Active Galactic Nuclei

Jörn Wilms

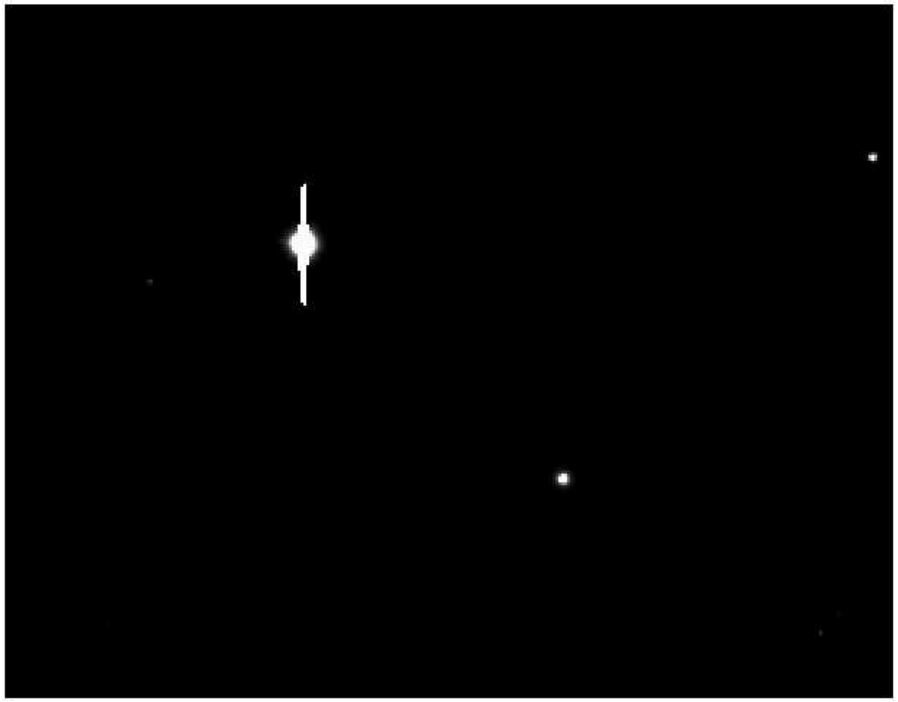
Wintersemester 2006/2007

Office: Dr. Karl Remeis-Sternwarte, Bamberg
email: joern.wilms@sternwarte.uni-erlangen.de
Tel.: (0951) 95222-13

http://astro.uni-tuebingen.de/~wilms/teach/agn

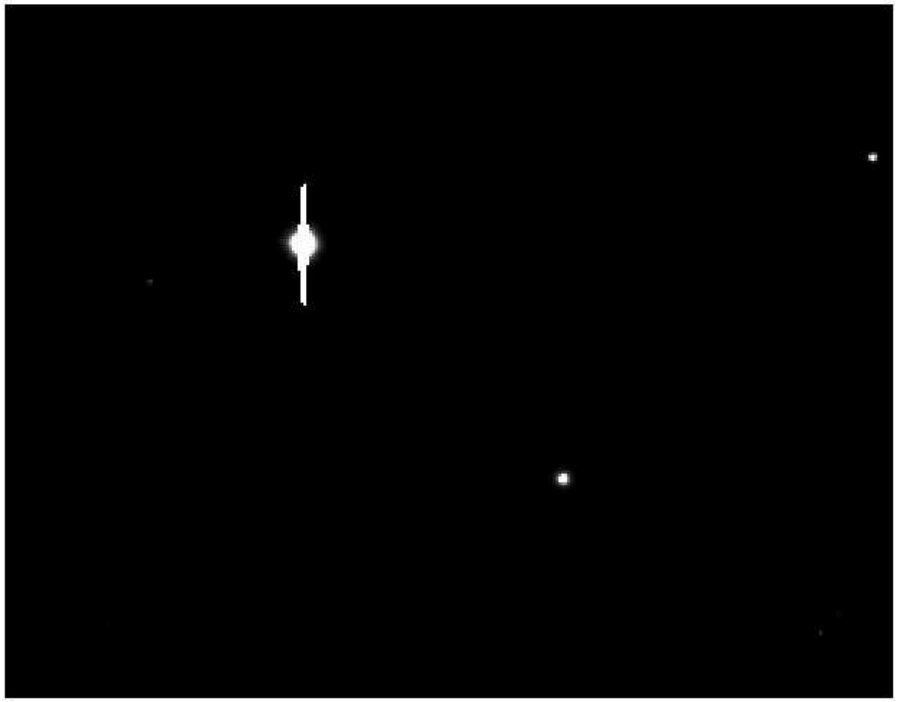
Friedrich–Alexander–Universität
Erlangen–Nürnberg

What are AGN?

