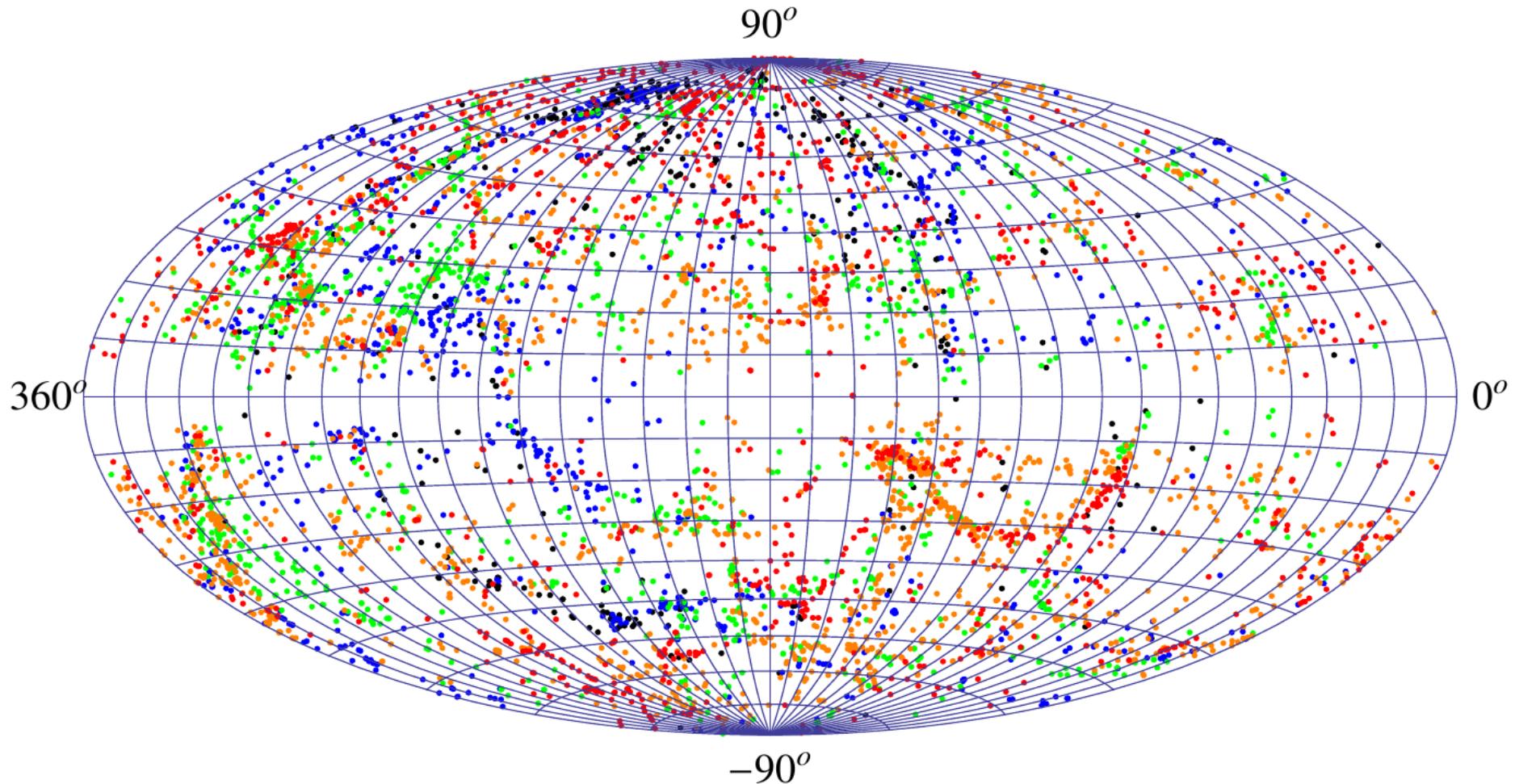
- Constructing the catalog

- Sample at 2 micron (Two Micron All Sky Survey - 2MASS, Skrutskie et al., 2006): all galaxies dominated by an **old stellar population** emit strongly at **2micron** (van der Wel et al. 2006), and the spheroidal component of the **older stellar population** correlates well with **supermassive black holes** (e.g., Faber et al. 1997, Wang & Biermann 1998, Haering & Rix 2004)

