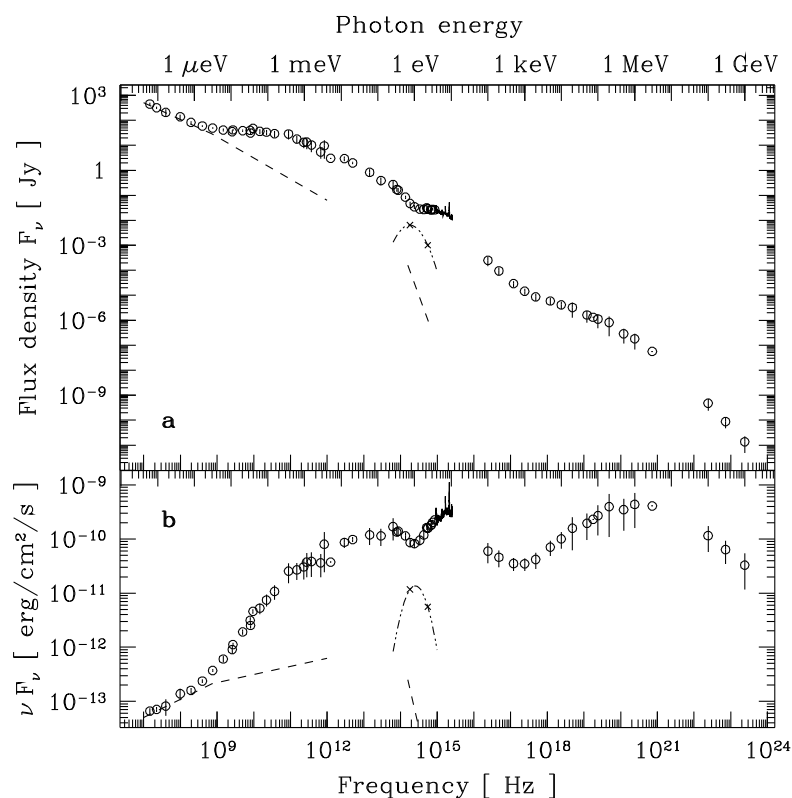


Active Galactic Nuclei

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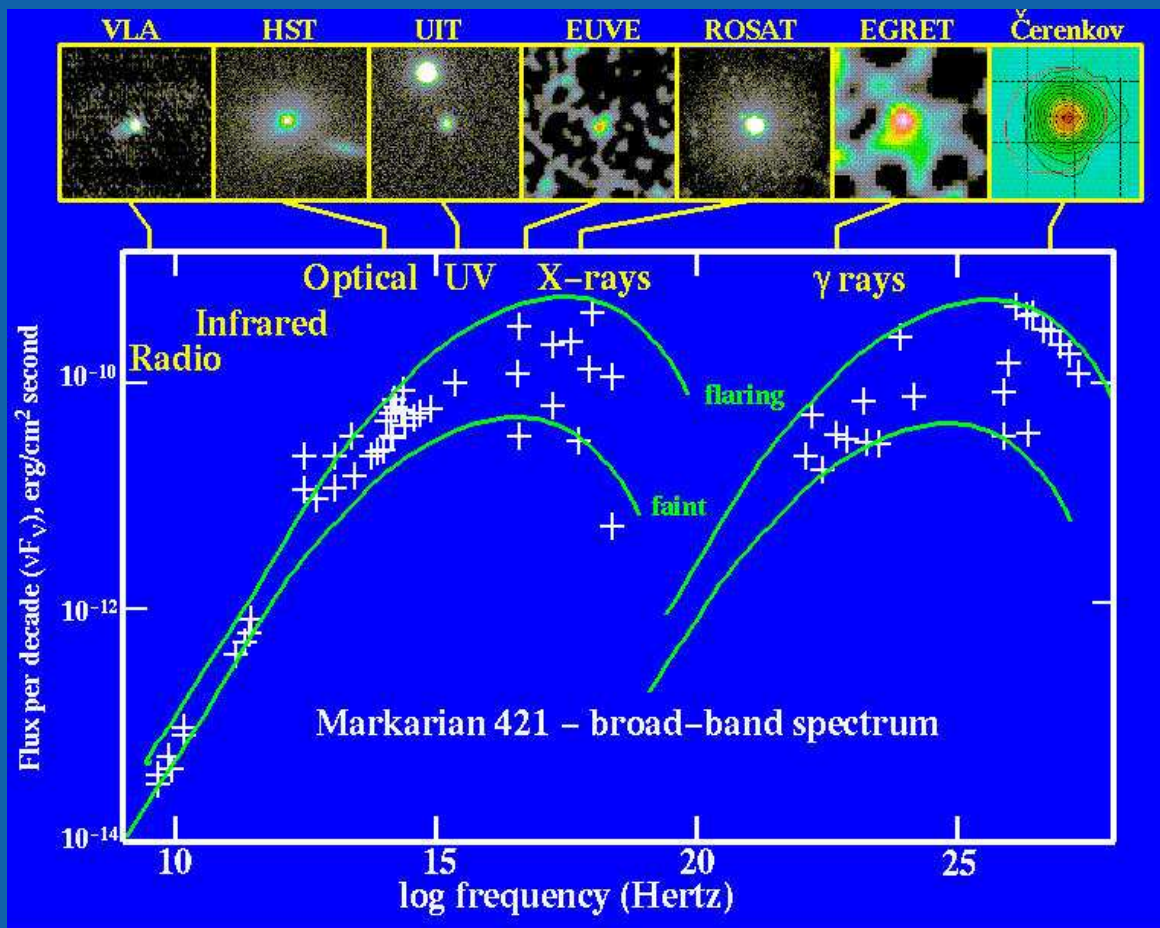
Broad Band Spectrum, I