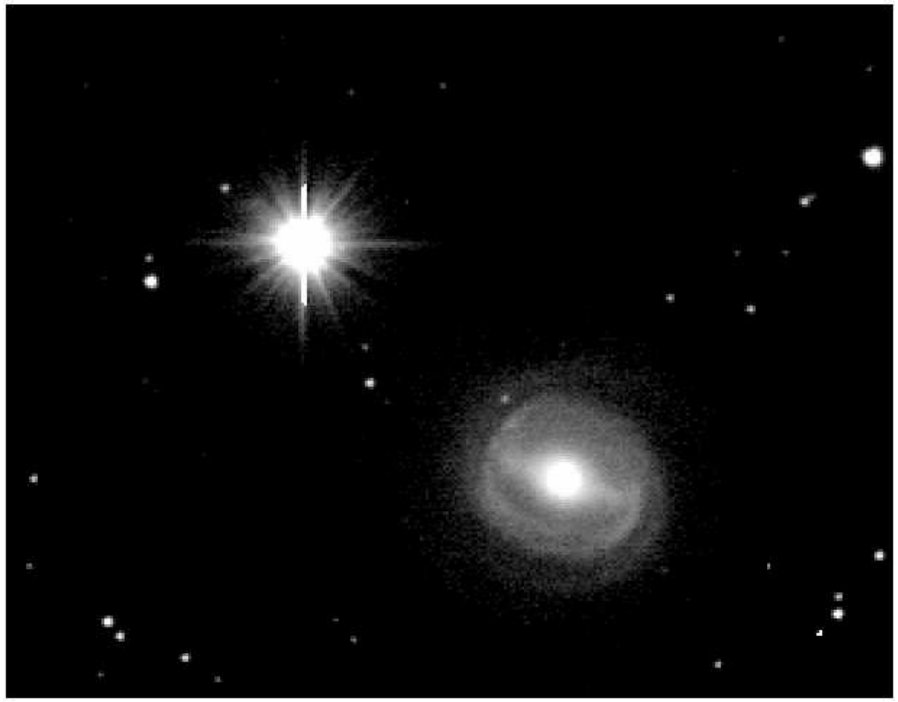


NGC 3783: *linear* intensity scale

What are AGN?

