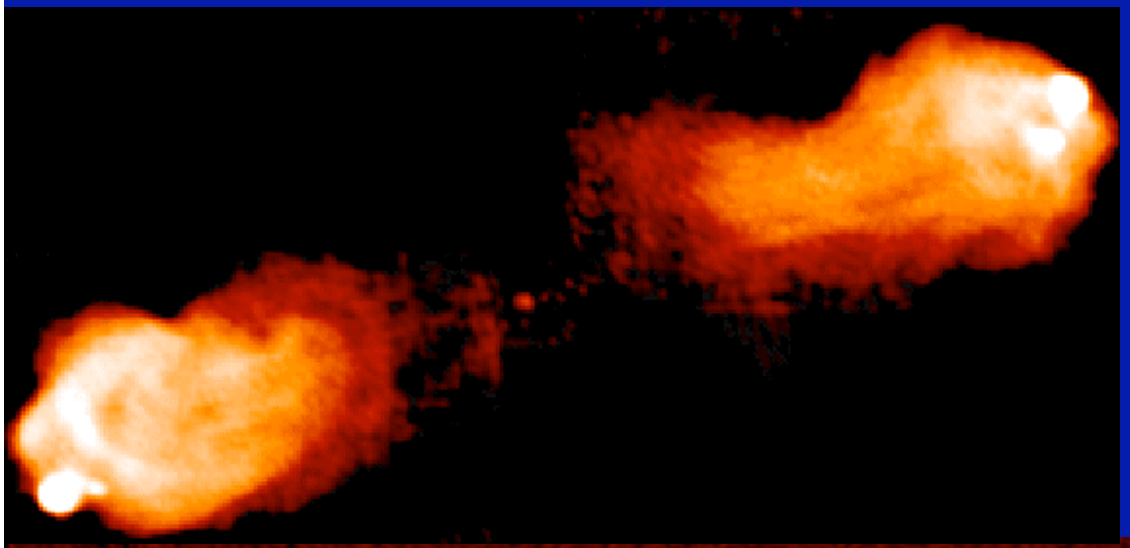
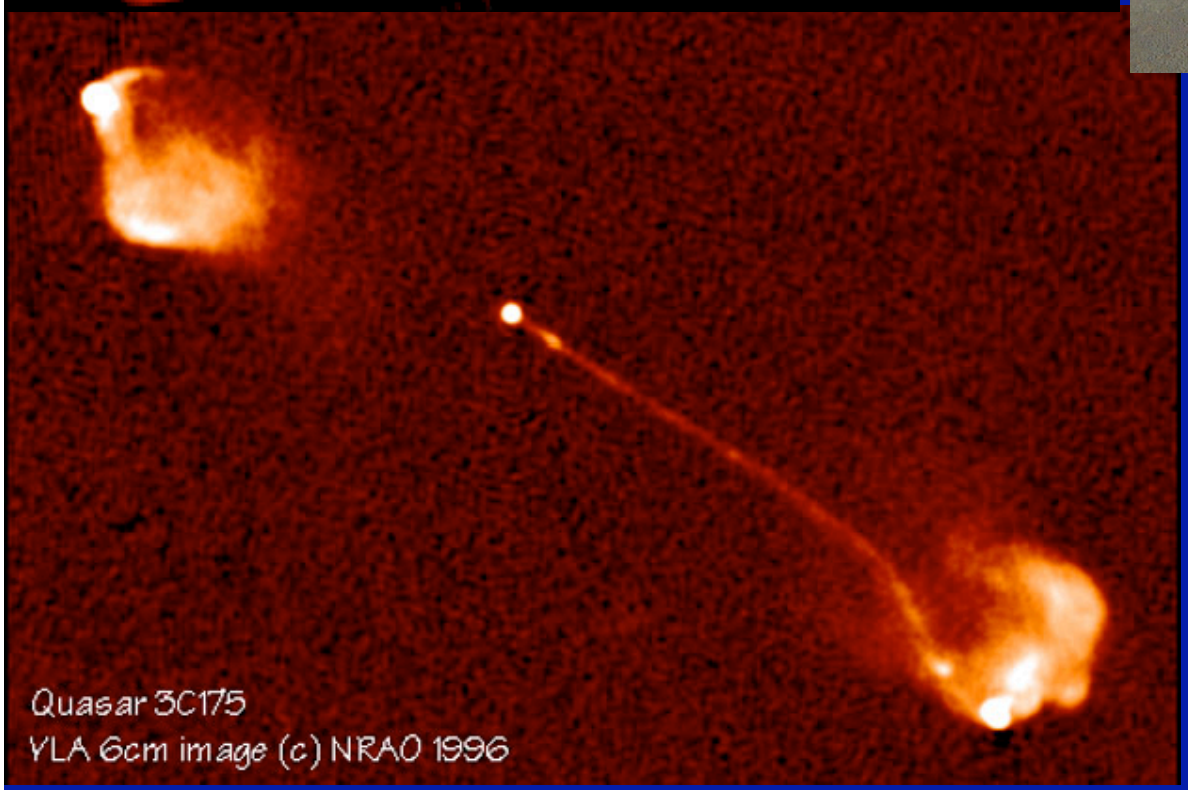
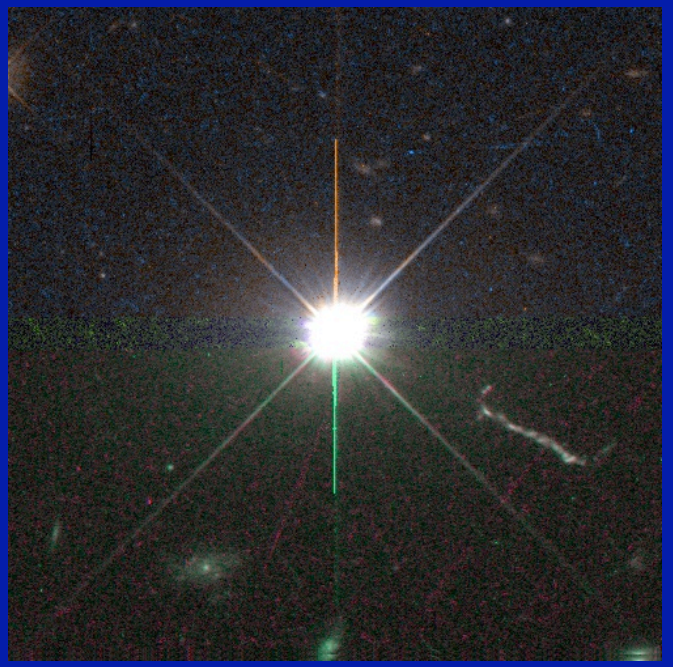
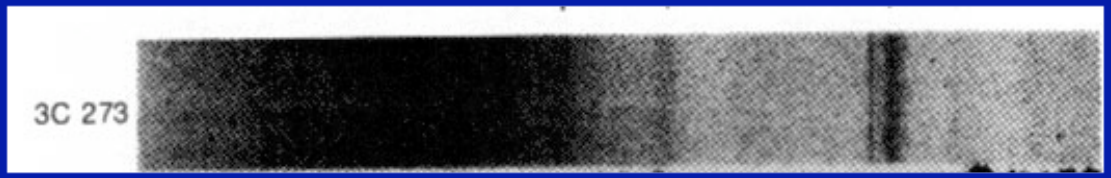
Centaurus A Radio Galaxy (VLT KUEYEN + FORS2)

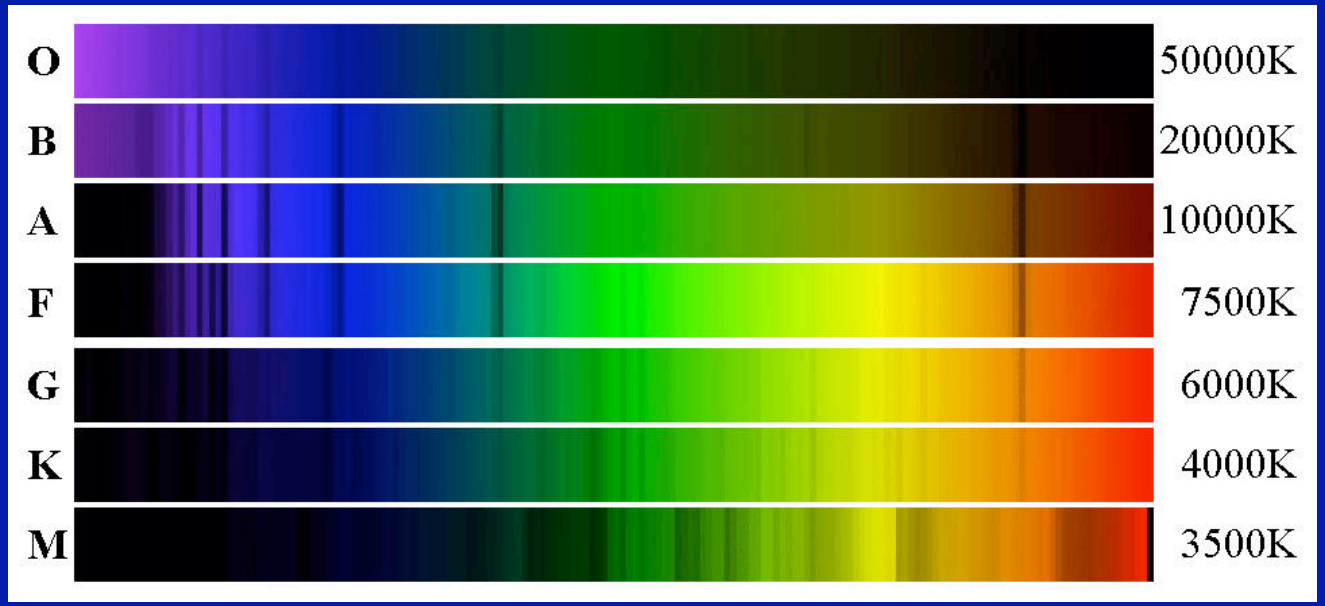
ESO PR Photo 05b/00 (8 February 2000)