$$M_{\text{BH}} \sim F_{2\mu\text{m}} \cdot D^2$$

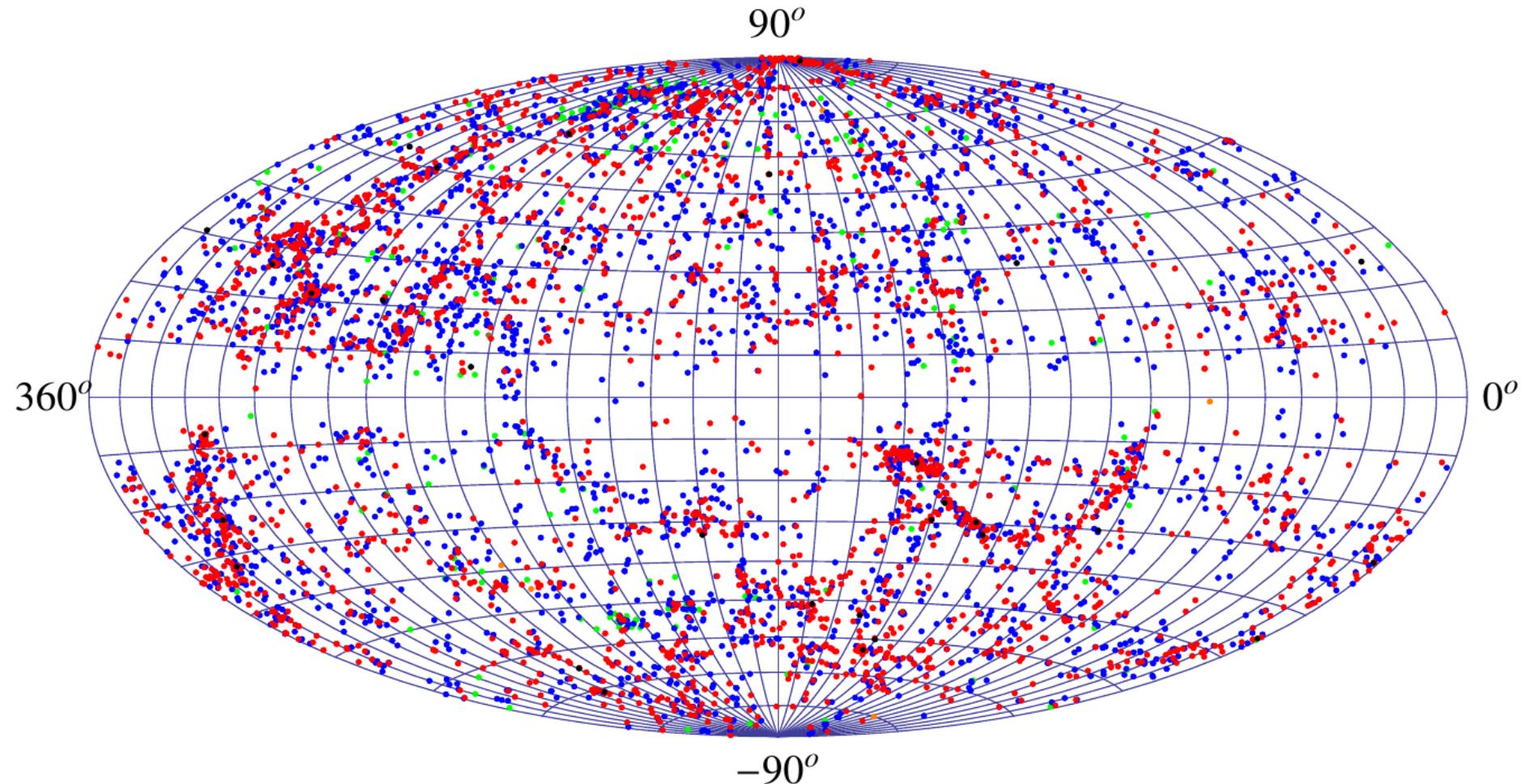
- Using Hubble type \longrightarrow • Scaling Relation \longrightarrow • Catalog

