

Observing black holes in Chile



Kristen Dage,
May 10, 2017

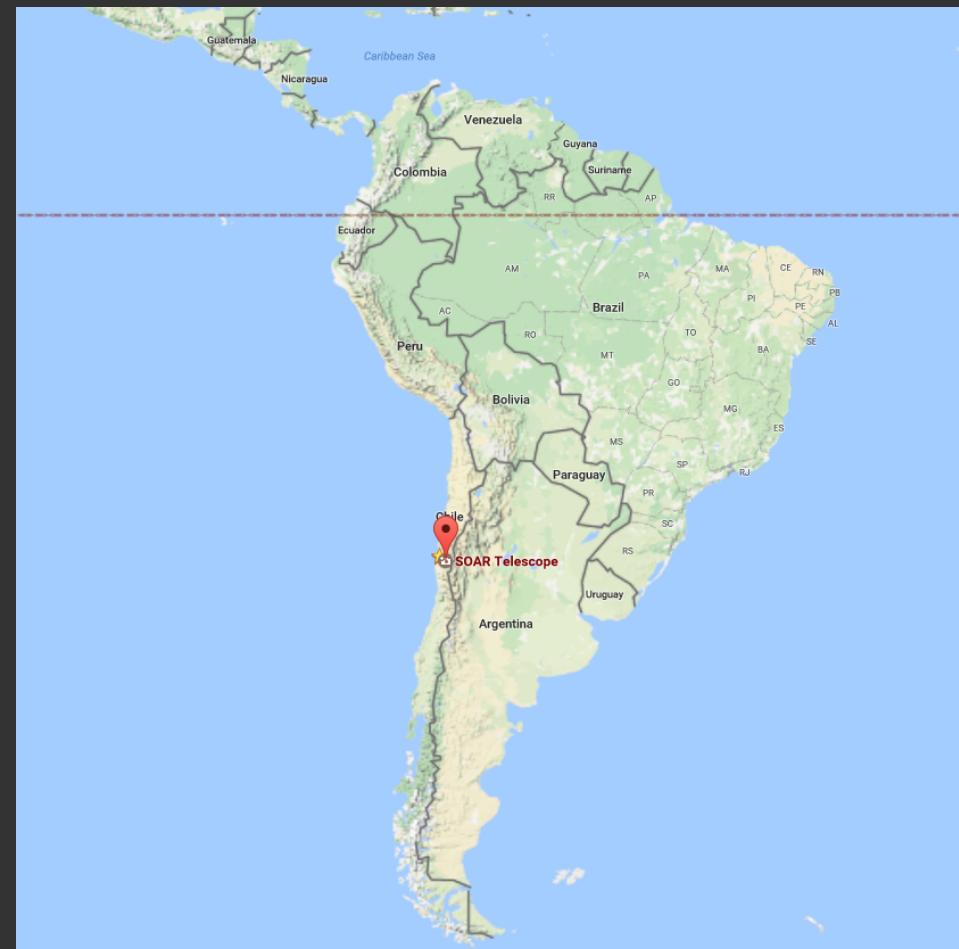
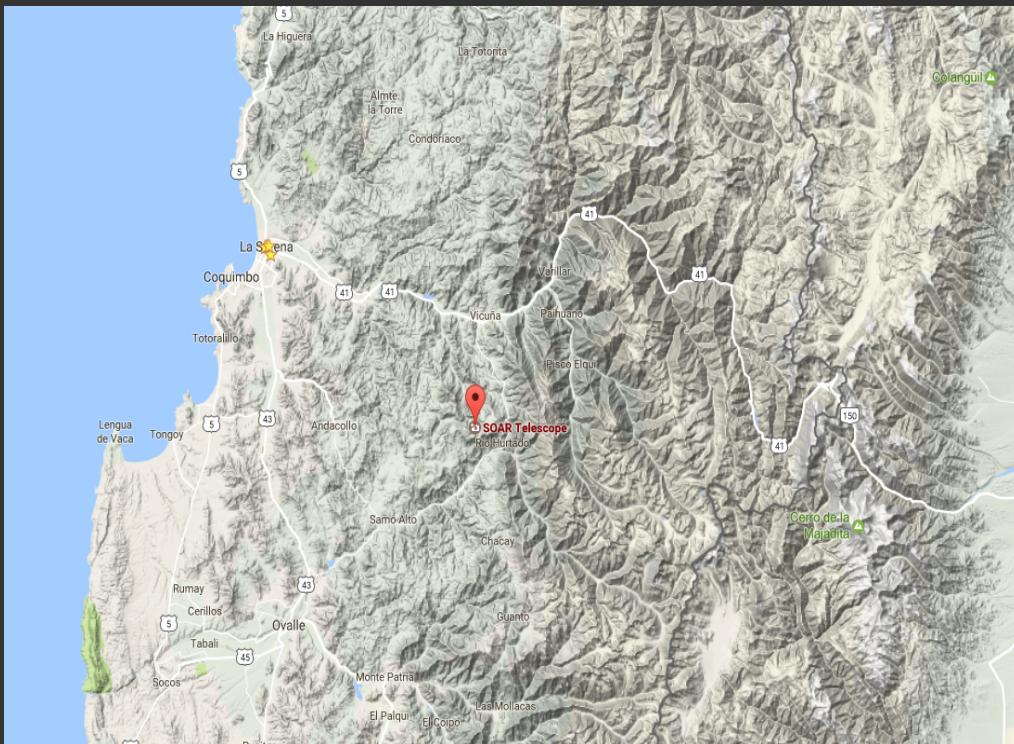
MICHIGAN STATE
UNIVERSITY