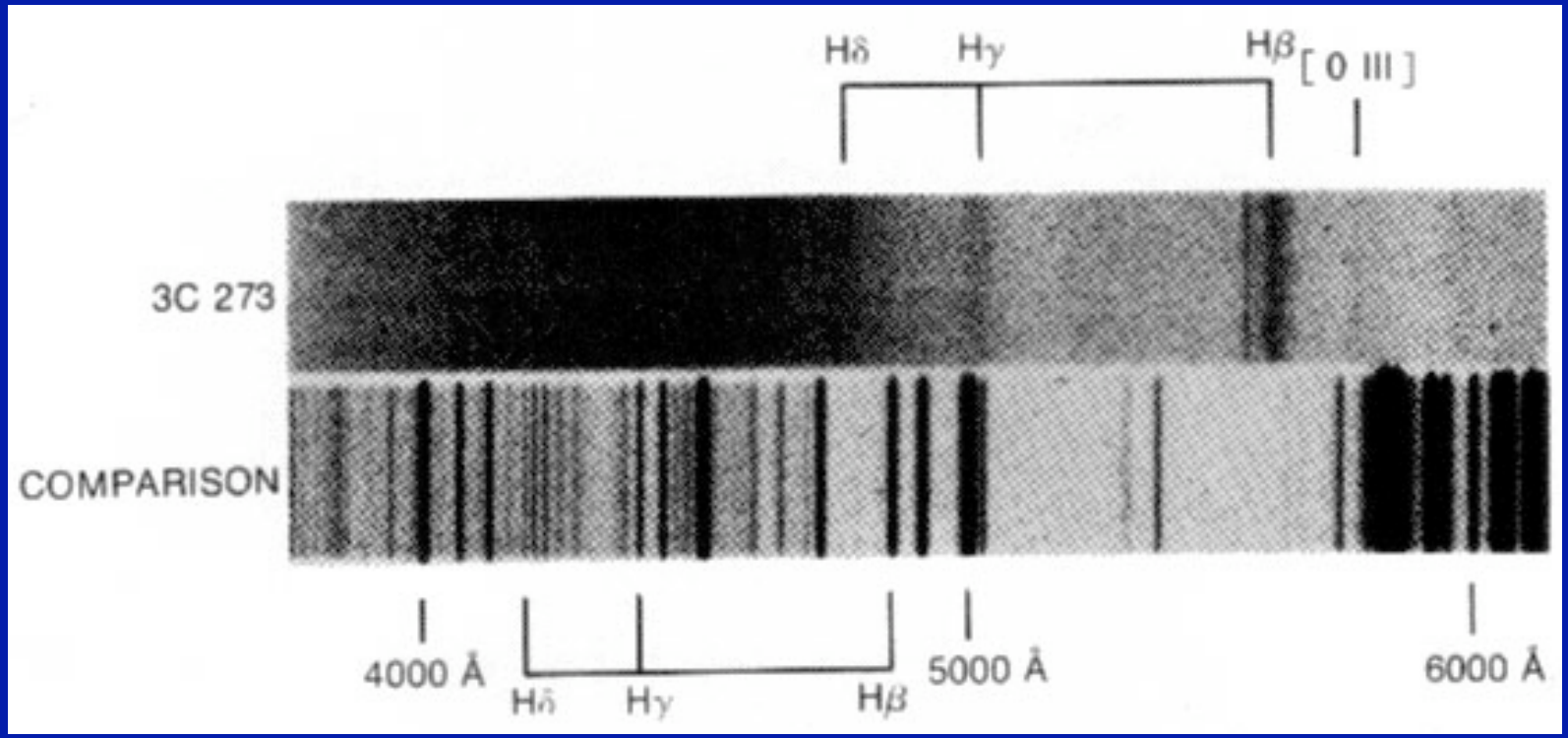


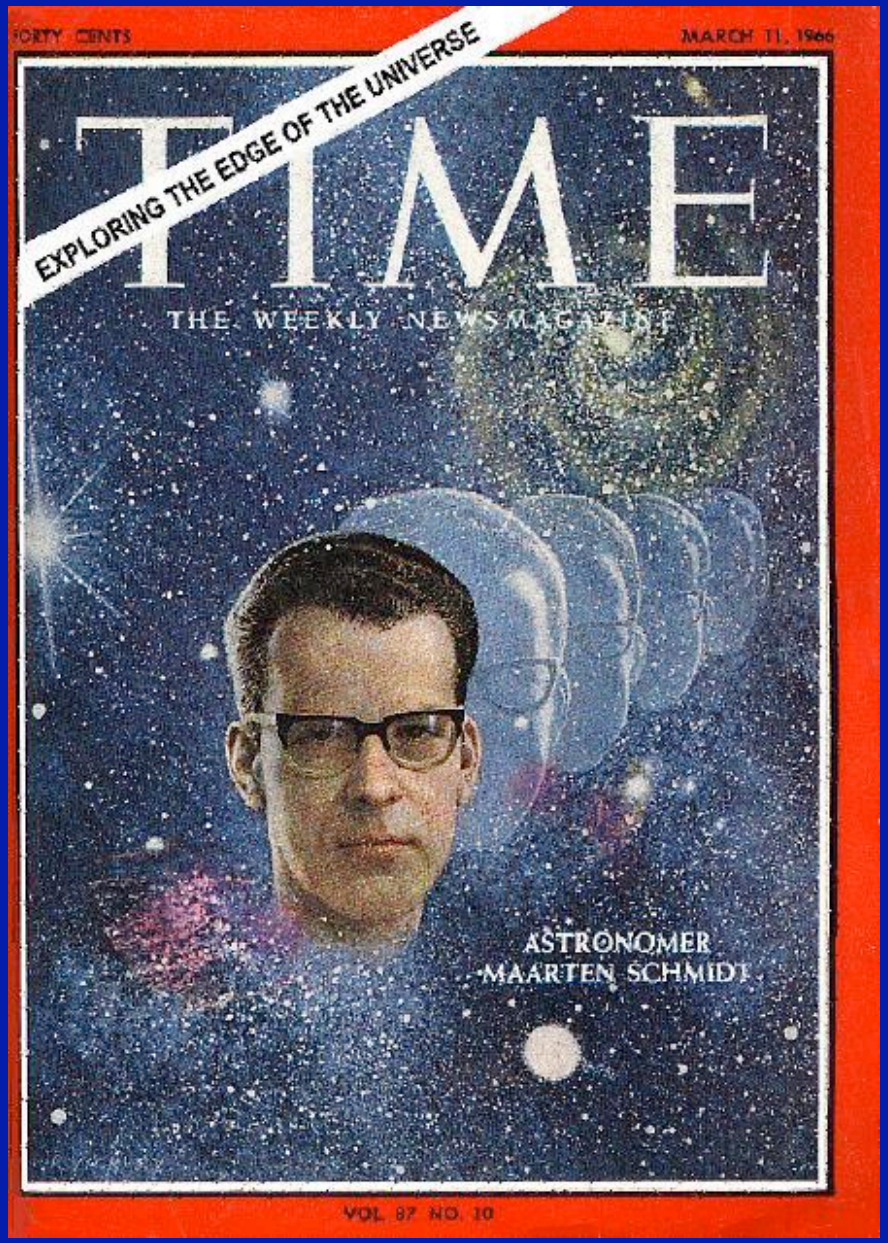

Quasar 3C175
VLA 6cm image (c) NRAO 1996

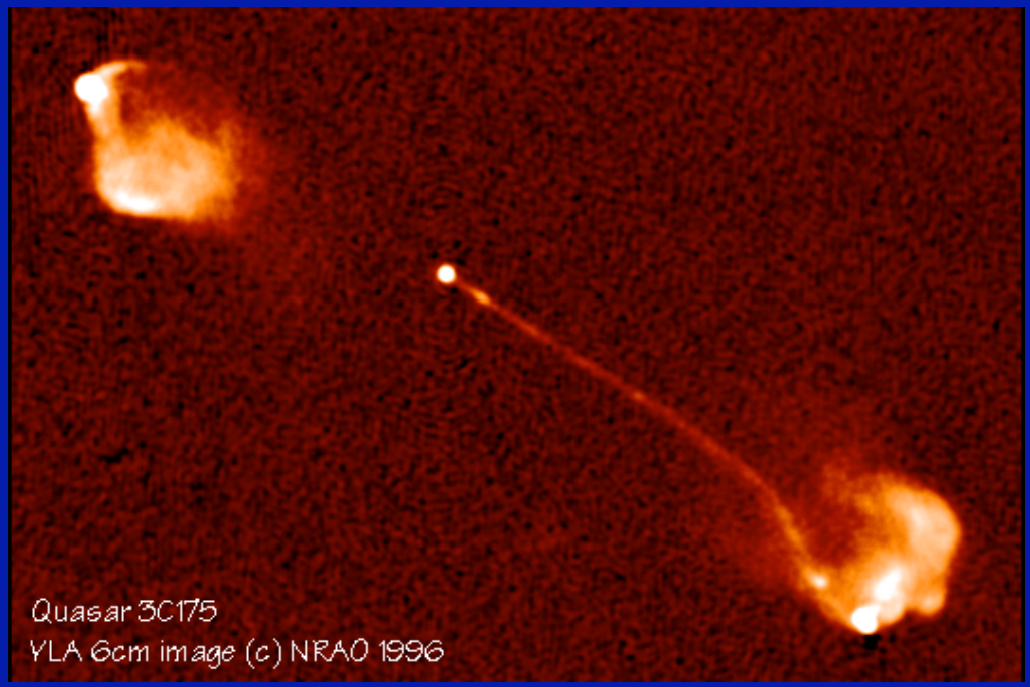


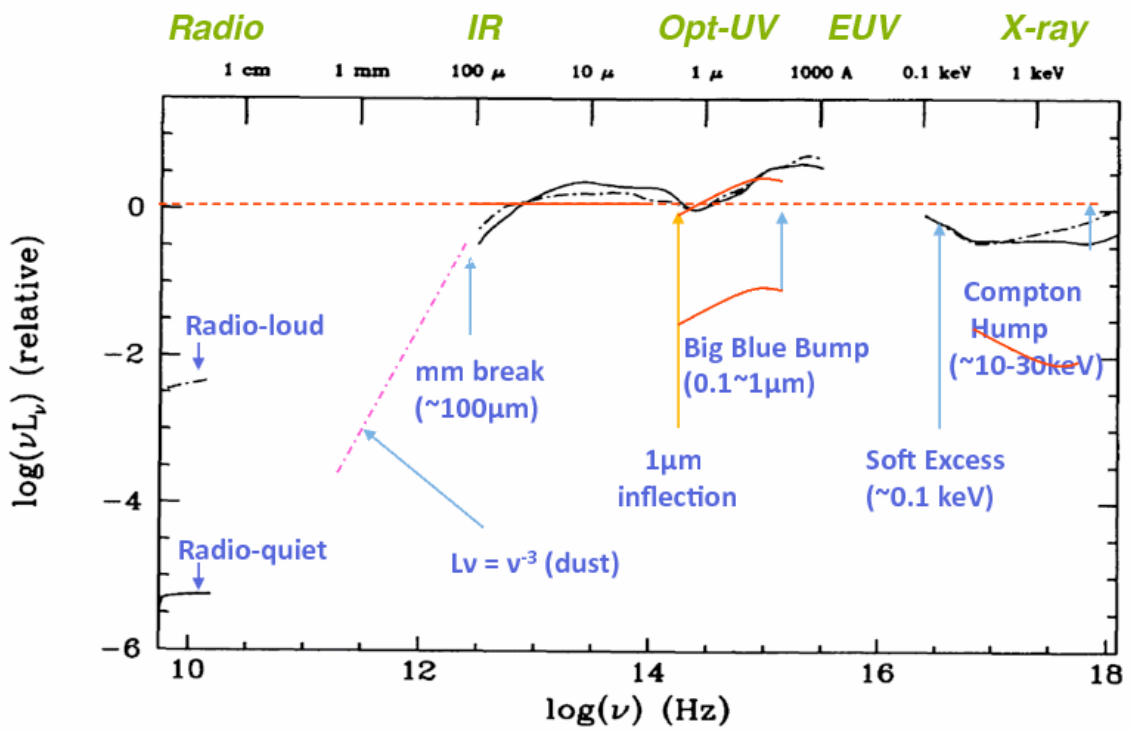

3C 273


O
50000K
B
20000K
A
10000K
F
7500K
G
6000K
K
4000K
M
3500K

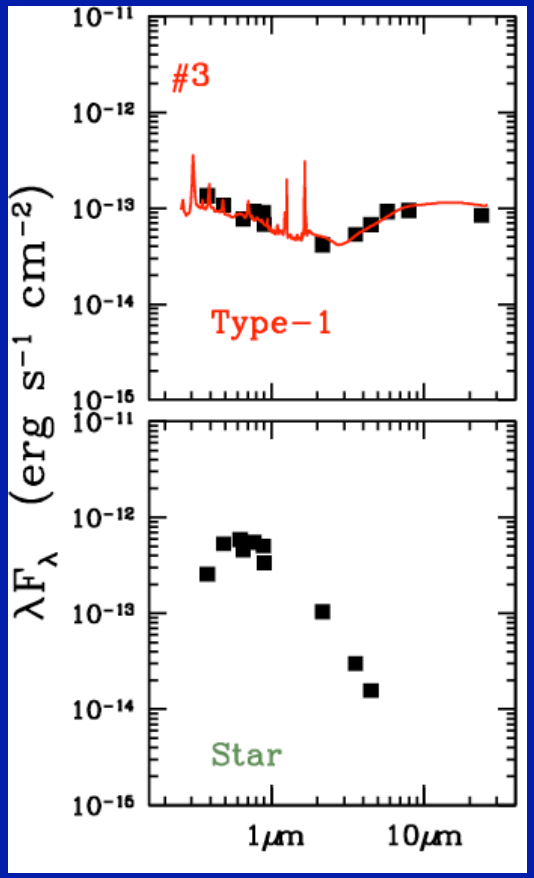

Hδ
Hγ
Hβ
[O III]
3C 273
COMPARISON
4000 Å
Hδ
Hγ
Hβ
5000 Å
6000 Å


FORTY CENTS
MARCH 11, 1966
EXPLORING THE EDGE OF THE UNIVERSE
TIME
THE WEEKLY NEWSMAGAZINE
ASTRONOMER
MAARTEN SCHMIDT
VOL. 87 NO. 10

