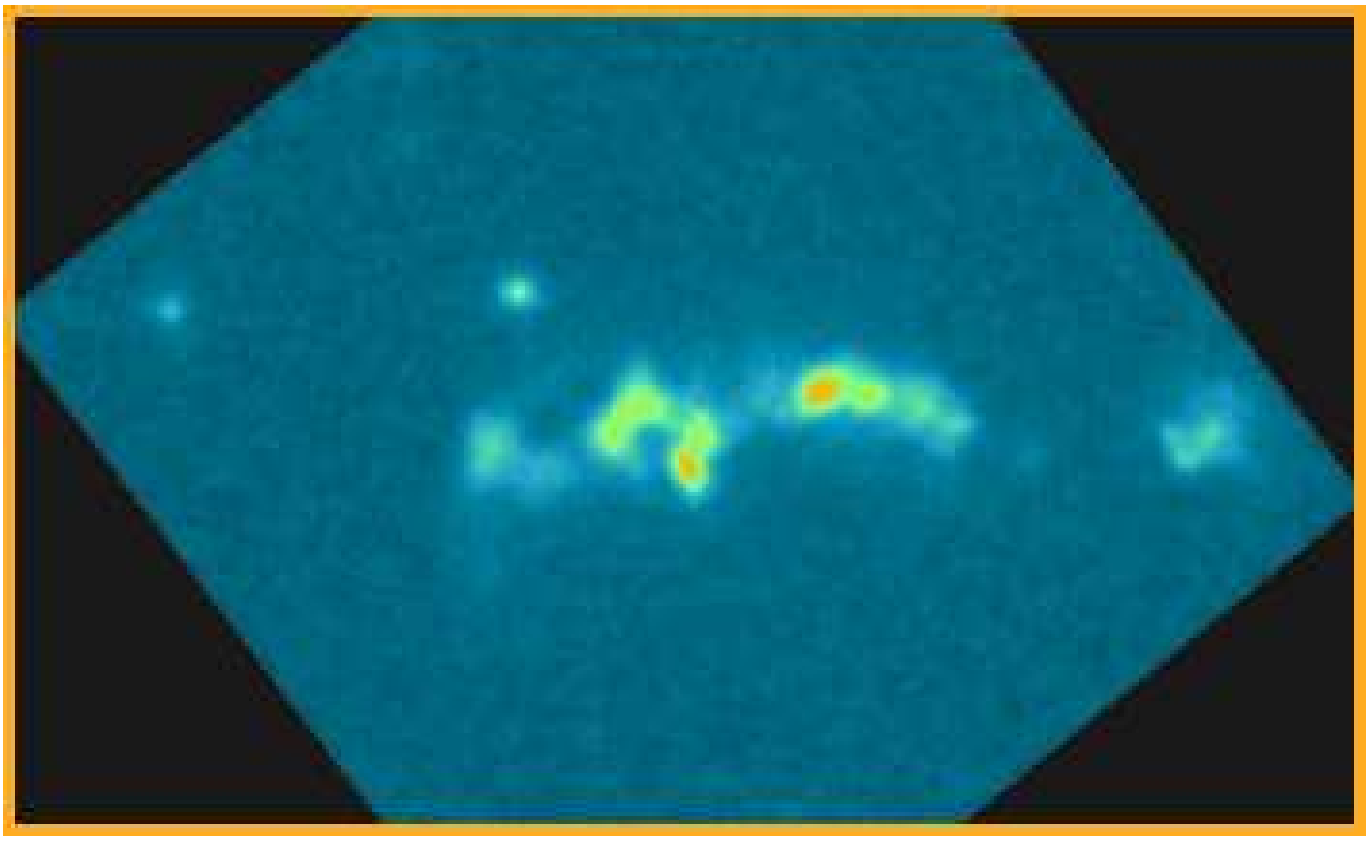
Quasar hosts

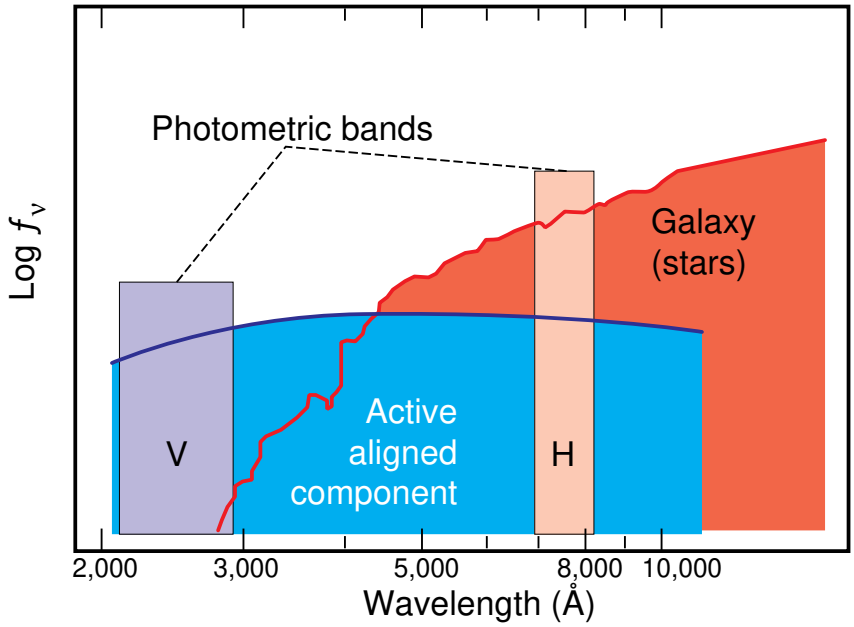
Introductory remarks

In our observations of these active objects, how do we differentiate between the stellar evolutionary processes in the galaxy and the AGN-induced extranuclear phenomena?



3C 324 (z=1.2) HST, PC (F702W) observation courtesy Mark Dickinson & Richard Hook

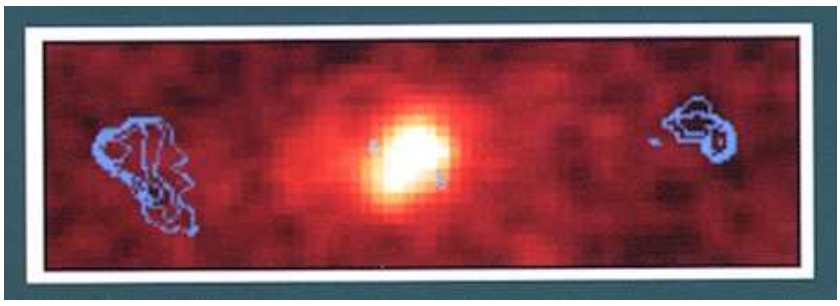
The importance of rest-frame waveband



In the high-redshift radio galaxies which exhibit the alignment effect, the observed properties above and below the 4000Å break are different

The longer wavelength images are smoother, rounder and more 'elliptical-like'

The rest-frame UV images are clumpy, elongated and generally polarized



3C 324

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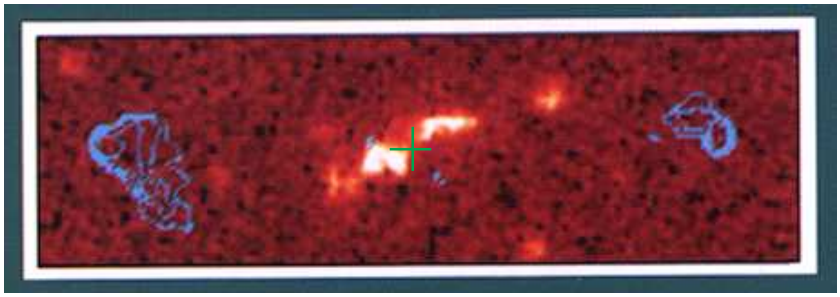


HST, F814W

(Best, Longair & Röttgering)