Cerro Pachon, Chile. Altitude: 2,715 m, or 1.687 miles



SOAR Telescope

(SOuthern Astrophysical Research Telescope)



Observing at SOAR





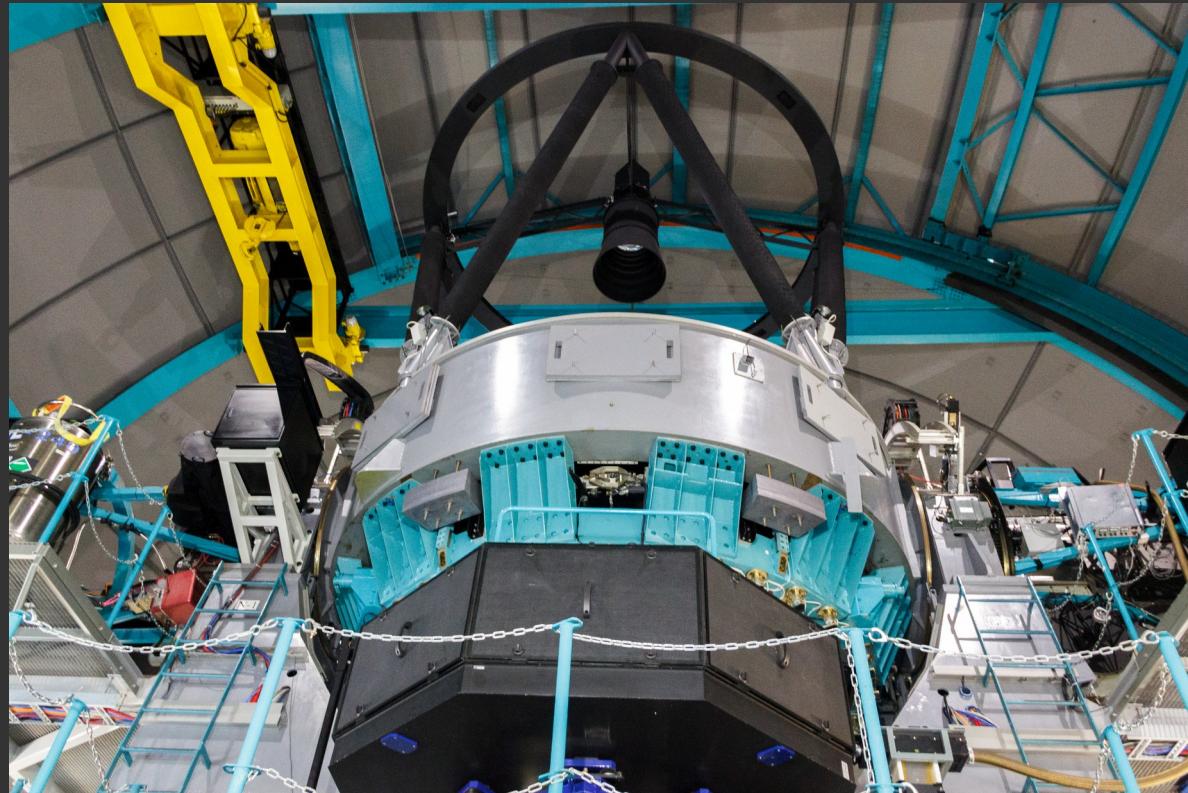
Why mountains?