- Sky plot color coded in Redshift



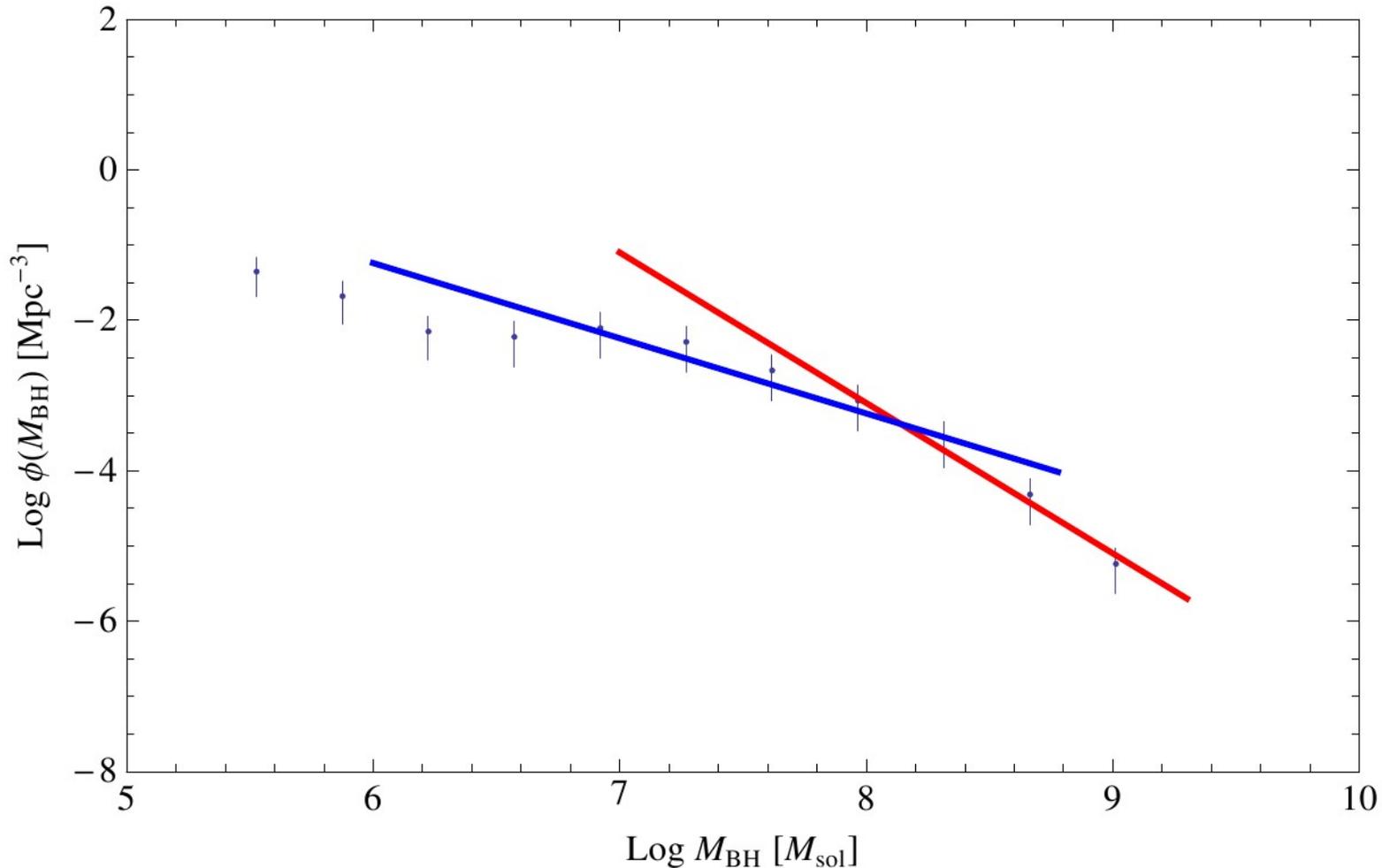
Aitoff projection in galactic coordinates of 5,895 NED candidate sources in the case of a complete sub sample. The choice was made from a complete sample of 10284 candidate brighter than 0.03Jy and selected at $z < 0.025$ and 2 micron. The color code is Black, Blue, Green, Orange, Red corresponding to redshifts between 0, 0.005, 0.01, 0.015, 0.02, 0.025