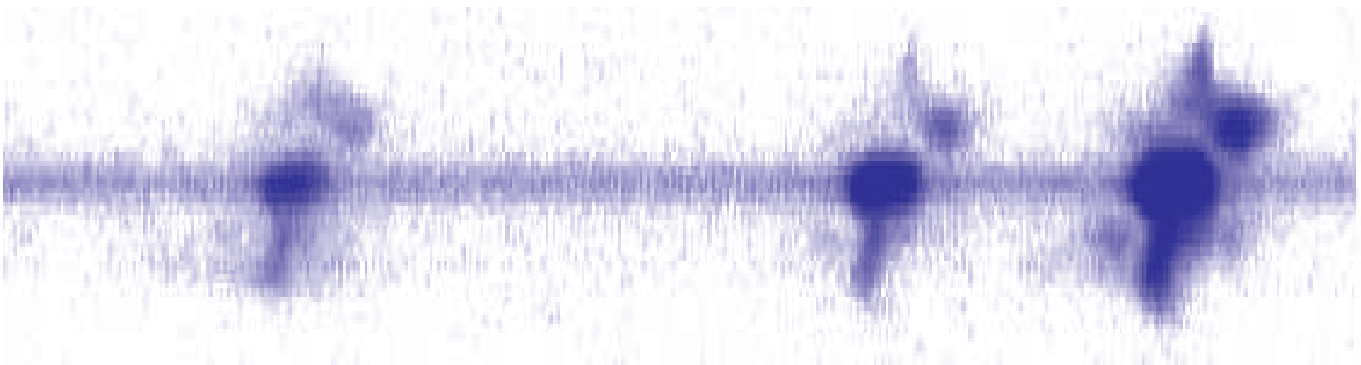
Contributors to the extended light in the radio galaxies

- Starlight (seen above the 4000Å break)
- Nebular continuum
- Extended emission lines (ionized by a hard continuum) with kinematically disturbed components (see 3C 171 below - Tadhunter et al.)
- Scattered quasar continuum
- Scattered quasar broad lines, eg. Mg II
- Scattered quasar (high critical density) narrow lines, cf. the [OIII] vs. the [OII] Jackson-Browne test

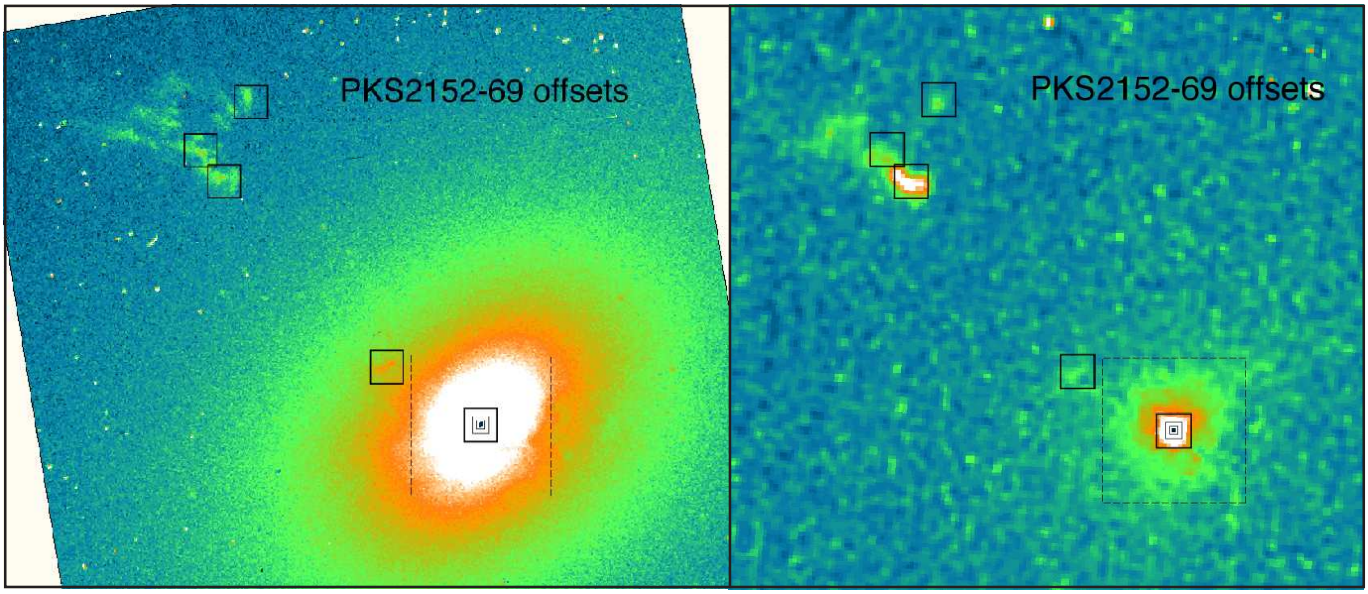
The scattered components are measured using imaging- and spectro-polarimetry