- Lack of light pollution + climate make mountains ideal
- The thinner atmosphere makes for better viewing conditions.



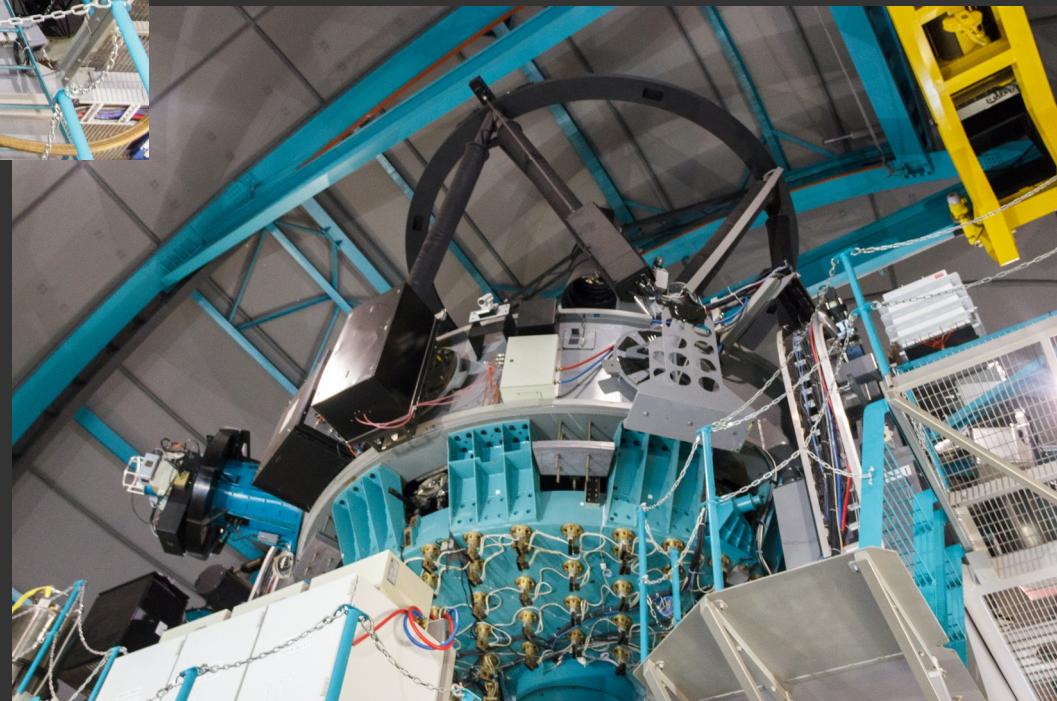
SOAR Telescope

4.1 meter telescope.