- Sky plot color coded in Black Holes Mass



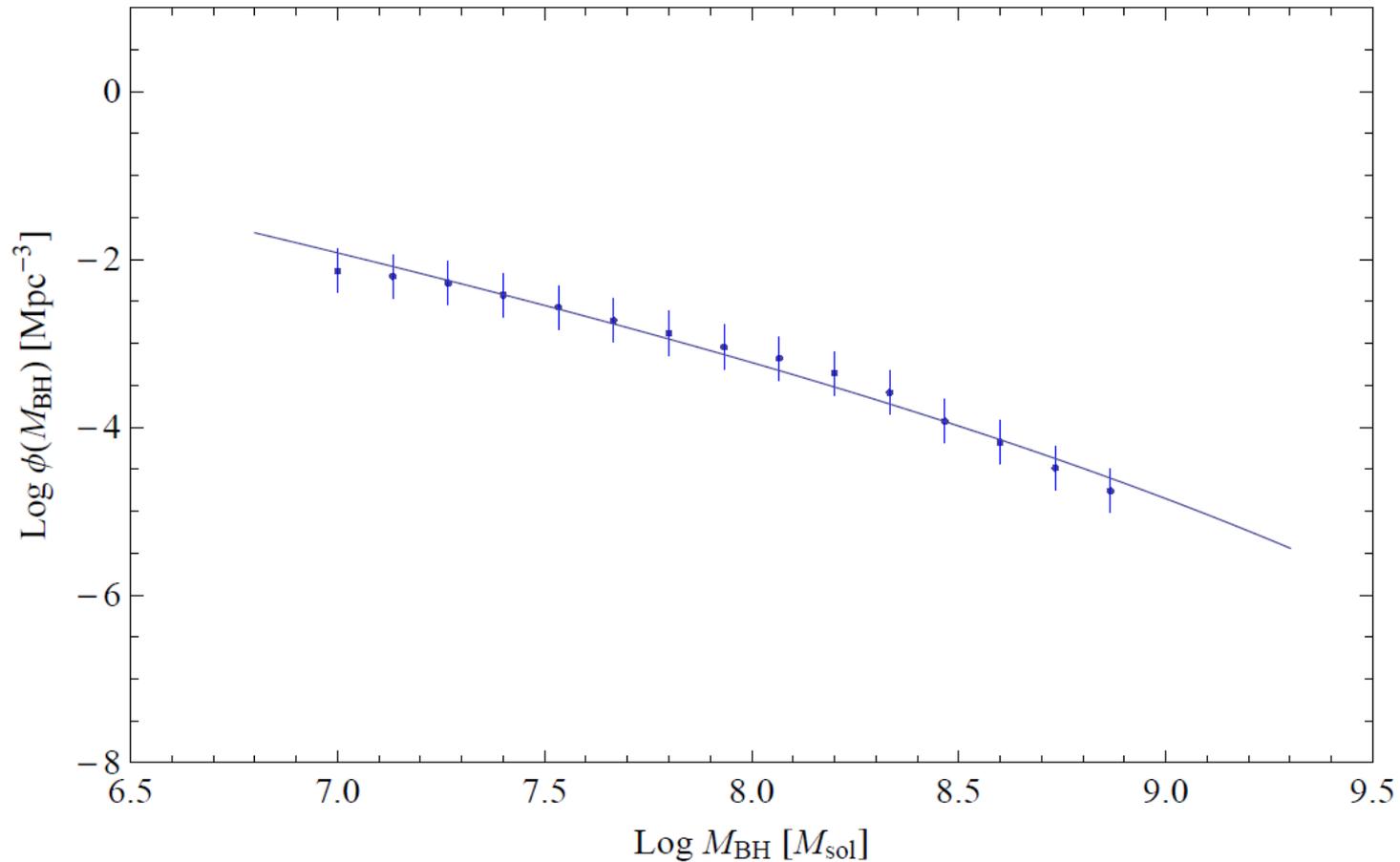
Aitoff projection in galactic coordinates of 5,895 NED candidate sources. The color code is Brown, Orange, Green, Blue, Red, Black corresponding to black hole masses between $10^5 M_{\text{sol}}$, $10^6 M_{\text{sol}}$, $10^7 M_{\text{sol}}$, $10^8 M_{\text{sol}}$, $10^9 M_{\text{sol}}$.