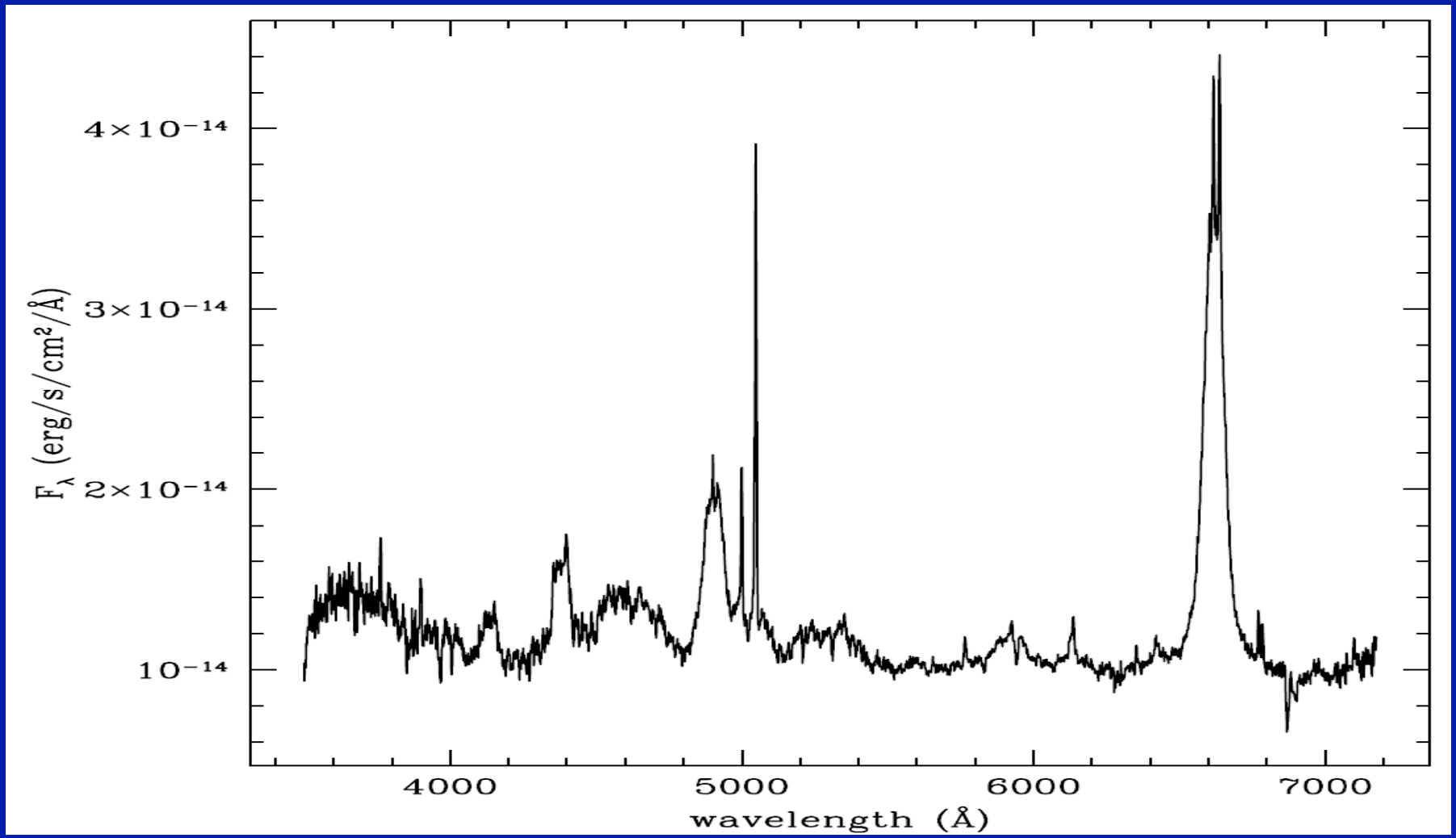

Quasar 3C175
VLA 6cm image (c) NRAO 1996

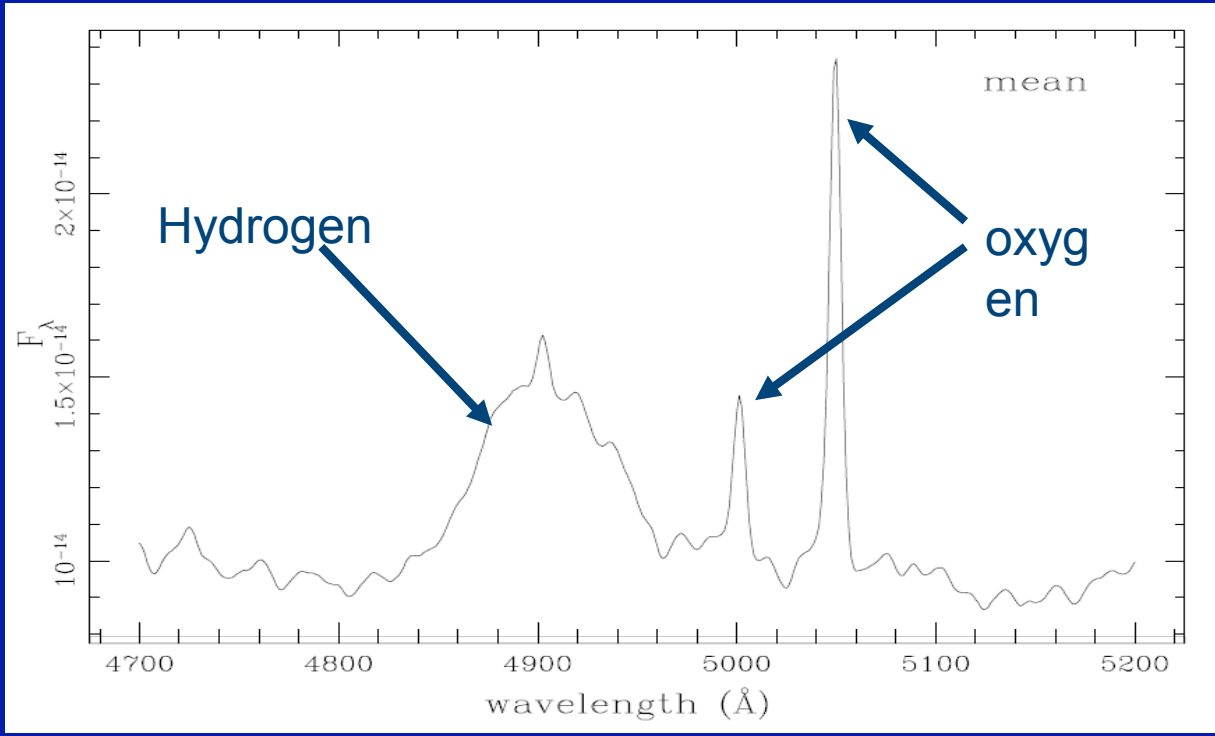


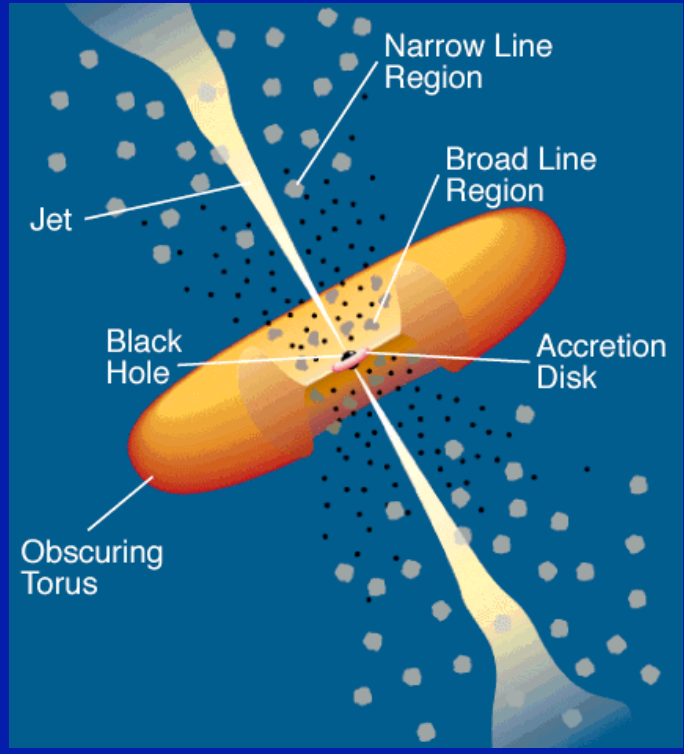
Elvis et al., 1994, ApJS, 95, 1

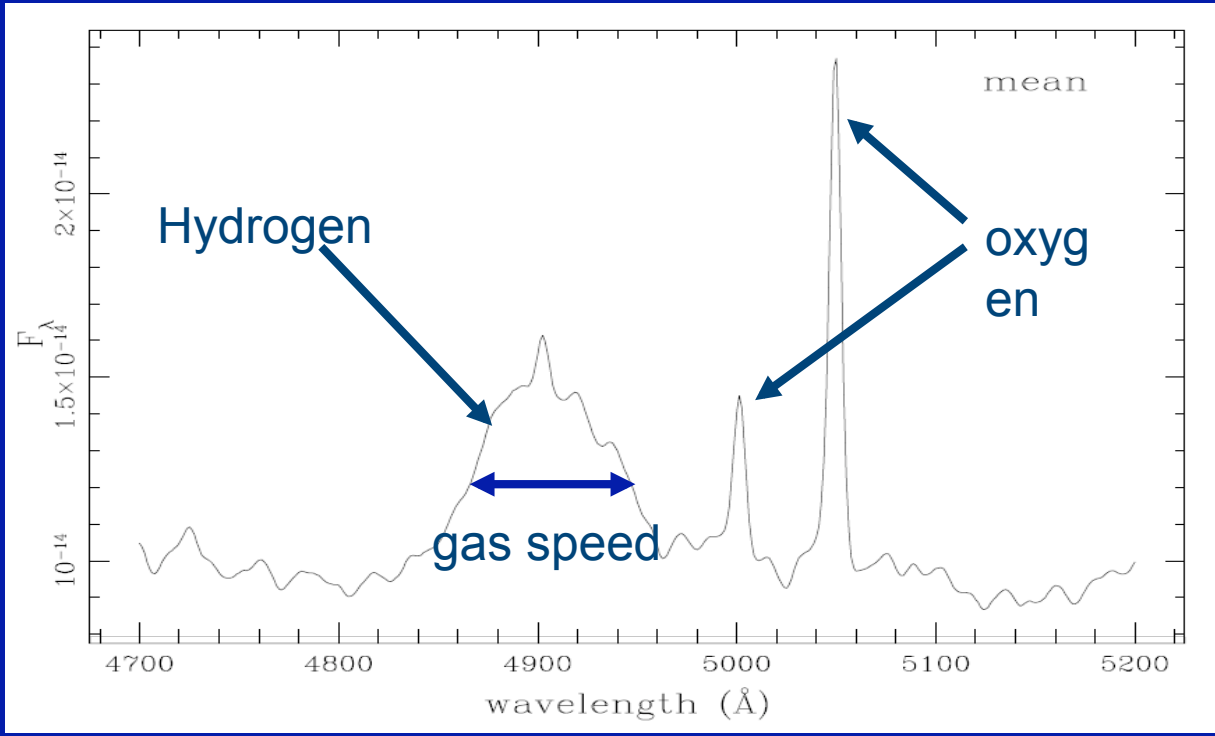


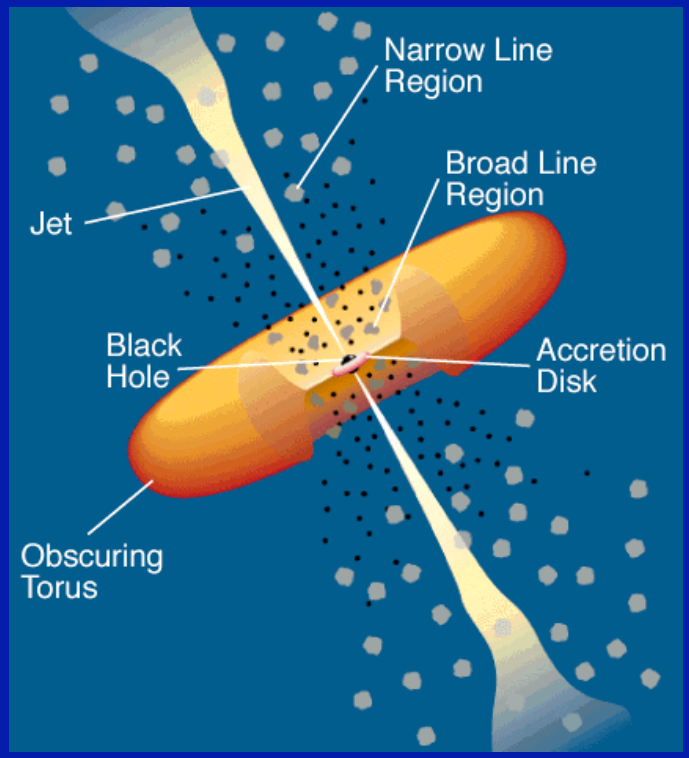
12h
16h
8h
20h
4h
0h
0.5
1.0
1.5
2.0
2.5
Redshift z

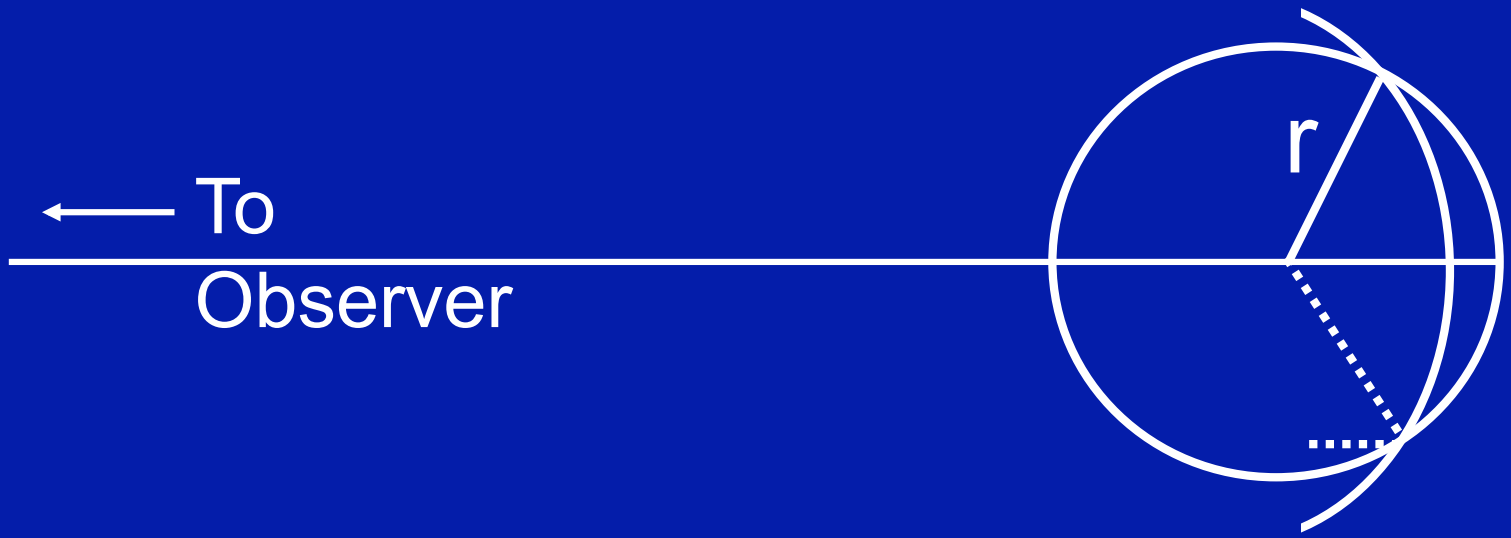

4×10⁻¹⁴
3×10⁻¹⁴
2×10⁻¹⁴
10⁻¹⁴
F_λ (erg/s/cm²/Å)
4000
5000
6000
7000
wavelength (Å)