Active Galactic Nuclei:
Emission over many
decades in energy

Türler et al. (1999): Spectral Energy
Distribution of 3C 273

Reminder: νf_ν -plot gives energy per
frequency decade

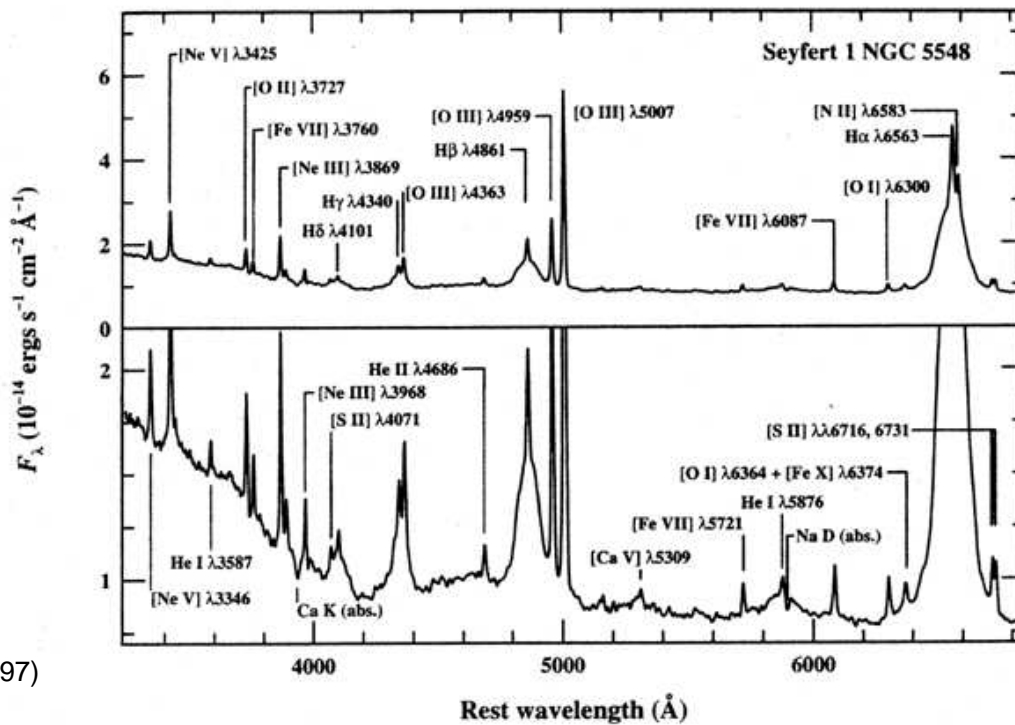


W. Keel

Radio Loud Galaxies: General model for broad band spectral energy distribution: **Synchrotron-Self Compton radiation**

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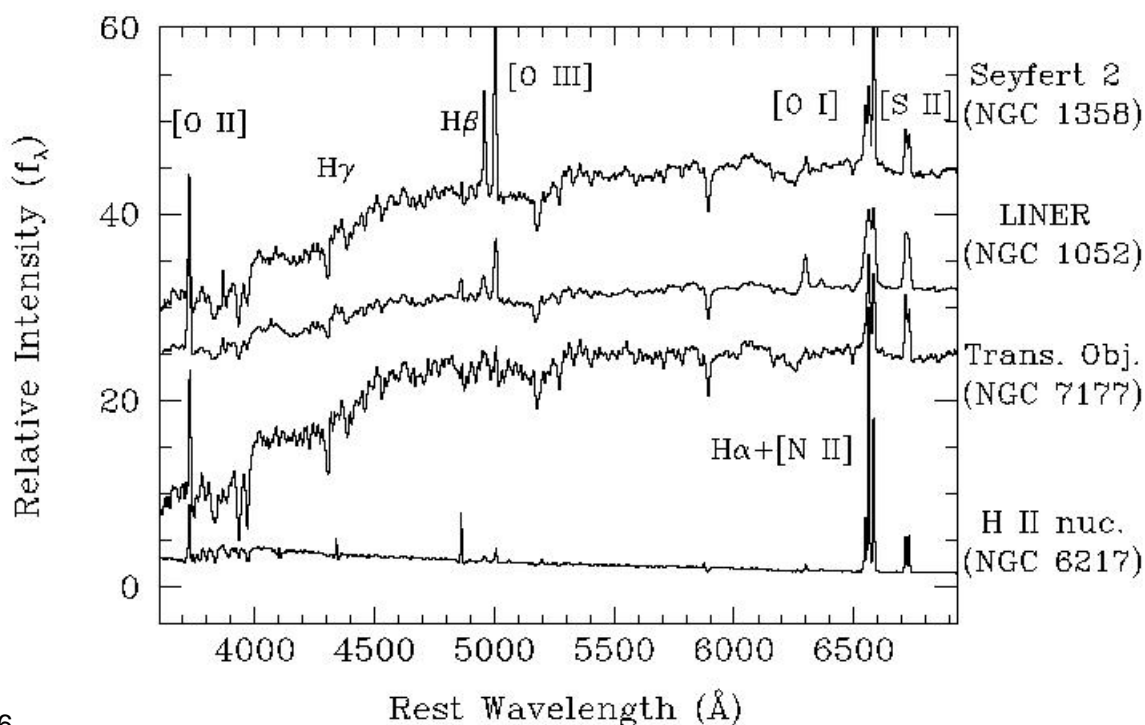
Seyfert Galaxies



Peterson (1997)

Optical/UV spectrum of NGC 5548: a **Seyfert 1 Galaxy**: broad lines!

Seyfert Galaxies



Ho, 1996

Seyfert 2 spectrum and sources with similar spectra: **narrow lines**

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Seyfert Galaxies

⇒ Center of AGN is copious source of optical emission lines, lines are indicative of the presence of many elemental ionization stages

Doppler effect: **Line width corresponds to velocity dispersion:**

$$\frac{\Delta\lambda}{\lambda} = \frac{\Delta v}{c} \quad (10.1)$$

“radio-quiet” AGN:

- Seyfert 1:**
- strong continuum from IR to X,
 - broad allowed lines (H I, He I, He II, **line width: 1000... 5000 km/s**),
 - narrow forbidden lines (O III, N II, S II, **line width ~ 500 km/s**).