• Integral Black Hole Mass Function



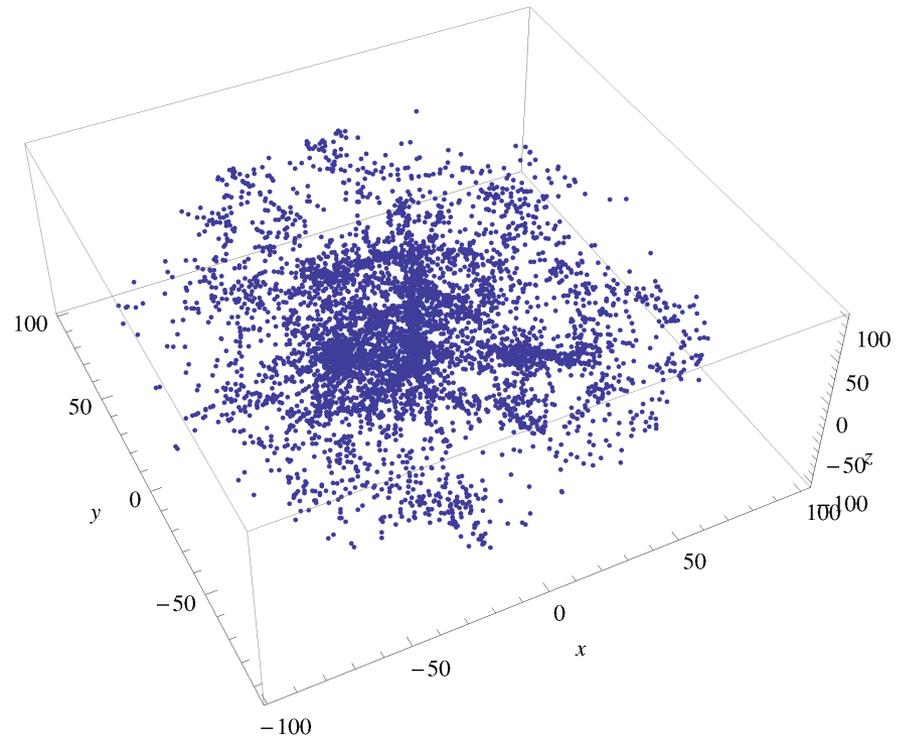
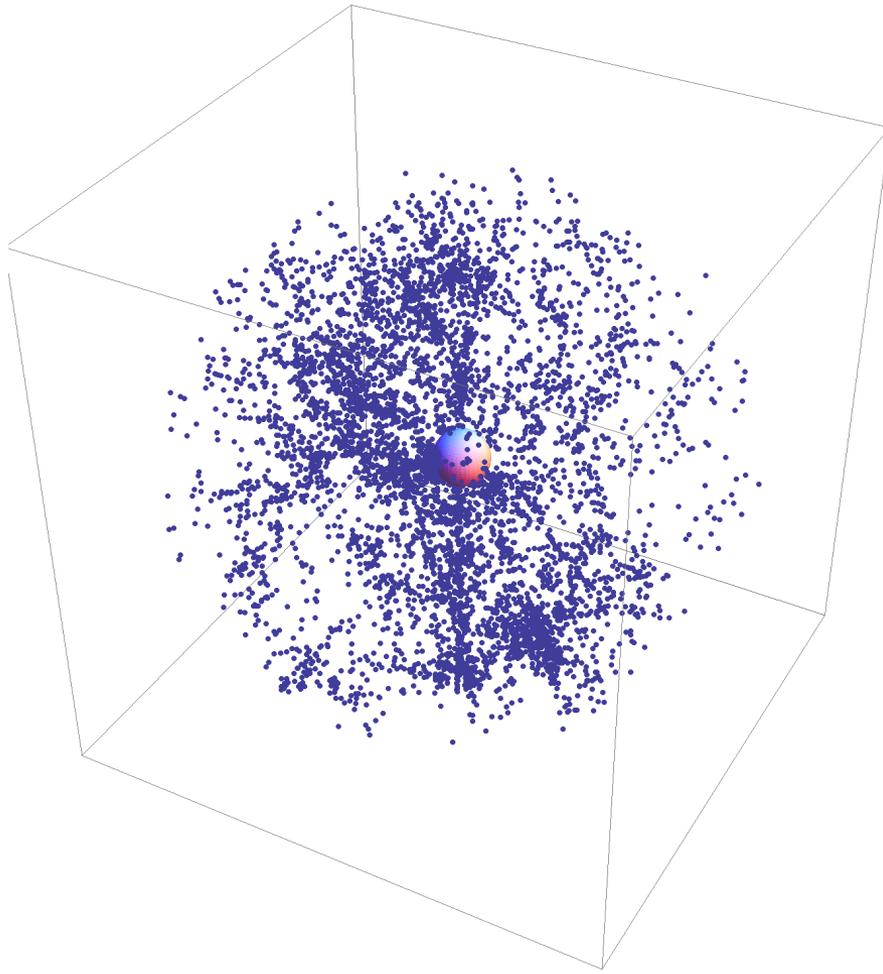
Integral mass function corrected for Hubble type sampling, 2928 objects, the slope of the lines is: red line -2.0 fitting $> 10^8 M_{\text{sol}}$, and blue line -1.0 fitting between $10^7 M_{\text{sol}}$ and $10^8 M_{\text{sol}}$. (Caramete&Biermann, A&A, 2010)