Extranuclear physical processes

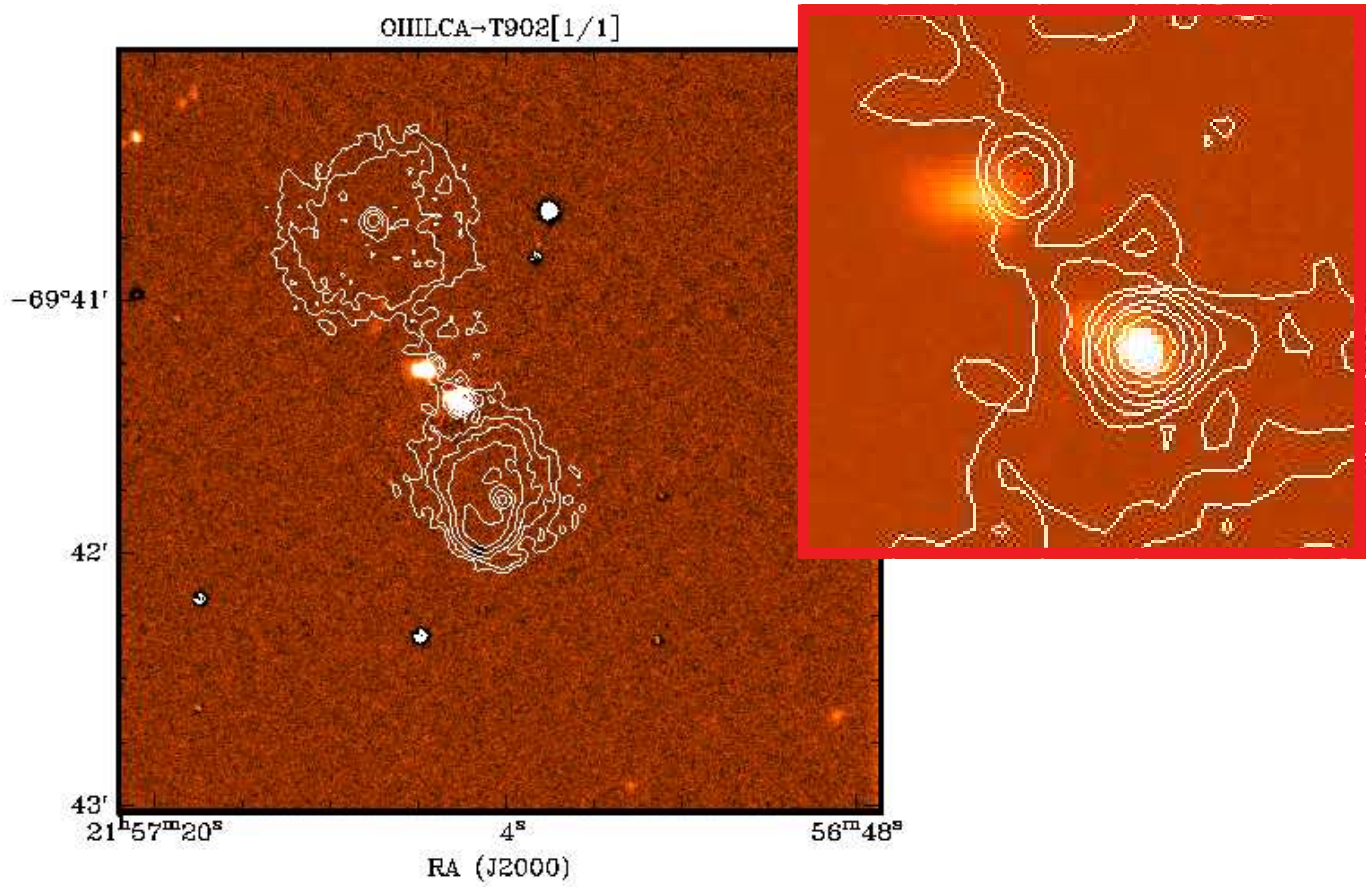
- Photoionization of the ISM by the AGN
- Scattering of the AGN radiation by dust and electrons
- Jet/cloud interactions and associated shocks
- AGN-induced star formation