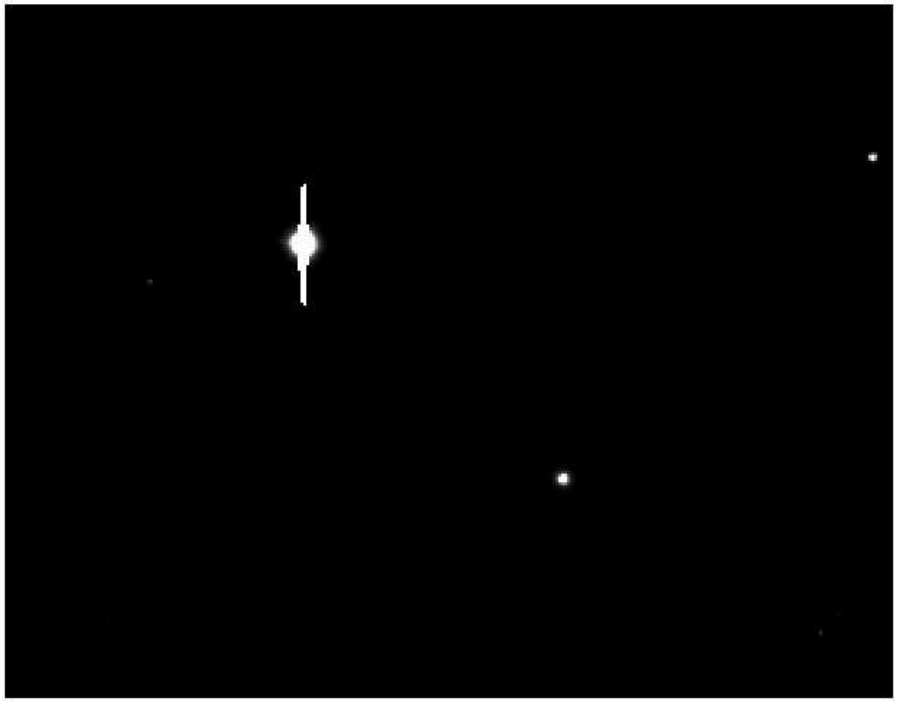


NGC 3783: *linear* intensity scale

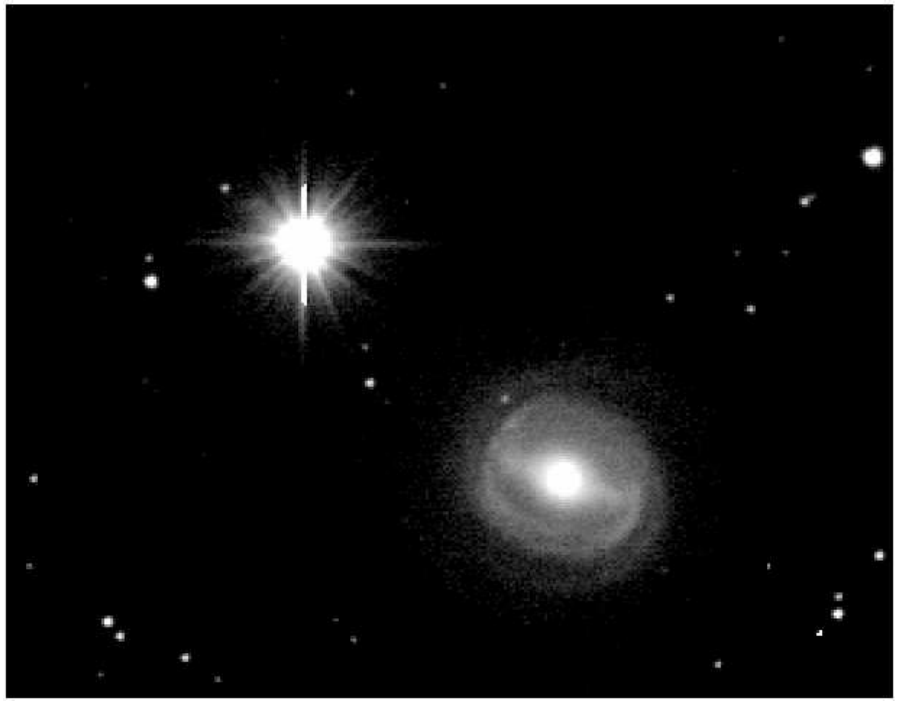


logarithmic intensity scale

What are AGN?