• Integral Black Hole Mass Function

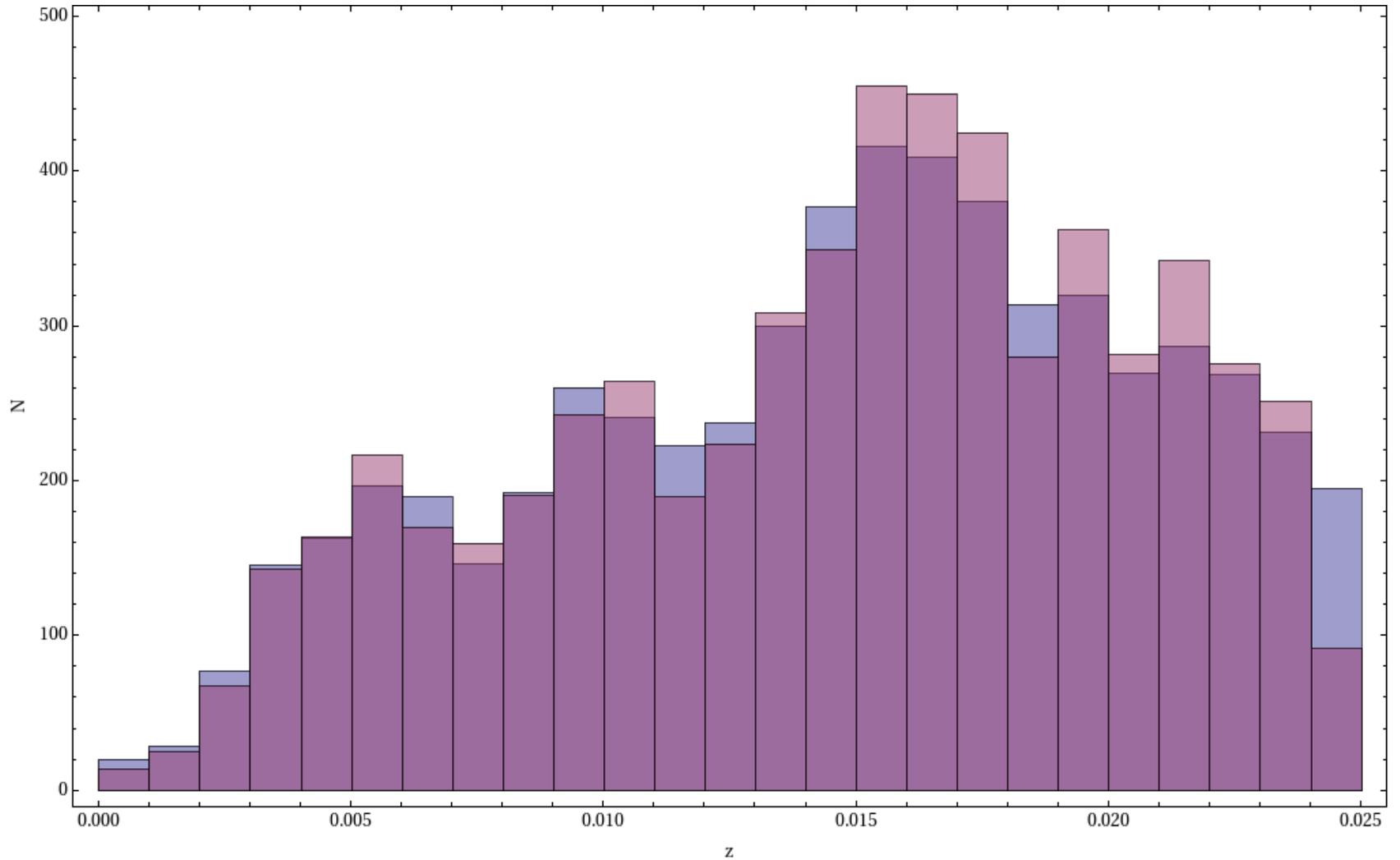


Integral mass function corrected for Hubble type sampling, 2928 objects with fit. The parameters after the fit are: $m_0 = 3.04 \cdot 10^6 \pm 2.8 \cdot 10^5$ Msol and $m_b = 9.73 \cdot 10^7 \pm 3.8 \cdot 10^7$ Msol.

- 3D Representation of the catalog



• Markov Chain Monte-Carlo



- Conclusions&Discussion

- A simple scaling method to give a big catalog of black holes
 - Fit formation physical models to the integral mass function as a check
 - N-body simulation of the distribution of black holes
 - Monte-Carlo multi-dimensional simulations of distribution of mass, redshift

- More info
-

<http://www.science-side.com/>

<http://www.space-science.ro/new1/cosmo/>

<http://www.mpifr-bonn.mpg.de/div/theory/>

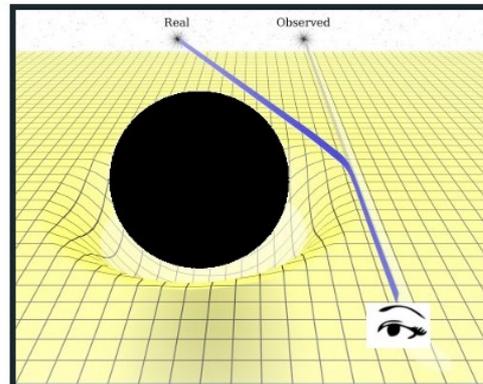
• More info

16 DEC 2010

Laurentiu Ioan Caramete

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Black holes as telescopes



Bending of light in the presence of a black hole

What can you do with a black hole? A first answer will be like, not much, and you better keep your **distance!**

It turns out that you can use the black hole in the center of our Galaxy as a **giant telescope**.