Example of jet/cloud interaction in PKS 2152-69

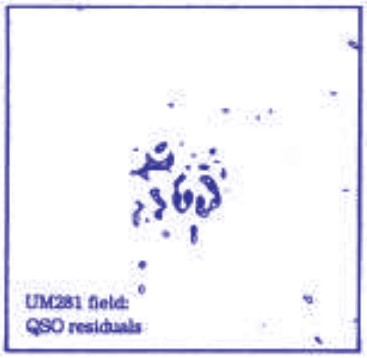


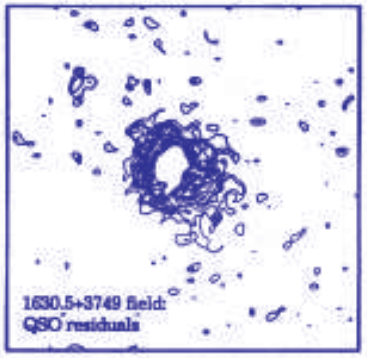
HST, F606W F300W

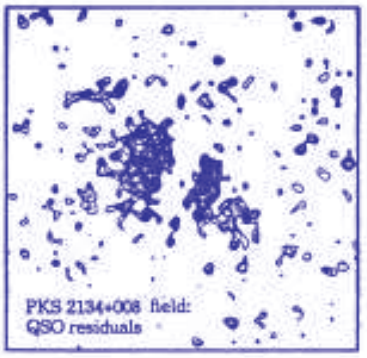


AT 6cm + NTT [OIII]

What do the phenomena observed in the galaxies imply for observations of the quasars?







Aretxaga, Boyle & Terlevich, 1995

If the powerful radio galaxies and the radio quasars are from the same parent population, the quasars must exhibit pseudo-hosts

These will be most apparent at shorter wavelengths where the AGN-induced activity dominates over a cool stellar population

These pseudo-hosts will contain the same components that we see in the aligned radio galaxies — but the scattered component will be relatively enhanced by the forward directed phase-function of the scattering particles

The magnitude of the effect can be estimated from the properties of the 3CR sample at a redshift around 1. We expect 10–15% of the quasar light to form a non-stellar pseudo-host

This hypothesis may be difficult to test using polarimetry, but high spatial resolution long-slit spectroscopy with HST is promising

Some of the new observational techniques since the 1989 ESO workshop on extranuclear activity

- HST -> high spatial resolution with high dynamic range
- Keck -> revolution in polarimetric capability etc!
- Revolution in near- and mid-IR capability
- Improvements in ground-based resolution (AO)
- FIR -> mm bracketing of the cool dust emission spectrum
- Ability to measure the molecular gas at high z
- Higher resolution and sensitivity of the x-ray observations
- '3D' spectroscopy

Some of the open questions

How is the star formation and the AGN formation coupled?

Will observations of the underlying galaxies resolve the radio loud/quiet dichotomy?

The nature of the radio quiet 'radio galaxies' at high redshift?