- Seyfert 2:**
- weak continuum,
 - both forbidden and allowed lines have **line width ~ 500 km/s**.

“forbidden lines”: emission lines caused by higher than dipole transitions (see later)

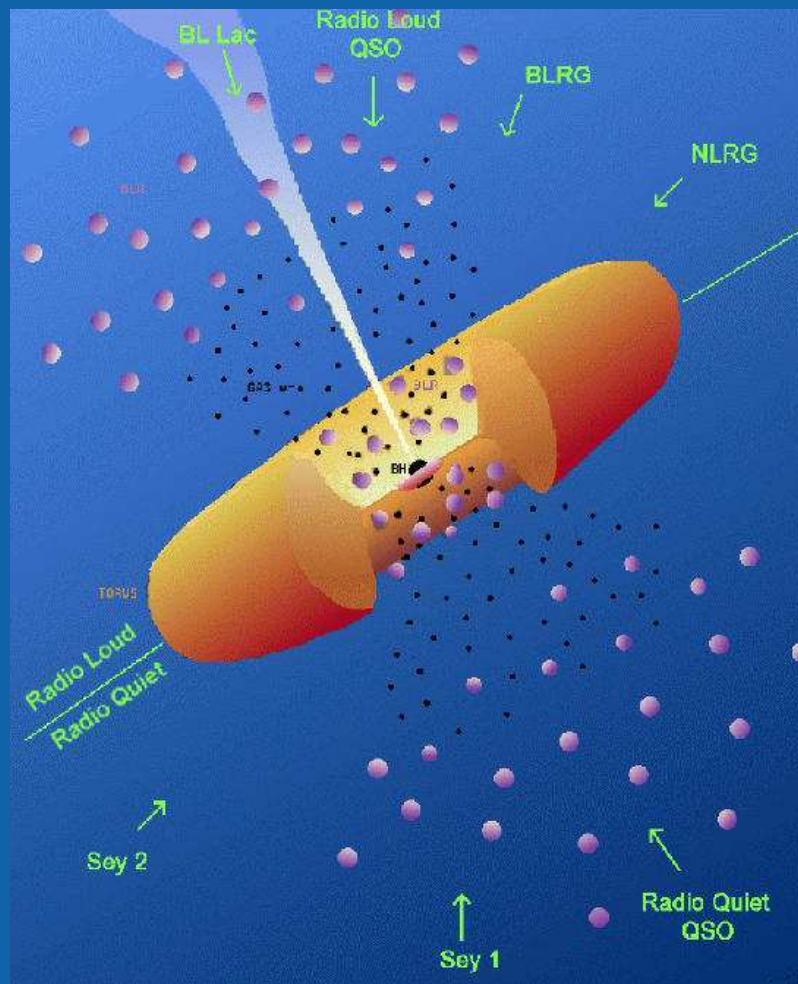
Similar behavior also for objects with jets (“radio-loud AGN”).

Classification in gory detail: Lawrence (1987), Urry & Padovani (1995)

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Urry & Padovani

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Line Diagnostics

Two types of AGN lines:

broad lines: FWHM: $\Delta\lambda/\lambda = \Delta\nu/\nu \sim 0.05 \dots 0.1$, i.e. $1000 \dots 10000 \text{ km s}^{-1}$

narrow lines: FWHM: $\Delta\lambda/\lambda = \Delta\nu/\nu \sim 0.002 \dots 0.1$, i.e. $\lesssim 100 \text{ km s}^{-1}$

Big questions: **What are the physical conditions in the absorbing gas?**

- Temperature?
- Density?
- Elemental Abundances?

⇒ **Line diagnostics!**