At least this is the idea of Amitai Bin-Nun of the **University of Pennsylvania** in his [publishes paper](#) in *Physical Review D*, to use the black hole from our very own Galaxy center (called **Sgr A***) to observe a **lensing** effect caused by the black hole on the light of young **Wolf-Rayet stars**.

The general concept is to observe this young stars which are part of

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Black Hole binaries as gravitational wave sources

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Credit: NASA, ESA and the Hubble Heritage (STScI/AURA)-ESA/Hubble Collaboration

The battle between GPU(Graphical Processing Unit) and CPU(Central processing unit) is even more fierce in the realm of science where many disciplines use simulations. One of this is astrophysics where simulations of physical processes in the Universe play an important role.
The main advantage of using the GPU [...]

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Baby Universe Book

moonchild 0



Did you know that cosmologists can make a "memory album" of the Universe in its infancy? A so called "Baby Book" which can contain pictures of the Universe when it was as young as 380.000 years old, out of which one can extract useful informations about the birth and evolution of Baby Universe...

18 NOV 2009

How To Weight A Black Hole

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Do you know what a black hole is? Well yes, everybody knows by now what this monster is, an astrophysical object that can absorb everything, even light and from the insight of it there is no way out. But do you know how to measure it's mass? In a recent article by B. Czerny and M. [...]