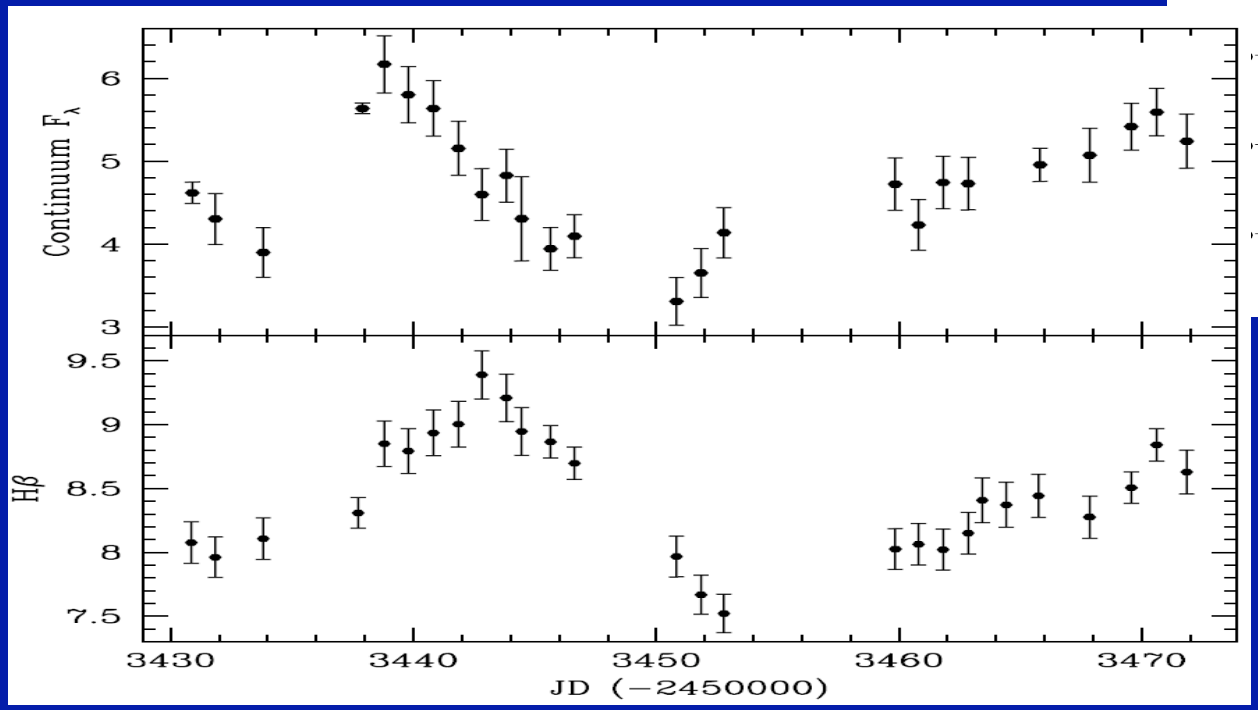

mean
Hydrogen
oxyg
en
F_λ
2×10^{-14}
1.5×10^{-14}
10^{-14}
4700
4800
4900
5000
5100
5200
wavelength (Å)

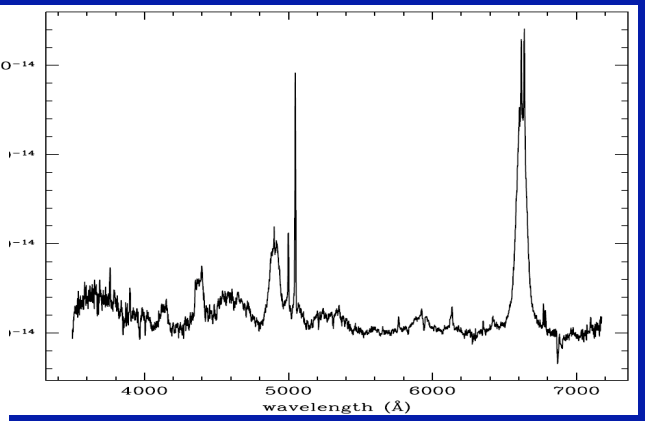

Narrow Line
Region
Broad Line
Region
Jet
Black
Hole
Accretion
Disk
Obscuring
Torus

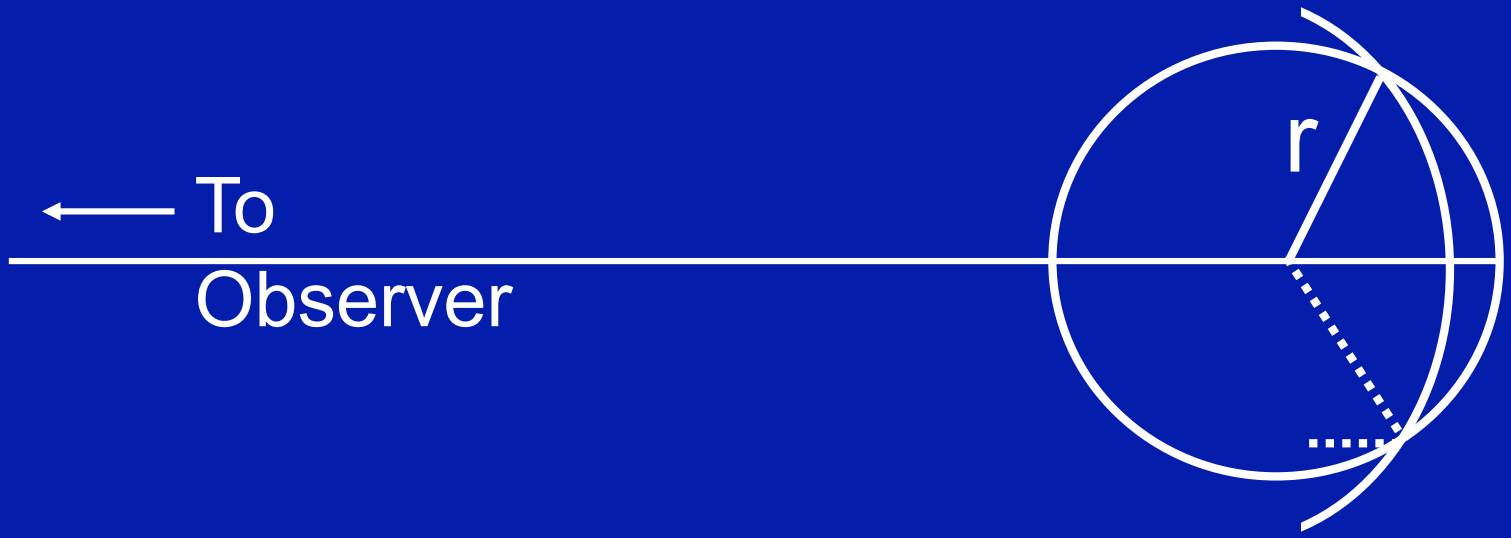

mean
Hydrogen
oxyg
en
gas speed
F_λ
2×10^{-14}
1.5×10^{-14}
10^{-14}
4700
4800
4900
5000
5100
5200
wavelength (Å)


Narrow Line
Region
Broad Line
Region
Jet
Black
Hole
Accretion
Disk
Obscuring
Torus

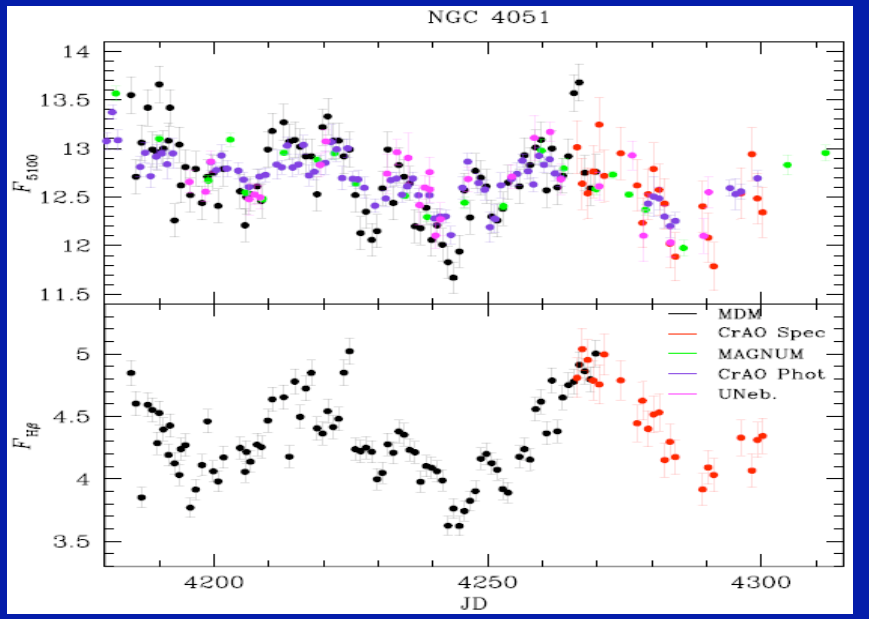

To
Observer
r

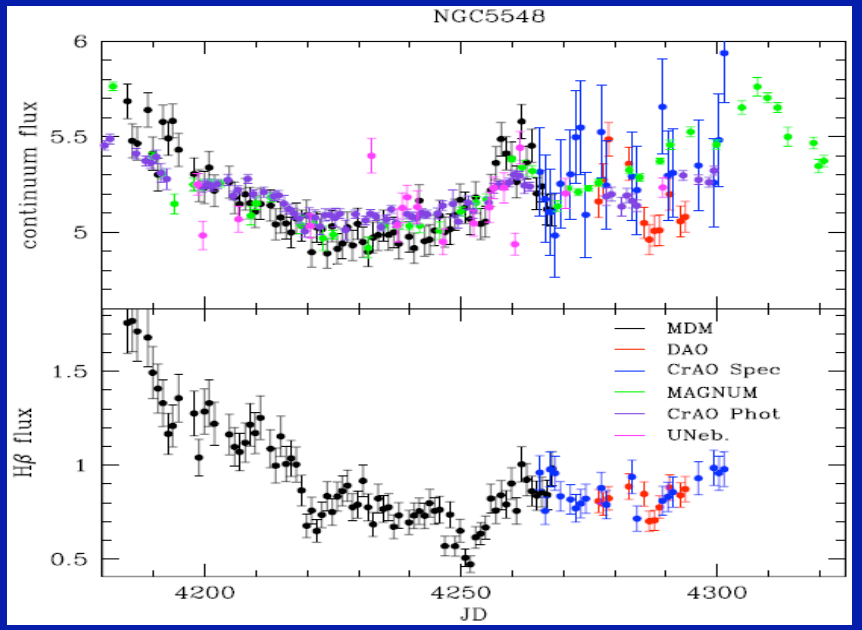

Continuum F_λ
Hβ
JD (−2450000)
3430
3440
3450
3460
3470

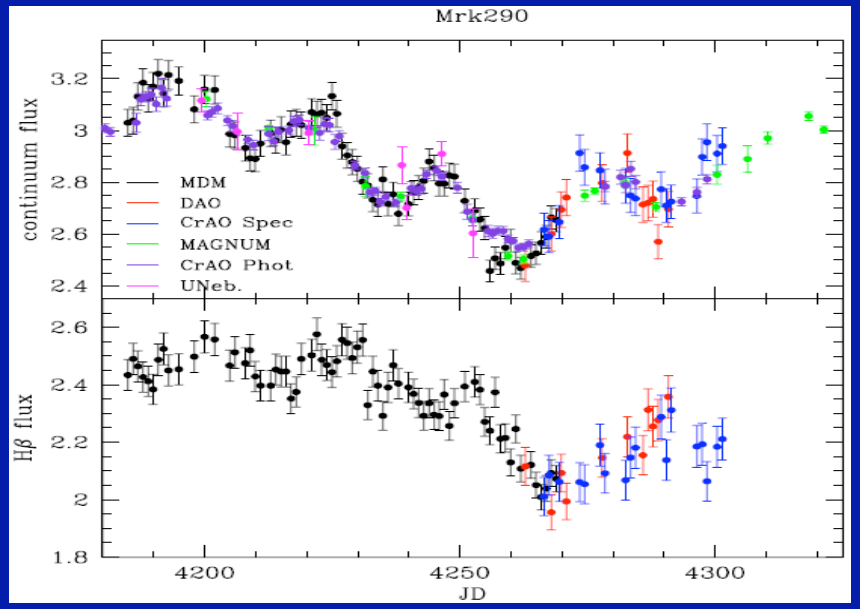

4×10⁻¹⁴
4000
5000
6000
7000
wavelength (Å)