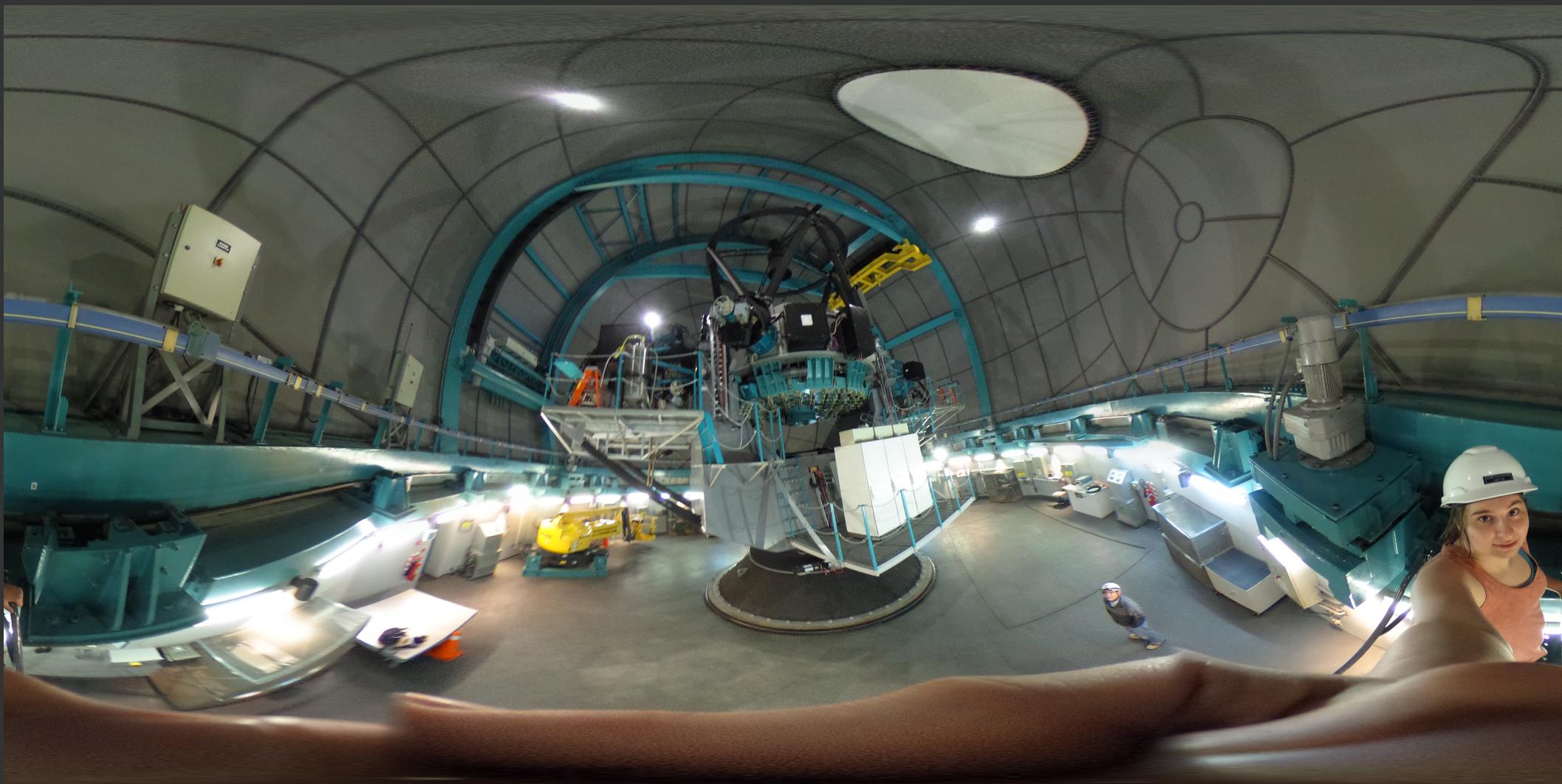


Collaboration of:

- National Optical Astronomy Observatory (NOAO),
- the Ministério da Ciencia e Tecnologia of the Federal Republic of Brazil (MCT),
- the University of North Carolina at Chapel Hill (UNC),
- and Michigan State University (MSU)



SOAR Telescope (with humans for scale)



How do we observe black holes?

- Since we can't directly observe black holes, we look at how they interact with things we can see.
- One such method is accretion:

The massive black hole steals material from a binary star, which forms a disk.



Where can we observe black holes?

