Introductory Astronomy

Week 6: Relativity and Black Holes

Clip 14: Black Holes in Astronomy

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Is This Real? Can We See Them?

- Technically, no. No light.. But in our time core stuck at R_S forever
- We see the effects of dense massive objects
- With mass transfer have accretion disk to $3R_S$ heated to $10^6\,\mathrm{K}$ - X-rays
- Cygnus X-1 is an X-ray source in close binary with type O supergiant
- Doppler produces mass $10-20M_\odot$ for unseen X-ray source companion
- Flickers in ms:

$$R \leq 3000\,\mathrm{km}$$

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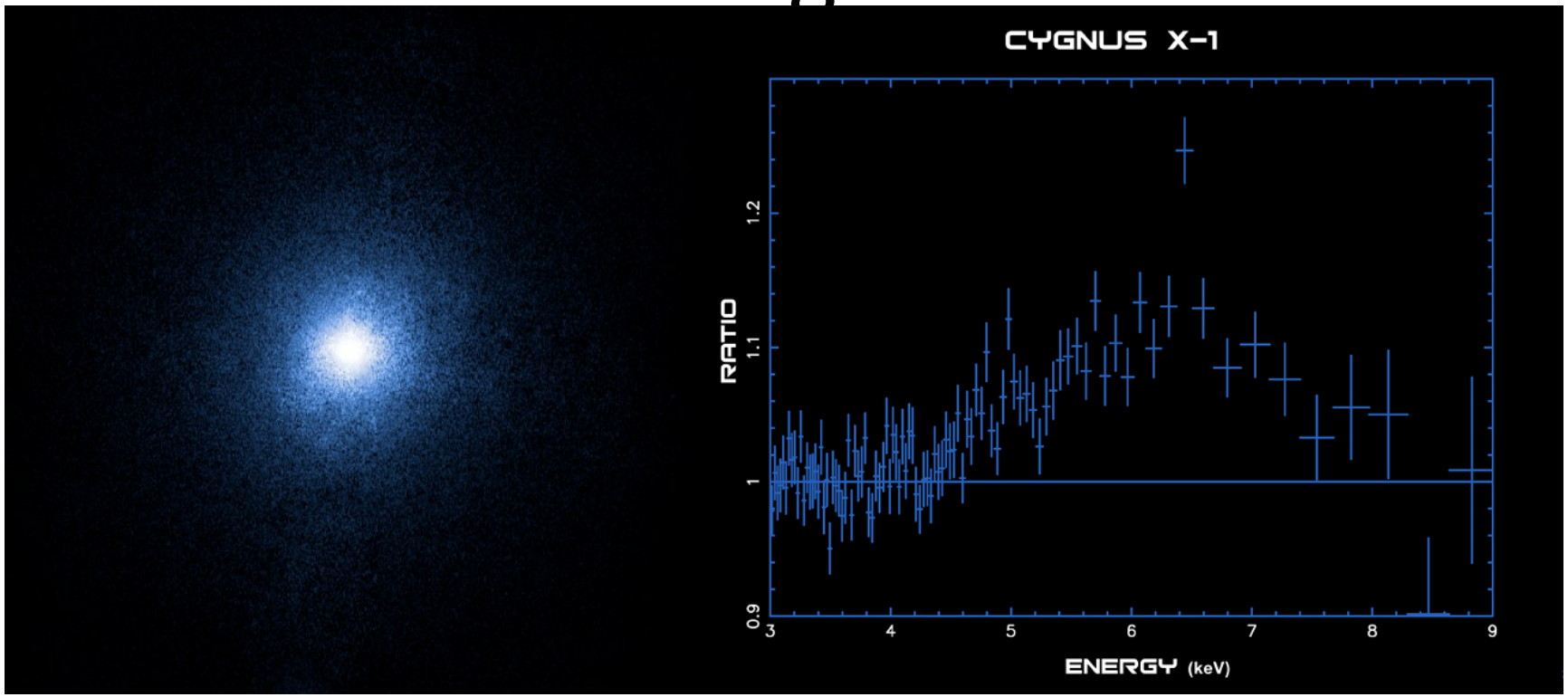
Images