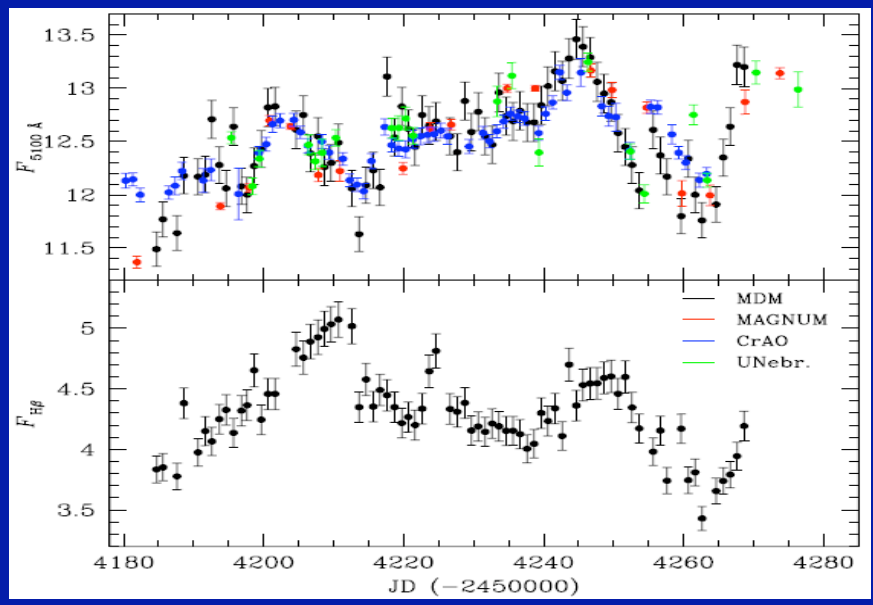

To
Observer
r

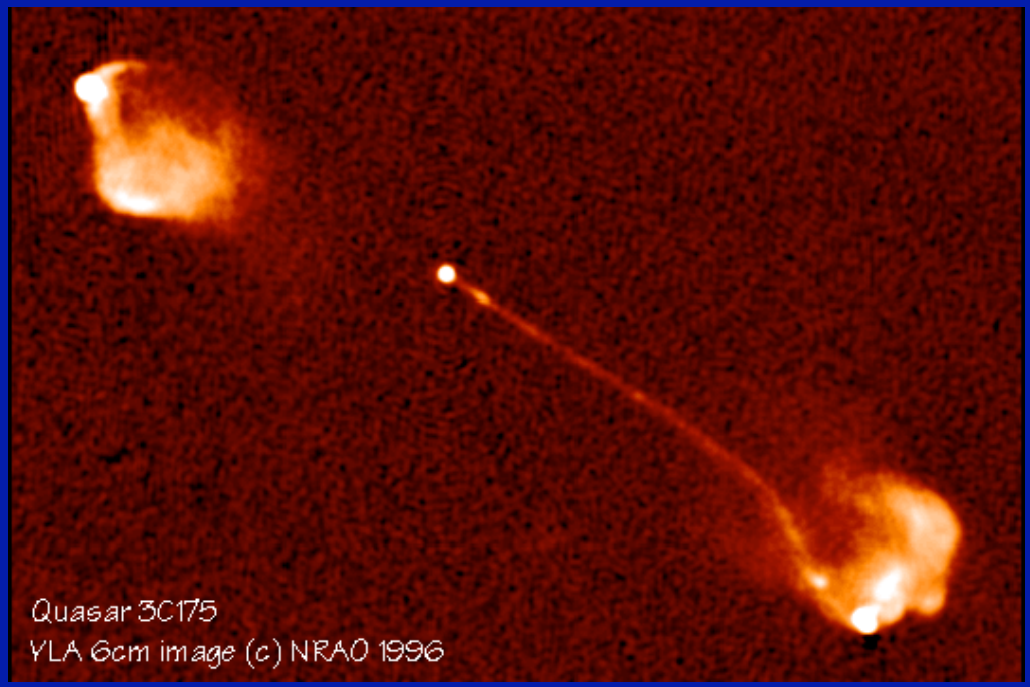
Reverberation mapping campaigns led by OSU graduate students Kate Grier and Kelly Denney and Professor Bradley Peterson.

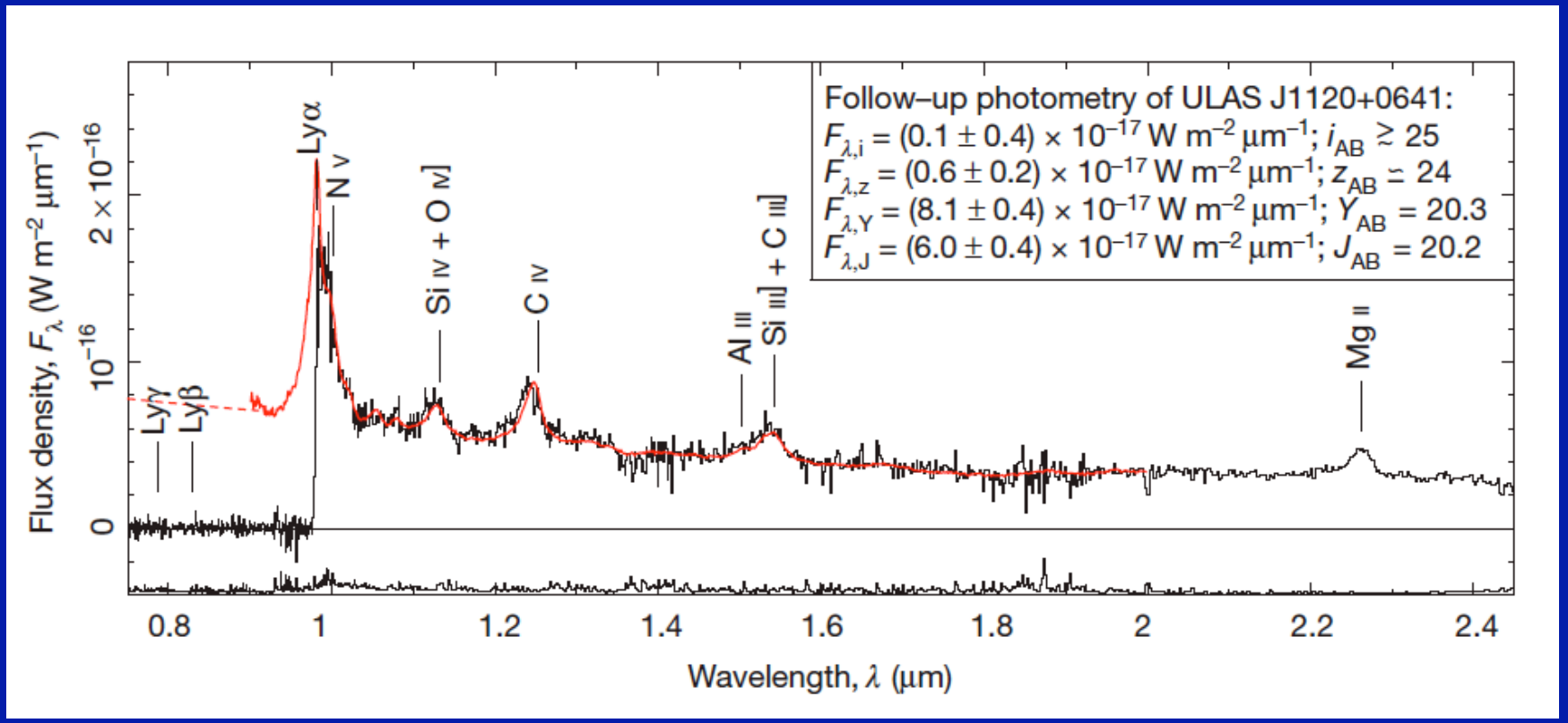




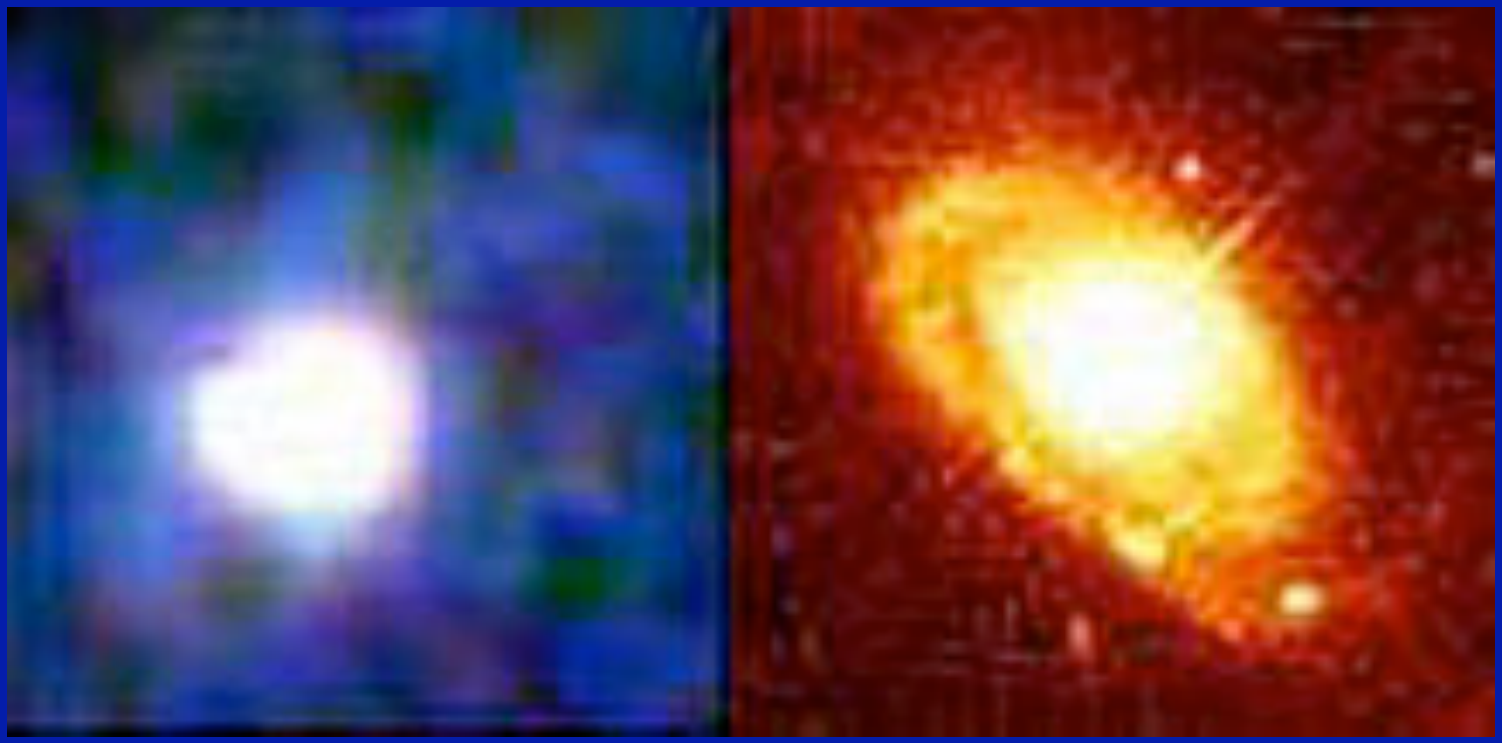


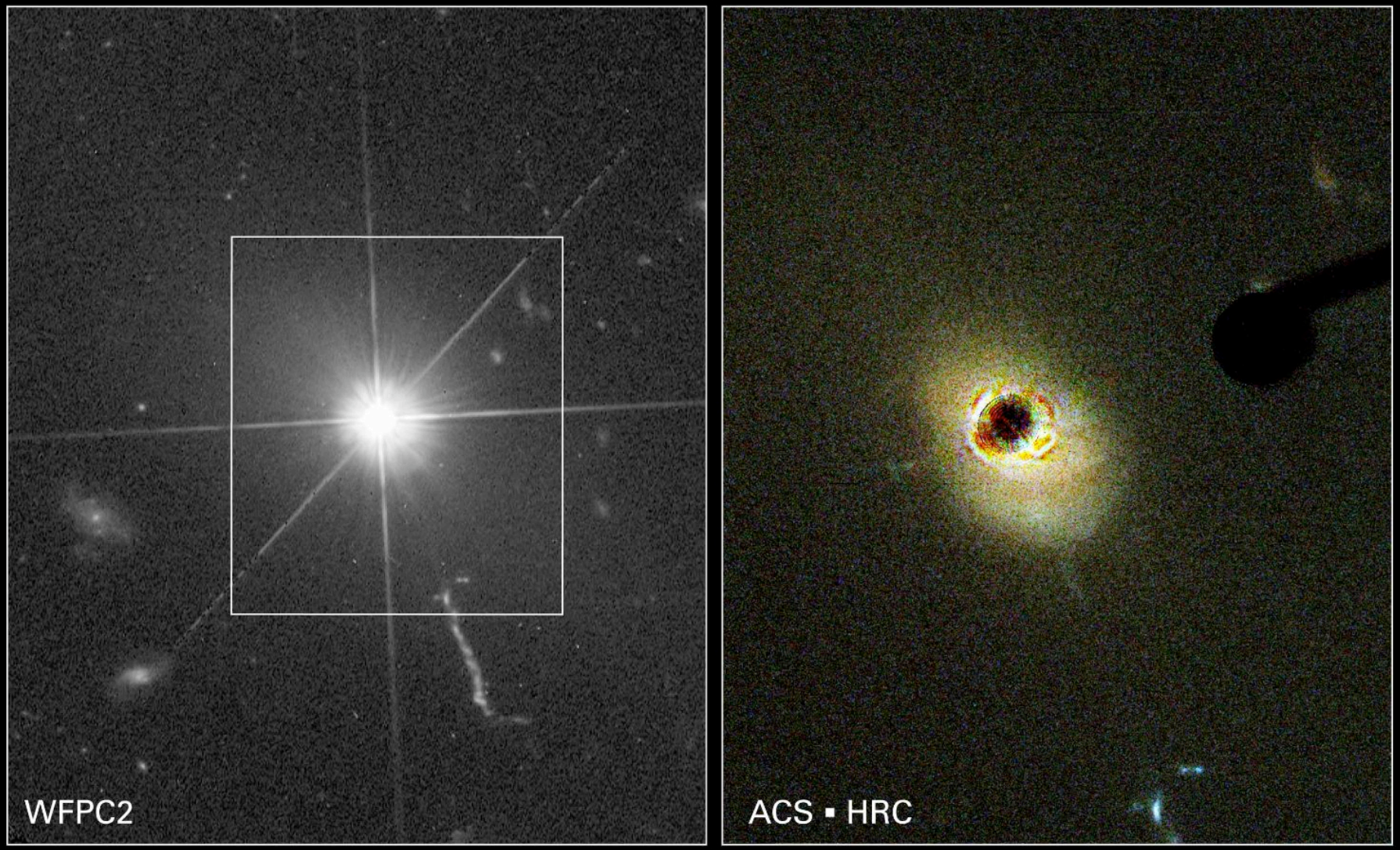



Quasar 3C175
VLA 6cm image (c) NRAO 1996



Most distant quasar currently known. Its light was emitted when the universe was 800 million years old (compared to 14 billion today), and expansion of the universe has stretched the wavelengths by a factor of 8.