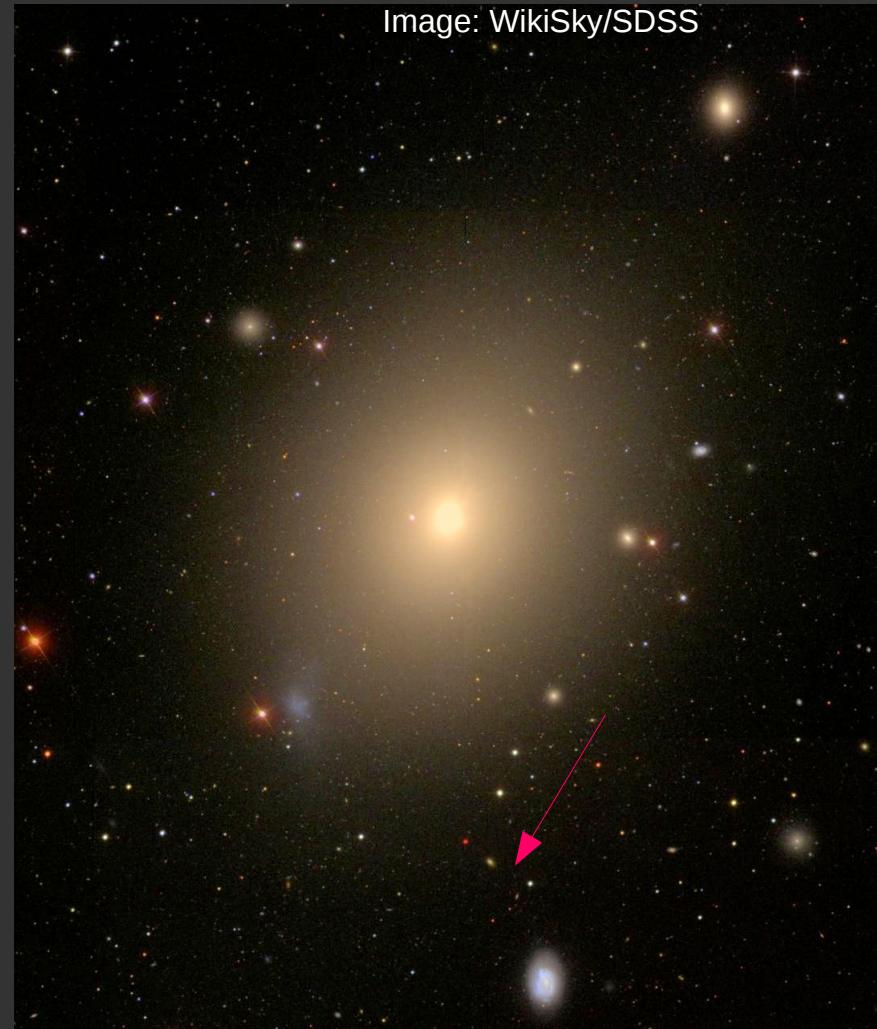
- One place is in globular clusters!
- Until recently, black holes were not thought to be in globular clusters.
- This changed in 2007, when the first black hole candidate was discovered in a globular cluster.



Globular cluster M30 (credit NASA, Hubble Advanced Camera for Surveys)