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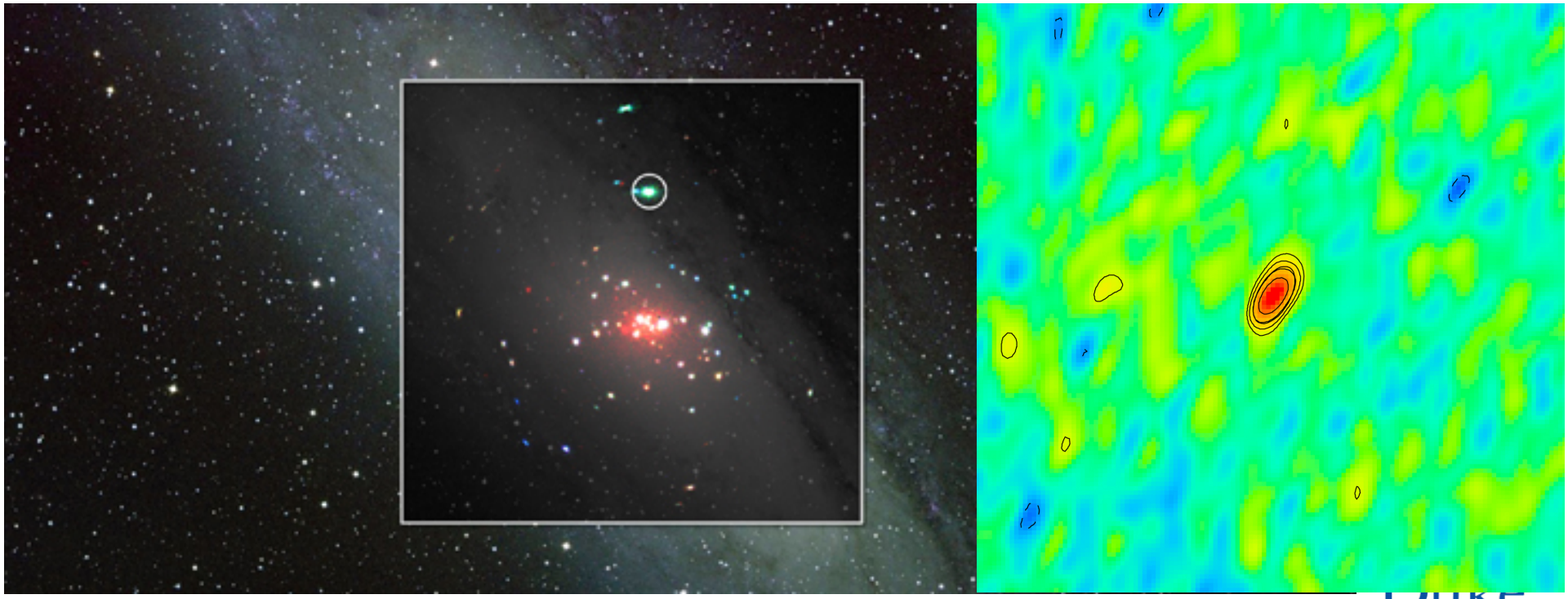
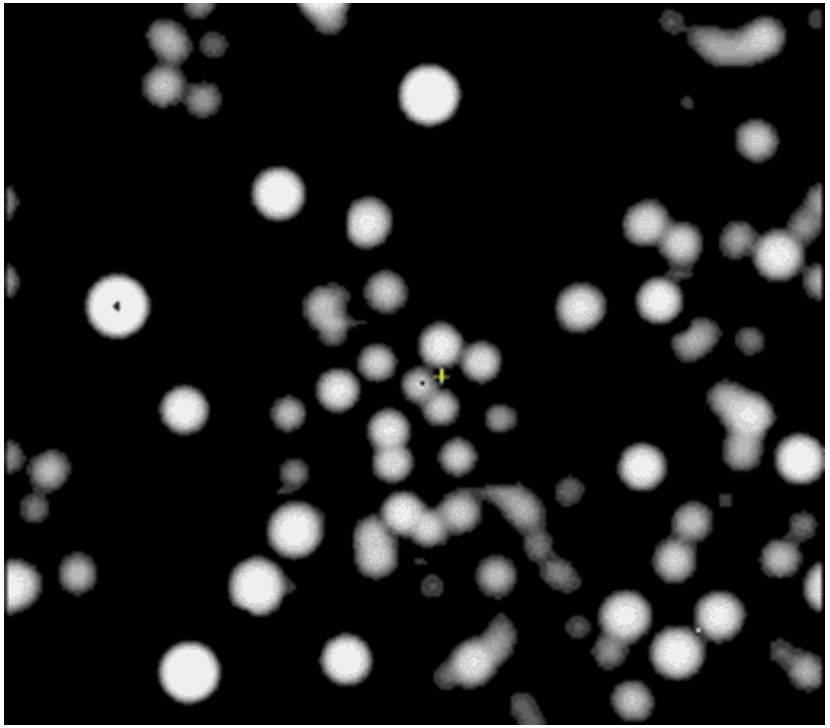
Black Hole in M31



Big Holes

- Stellar motions near center of Milky Way show compact object of mass

  $10^{6-7} M_{\odot}$
- Energetic jets and X-rays from SgR A*
- Most galaxies seem to have massive black holes in their centers
- Intermediate-mass black holes are new and under study



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Credits

- Cygnus X-1: NASA/CXC http://www.nasa.gov/mission_pages/chandra/multimedia/photo09-065.html
- Cygnus X-1 Spectrum: NASA/CXC/SAO/J.Miller et al. http://chandra.harvard.edu/photo/2003/bhspin/cygx1_spectrum.jpg
- M31 Black Hole: Bill Schoening, Vanessa Harvey/REU program/ NOAO/AURA/NSF; ESA/M. Middleton et al. http://www.nasa.gov/topics/universe/features/andromeda-xray.html
- Proper Motion Near SgR A*: : A. Eckart (U. Koeln) & R. Genzel (MPE-Garching), SHARP I, NTT, La Silla Obs., ESO http://apod.nasa.gov/apod/ap070114.html