NGC 3783: *linear* intensity scale

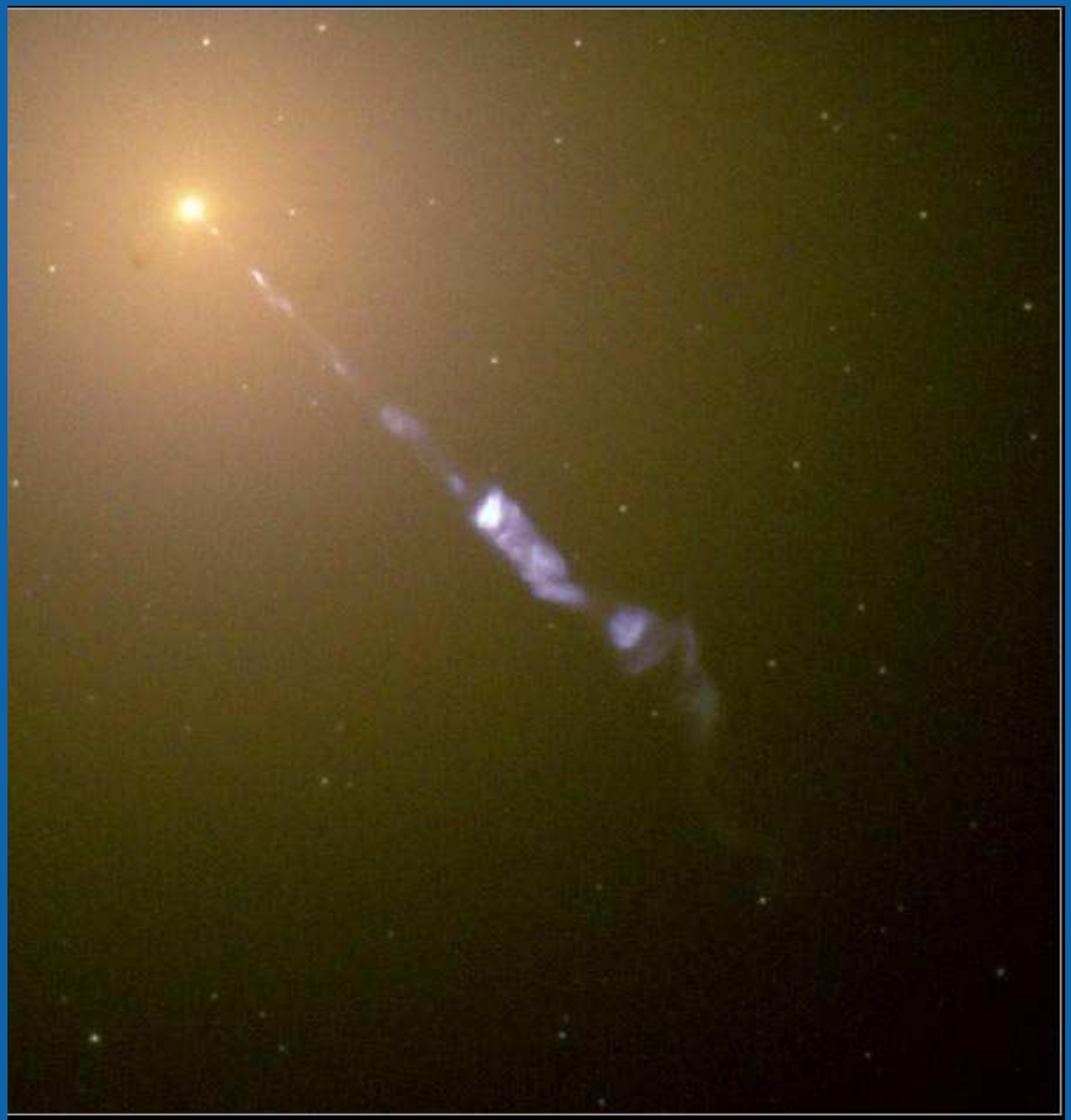


logarithmic intensity scale

Active Galactic Nuclei (AGN): supermassive black holes ($M \sim 10^{6\ldots8}\, M_\odot$),
accreting $1 \ldots 2\, M_\odot/\mathrm{yr}$
$\Longrightarrow$ luminosity $\sim 10^{10}\, L_\odot$ (comparable to galaxy luminosity)

M87 – R. Gendler

http://www.robgendlerastropics.com/M87NM.html


Hubble
Heritage
PRC00-20 • Space Telescope Science Institute • NASA and The Hubble Heritage Team (STScI/AURA)

What are AGN?

Observational characteristics of AGN:

- (Normally) high luminosity
- Emission throughout the electromagnetic spectrum (radio to keV, MeV, TeV)

  $\Longrightarrow$ spectrum is "nonthermal"
- flat νf_ν spectra: similar emission per frequency decade
- strong variability (days to years)
- radio loud sources: relativistic jets, which can be superluminous ($v_{\text{apparent}} \gg c$)
- broad optical lines ($v_{\text{characteristic}} \sim$ several$1000\,\text{km}\,\text{s}^{-1}$)

Outline

16 Oct	Introduction, History
23 Oct	AGN Taxonomy
30 Oct	Unification
6 Nov	Accretion and Accretion Disks
13 Nov	Measurement Methods
20 Nov	Continuum Emission and Broad Fe Kα lines
27 Nov	Line Diagnostics, Photoionization
4 Dec	**no lecture**
11 Dec	Broad-line Region
18 Dec	Narrow-line Region
8 Jan	Radio loud AGN
15 Jan	Jets
22 Jan	AGN Environment: Host galaxies
29 Jan	Cosmology: Quasar Surveys
5 Feb	AGN Evolution
12 Feb	Summary

Textbooks on AGN

PETERSON, B.M., 1997, An Introduction to Active Galactic Nuclei, Cambridge: Cambridge Univ. Press, 254pp., $45

Undergraduate level introduction to Active Galactic Nuclei, level is slightly lower than ours.

KROLIK, J., 1999, Active Galactic Nuclei: From the Central Black Hole to the Galactic Environment, Princeton: Princeton Univ. Press, 632pp., $57.50

The most comprehensive textbook on AGN available, covers much more material than what is possible here.

KEMBHAVI, A.J. & NARLIKAR, J.V., 1999, Quasars and Active Galactic Nuclei: An Introduction, Cambridge: Cambridge Univ. Press, 476pp., $50

Graduate level textbook, similar to Krolik, but often explains things from a somewhat different point of view.

Other Textbooks

BRADT, H., 2003, Astronomy Methods: A Physical Approach to Astronomical Observations, Cambridge: Cambridge Univ. Press, 458pp., €57.50

Summary of many technical details that are useful to know if you want to become a professional astronomer. Detectors, radiation processes, etc.

PADMANABHAN, T., 2000, Theoretical Astrophysics: Volumes 1–3, Cambridge: Cambridge Univ. Press, ∼ 500pp. each, ∼€60 per volume

Introduction to the (theoretical) physics of astrophysics. Short, concise, great. Graduate level, but understandable, although not for the faint hearted. . .

FRANK, J., KING, A., RAINE, D., 2002, Accretion Power in Astrophysics, 3rd edition, Cambridge: Cambridge Univ. Press, 398pp., €55.90

The standard textbook on accretion, covering all relevant areas of the field, including AGN.