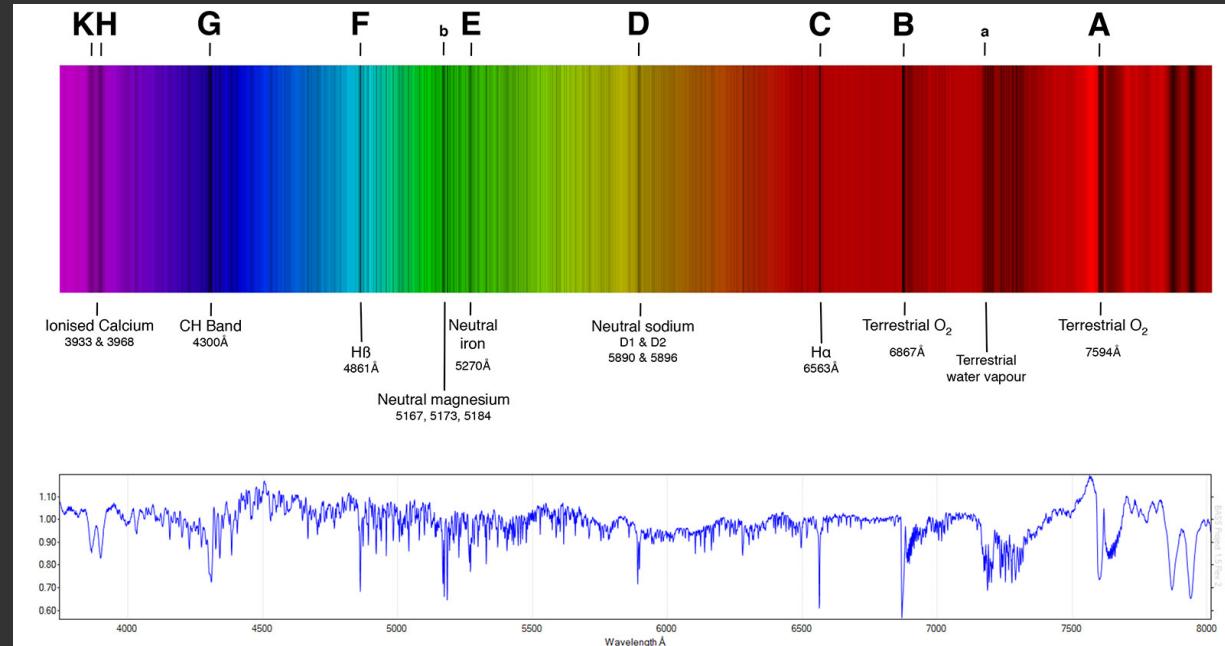
RZ2109 – a black hole in a globular cluster?

- Located near NGC 4472, which is about 56 million light-years away.
- RZ2109 is very luminous and variable in X-ray
 - Black hole candidate
 - Very few other systems like this



Spectroscopy—quick note

- Spectroscopy is like a prism:
 - Incoming light is broken up into its constituents
- Every element has a unique “fingerprint”
- By doing this, we can see what kinds of elements are in the system.