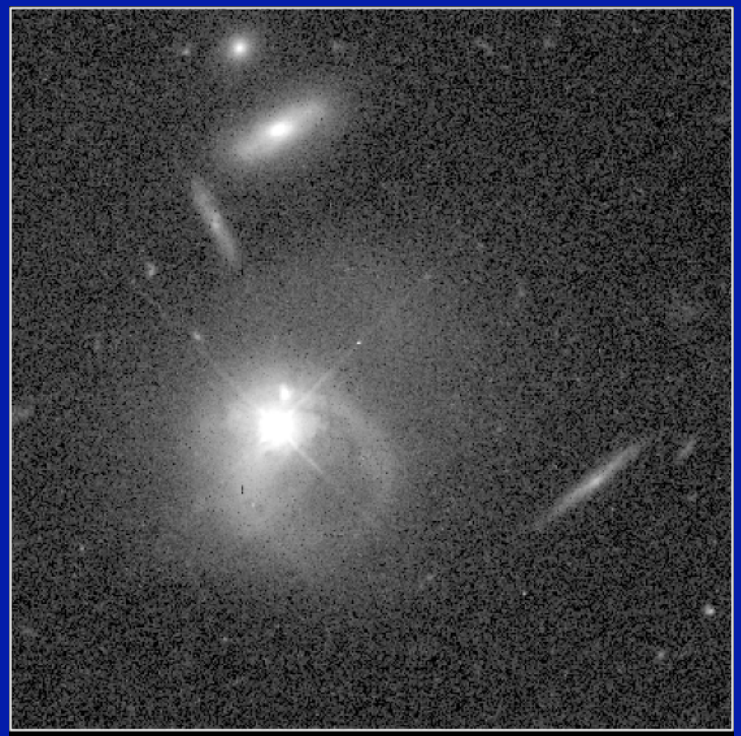




Quasar 3C 273

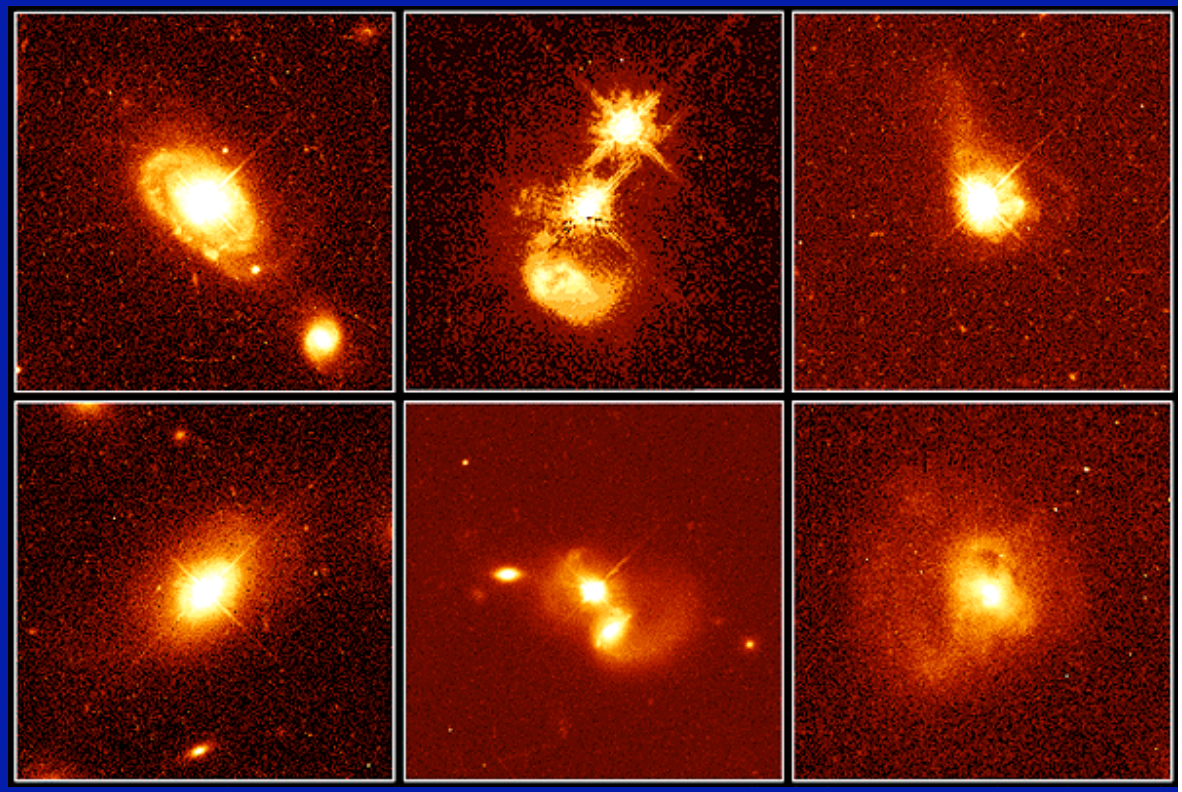
Hubble Space Telescope ▪ ACS HRC Coronagraph

NASA, A. Martel (JHU), the ACS Science Team, J. Bahcall (IAS) and ESA ▪ STScI-PRC03-03

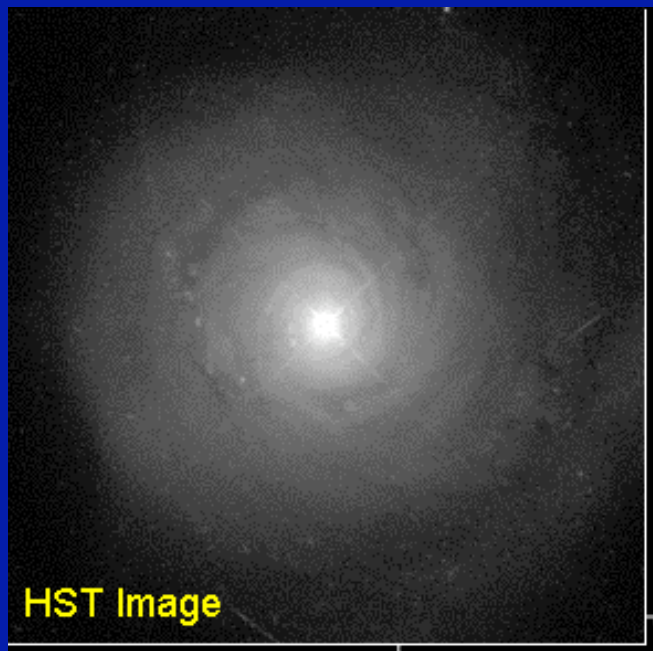


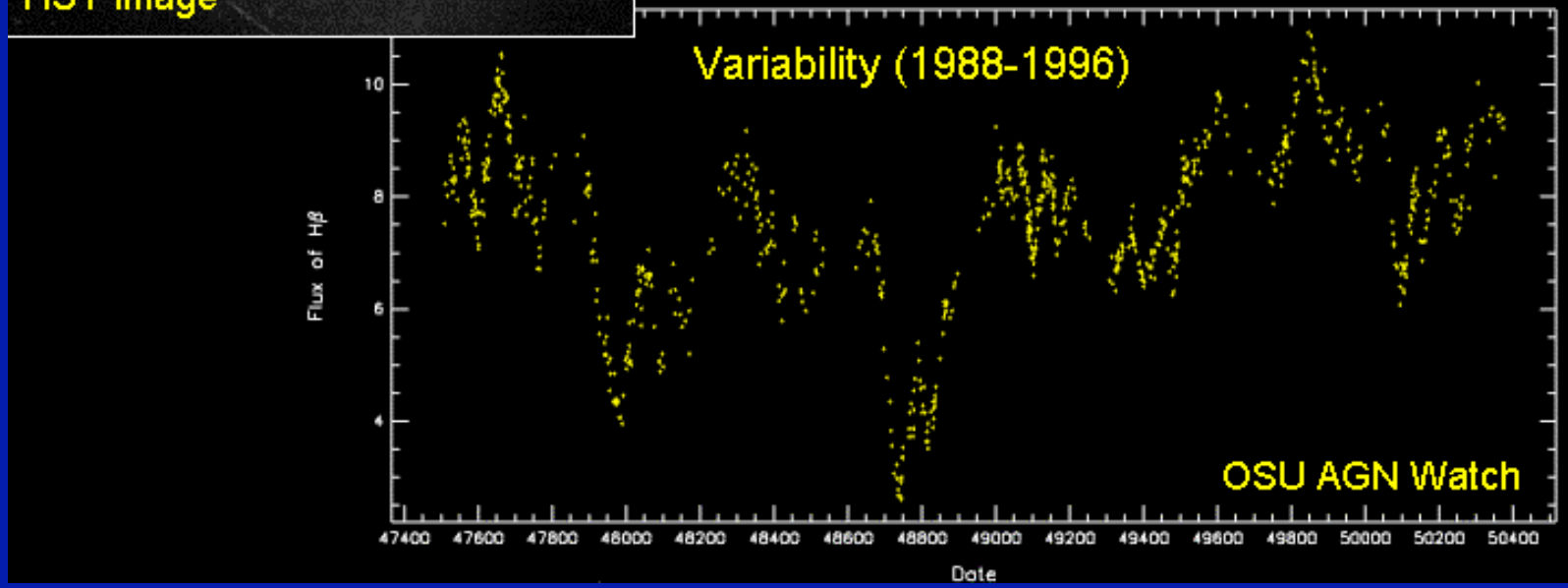
Quasar PKS 2349 HST • WFPC2

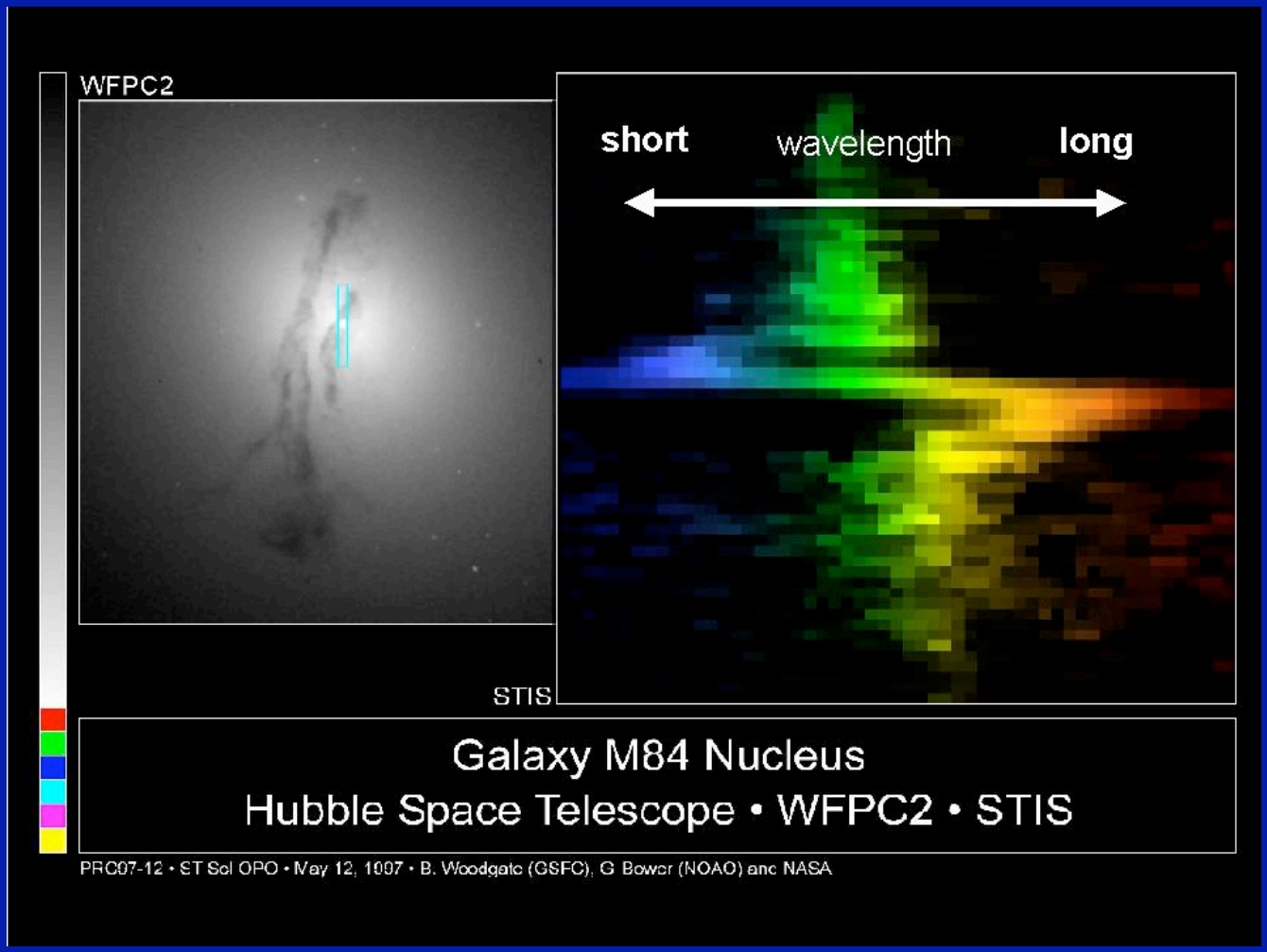
ST ScI OPO • January 1995 • J. Bahcall (Princeton), NASA