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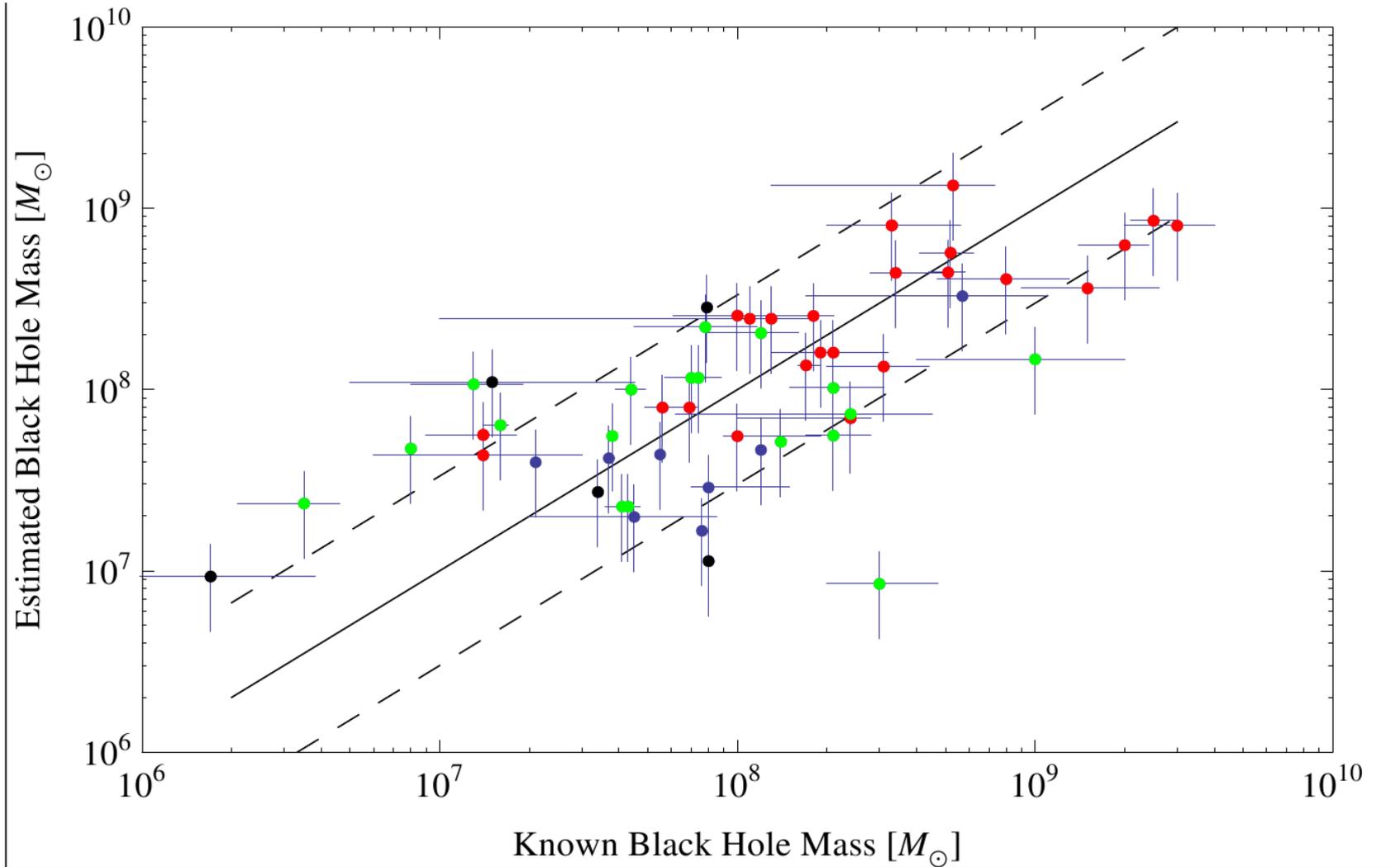
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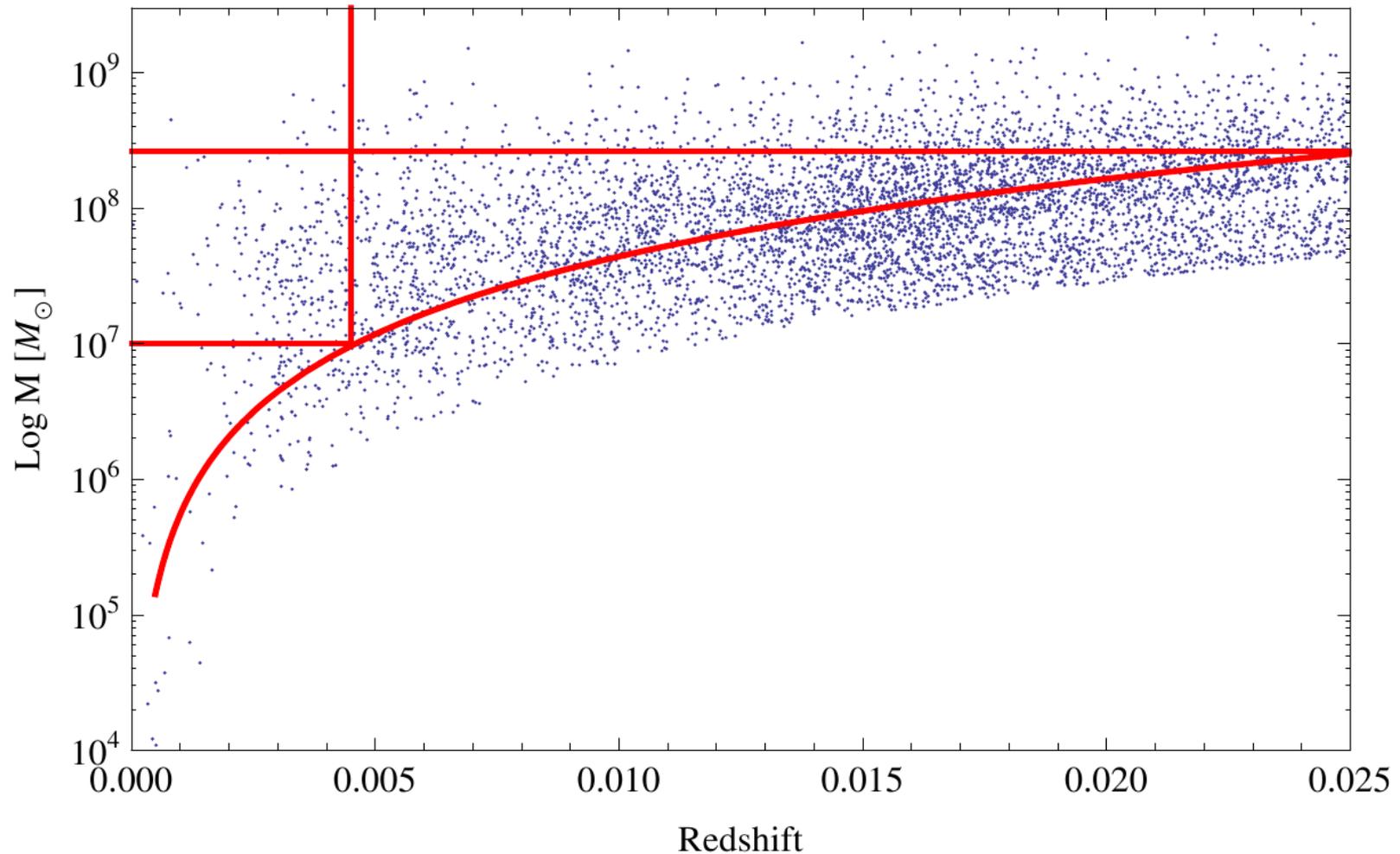
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Plot of Mass over redshift for the massive black hole catalog with the selection curve for elliptical galaxies in blue. This also shows the stepwise selection procedure with the two most extreme cases, the lowest mass, and the highest redshift, also in red.