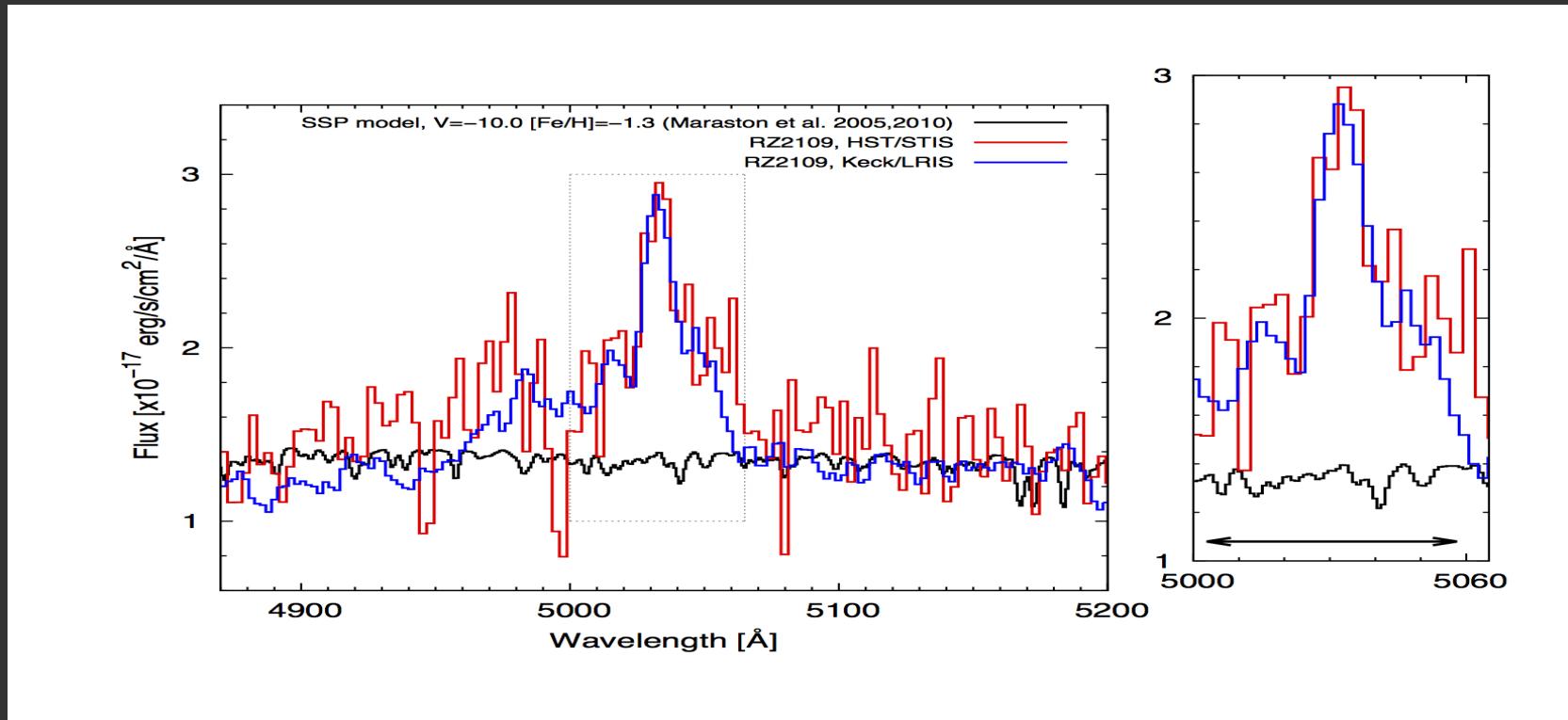


RZ2109 in Optical

- Optical spectroscopy of this object reveals something exciting!

RZ2109 in Optical

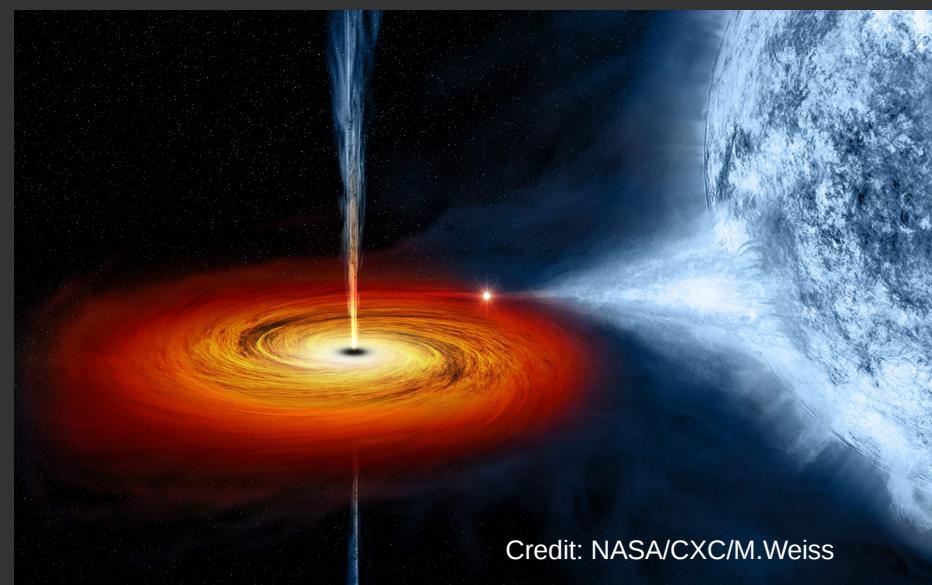
- We see bright, broad oxygen lines.
- This oxygen is very rare in globular clusters



Peacock et al (2012): bright [OIII] 5007 emission line

Guess as to the nature of the source

- Because of all the oxygen we see, we think RZ2109 is a black hole in binary with a white dwarf.
- Oxygen and X-ray signals should be linked, and knowing how each changes will help us determine the nature and origin of this wonderful object.



Credit: NASA/CXC/M.Weiss

Questions?



Other observatories

- Gemini-South
- LSST – Coming soon!