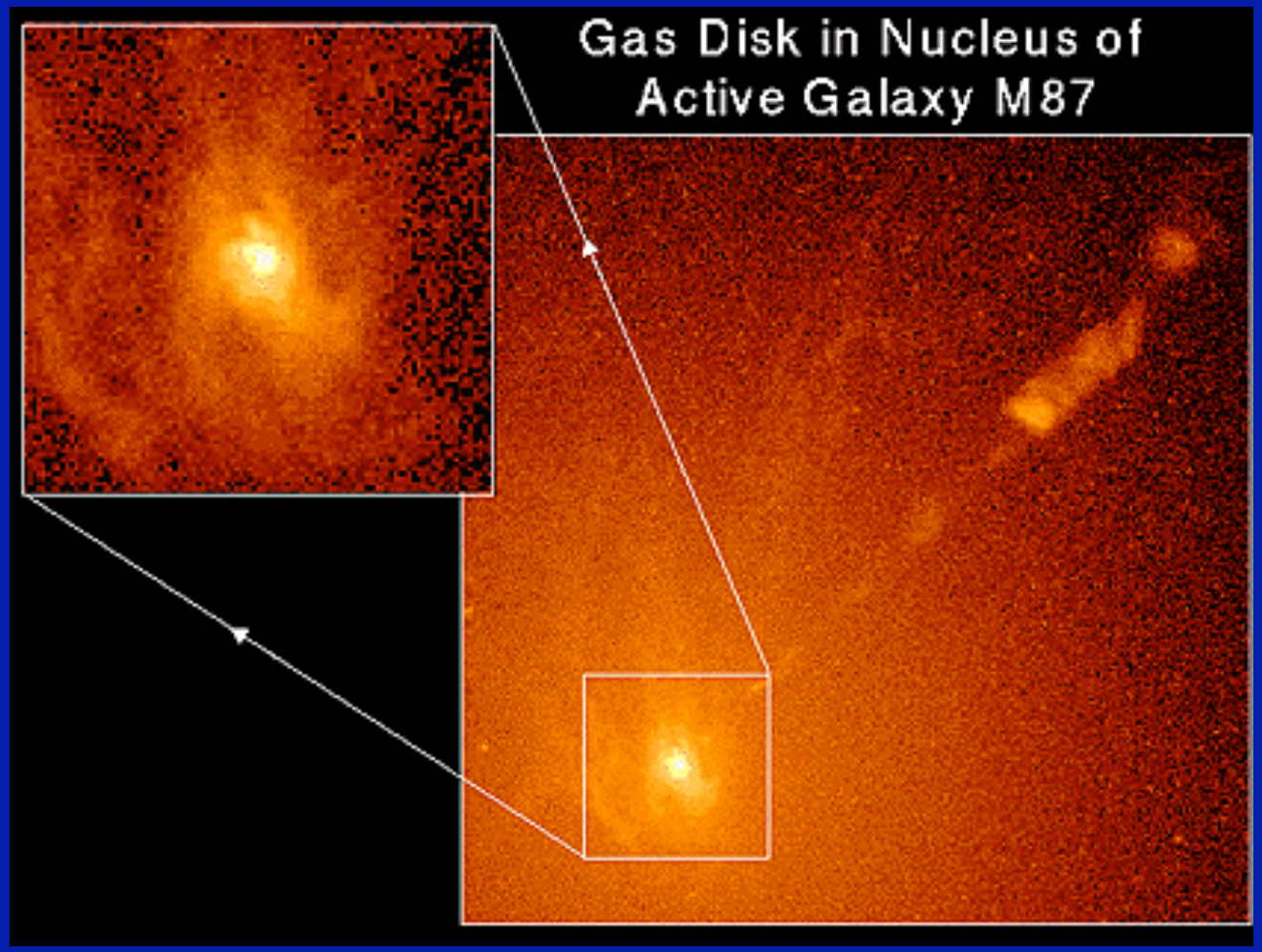


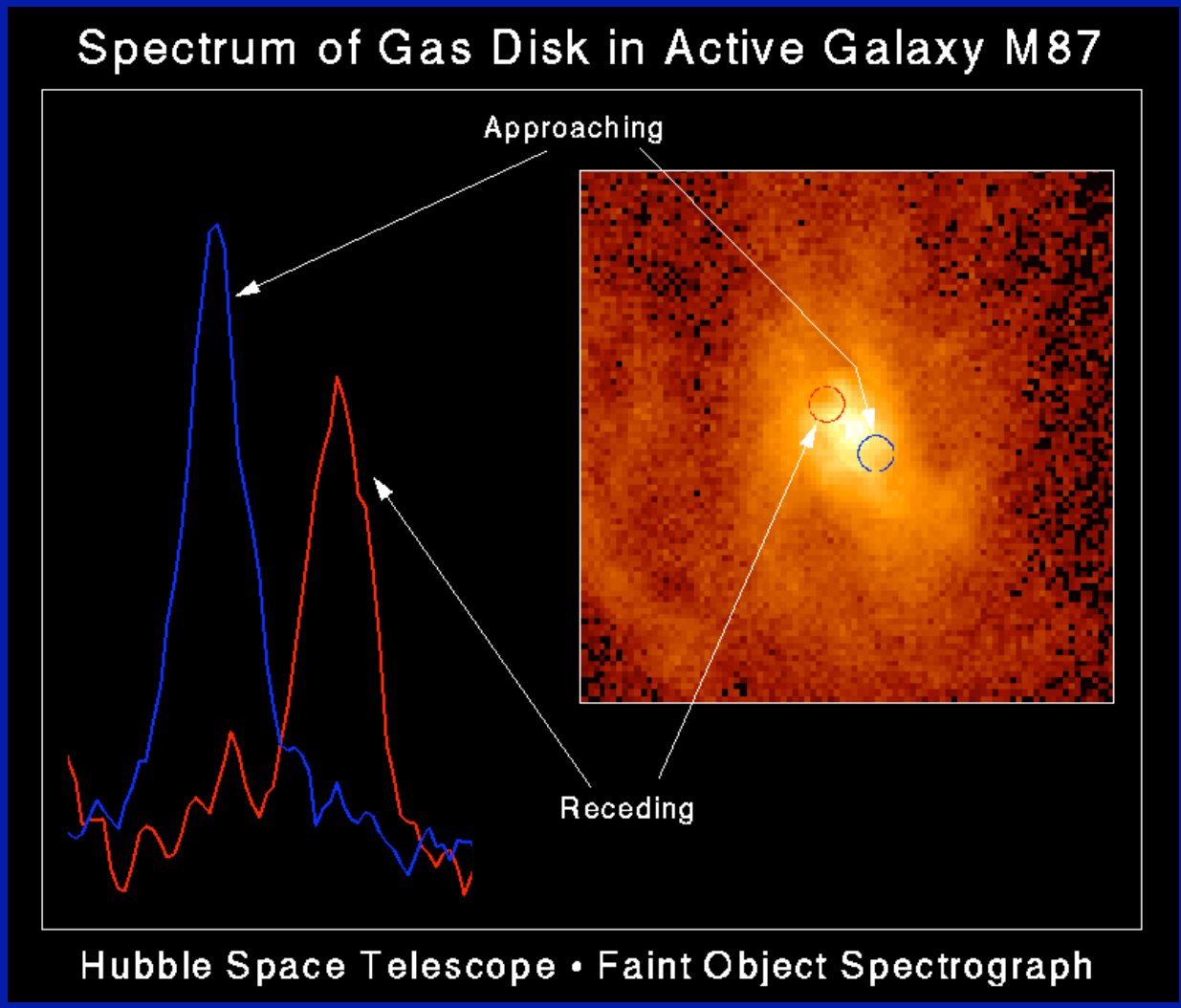
Bright Active Galaxy NGC 5548

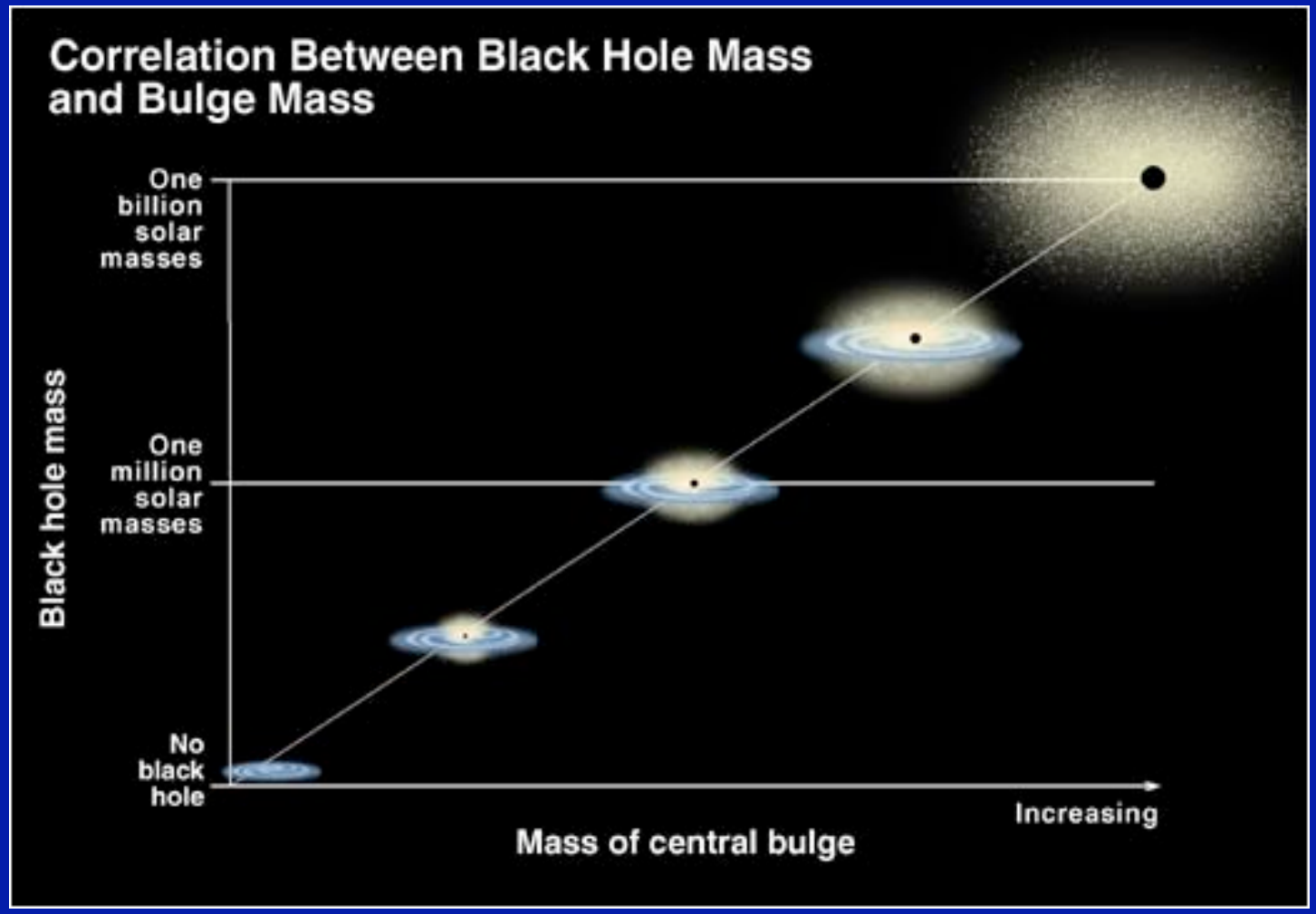


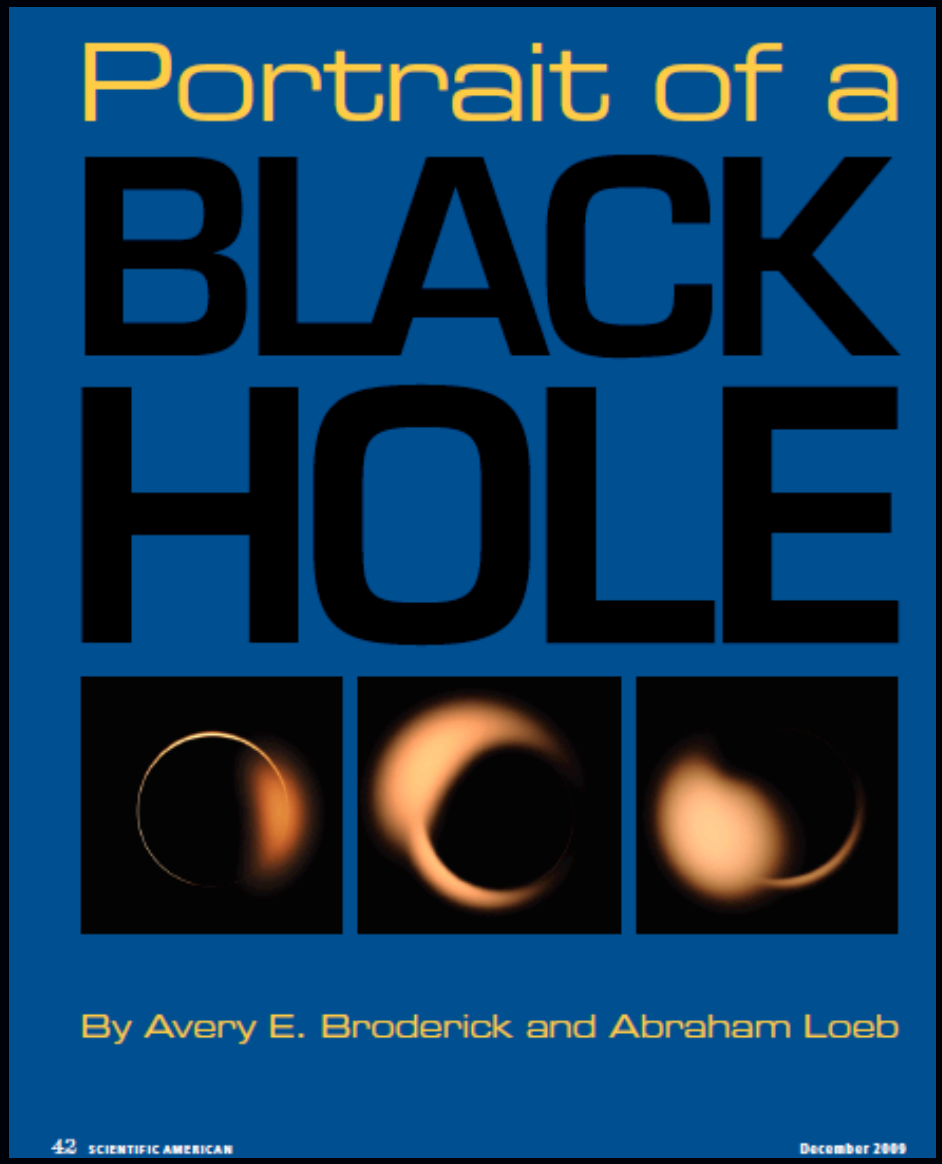



WFPC2
short
wavelength
long
STIS
Galaxy M84 Nucleus
Hubble Space Telescope • WFPC2 • STIS
PRC97-12 • ST ScI OPO • May 12, 1997 • B. Woodgate (GSFC), G. Bower (NOAO) and NASA

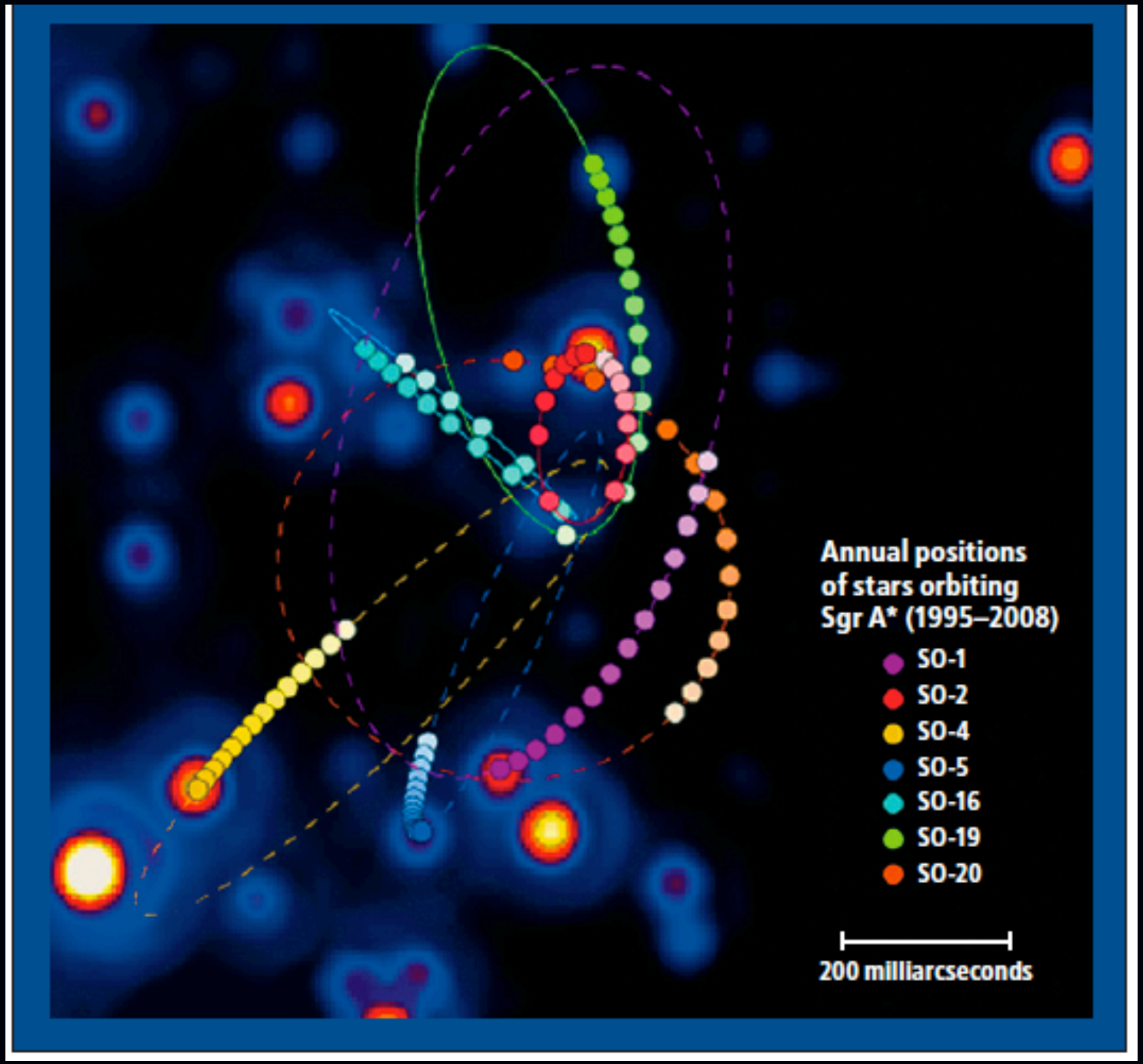

Gas Disk in Nucleus of
Active Galaxy M87

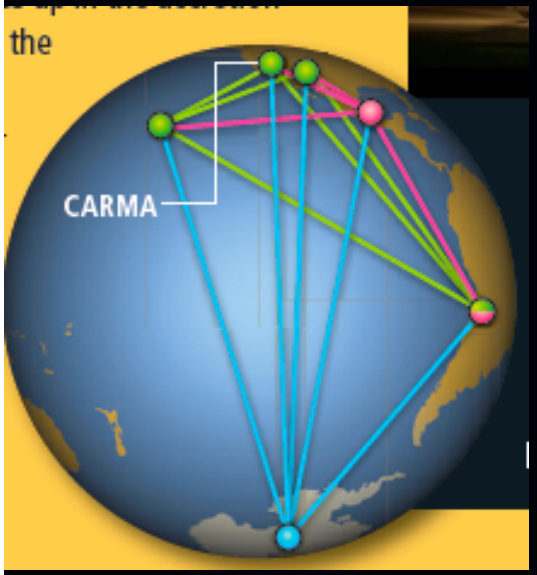

Spectrum of Gas Disk in Active Galaxy M87
Approaching
Receding
Hubble Space Telescope • Faint Object Spectrograph

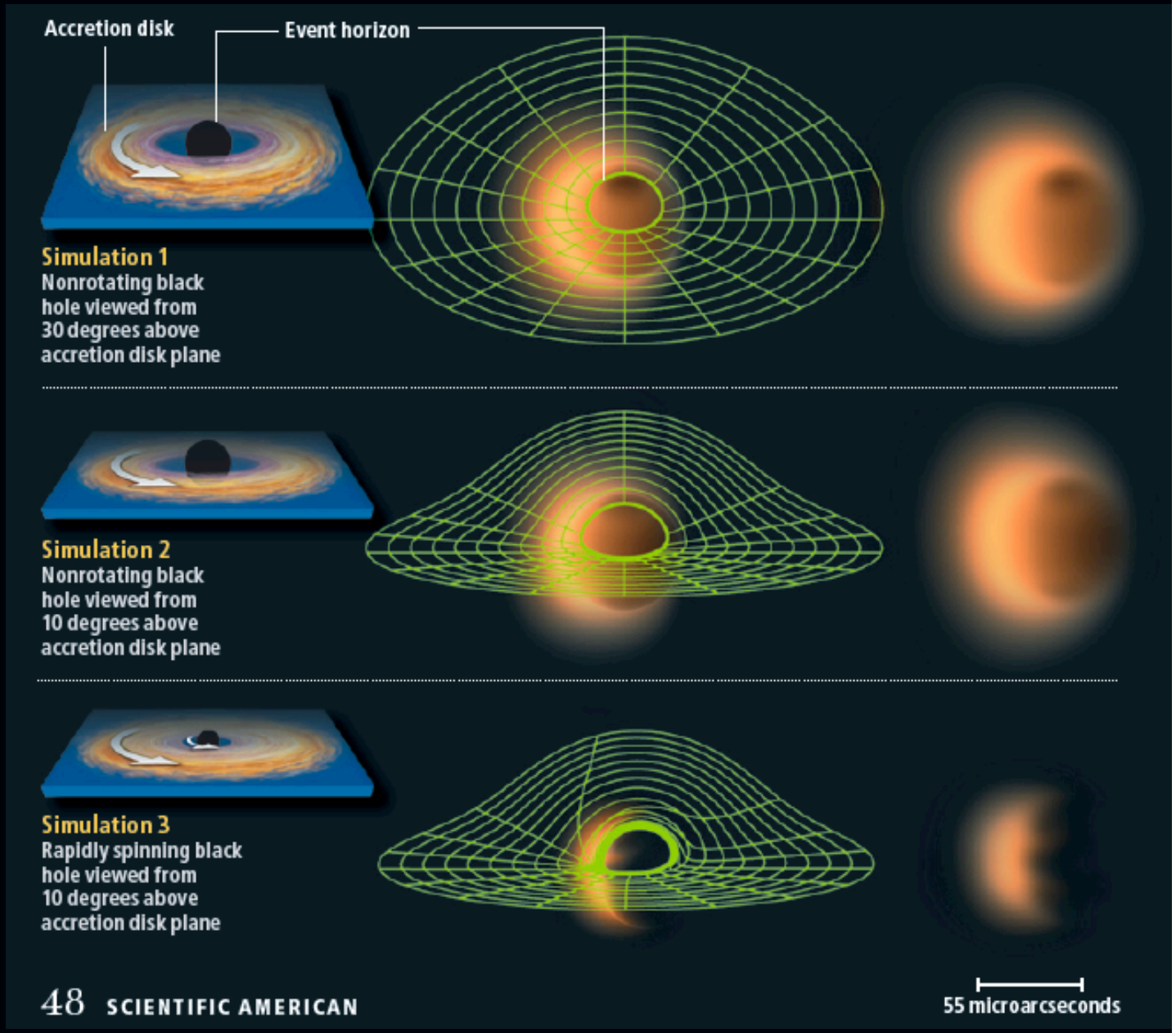

Correlation Between Black Hole Mass and Bulge Mass
One billion solar masses
One million solar masses
No black hole
Black hole mass
Increasing
Mass of central bulge



Remaining images taken from 2008 Scientific American article by Avery Broderick & Avi Loeb


Annual positions
of stars orbiting
Sgr A* (1995–2008)
SO-1
SO-2
SO-4
SO-5
SO-16
SO-19
SO-20
200 milliarcseconds


the
CARMA


Accretion disk
Event horizon
Simulation 1
Nonrotating black hole viewed from 30 degrees above accretion disk plane
Simulation 2
Nonrotating black hole viewed from 10 degrees above accretion disk plane
Simulation 3
Rapidly spinning black hole viewed from 10 degrees above accretion disk plane
55 microarcseconds