Discussion: life cycles

Why do we care about life cycles?

Relevance to feedback:

- How much energy is released into the environments?
- On what size scales? On what time scales?
- What is the environmental impact of GPS/CSS sources?
- What is the jet injection history of a typical low redshift galaxy (as function of mass, environment)?

Relevance to AGN physics:

- What determines the timescale of activity? Is it fueling?
- Are lifetimes different for FRI/FRII or LERG/HERG?
- BCGs in cool cores suggest that galaxies will be active as long as they are fed.

How do we determine accurate ages of radio sources? (Mahatma, Brienza)
Spectral vs. Dynamical ages?
Agreement in CSOs (Orienti)

Are there multiple timescales for activity?
e.g. short timescales related to the accretion disk - Schawinski et al. 2015?

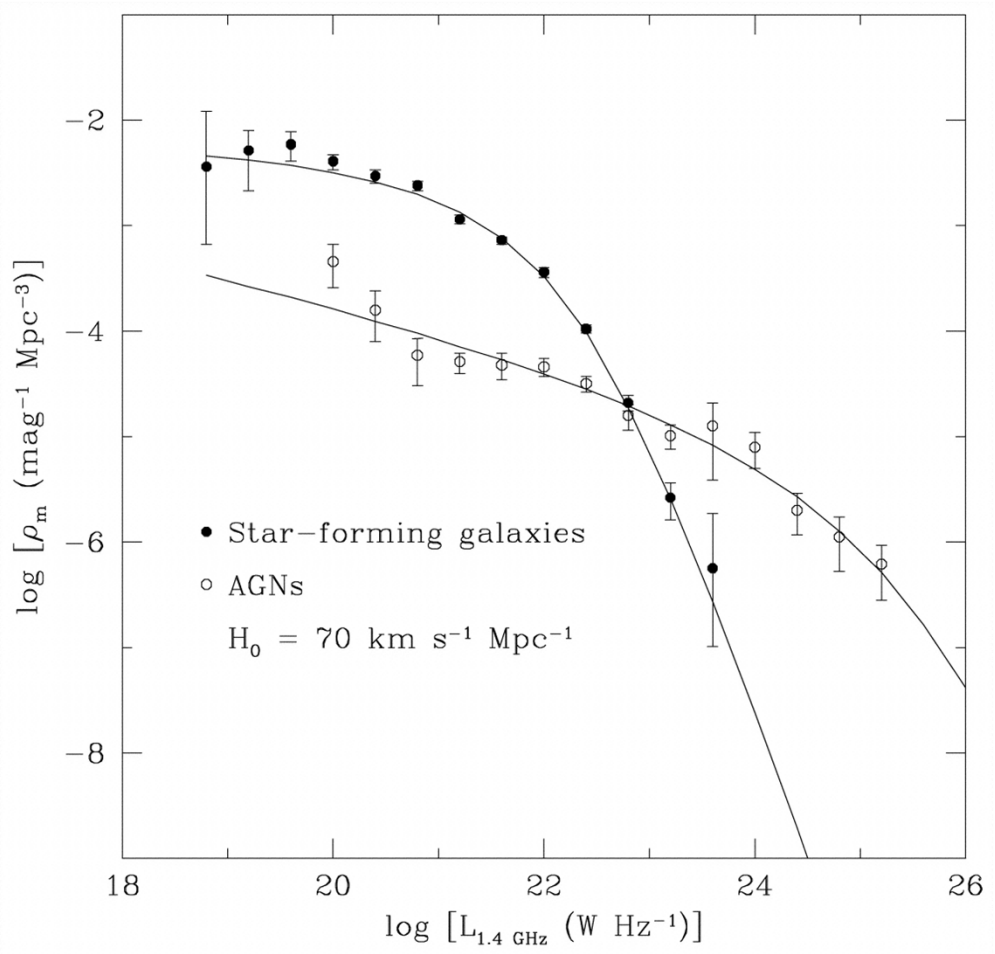
Are there different classes of objects which differ in their life cycles (Orienti, Dallacasa, Wolowska)?
Are there intermittent or short lived radio galaxies?

What are the radio transients (Wolowska)?

How often do radio sources become active? (Callingham, Jamrozy, Jurlin)

How can we move from small sample studies of young sources, relic/remnants etc to population-wide conclusions?

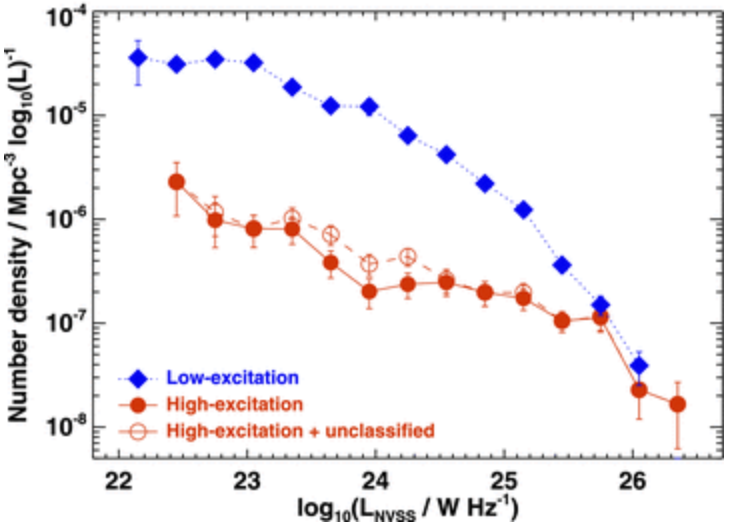
What sample selection and follow up activities should we be doing with LoTSS and other large radio surveys to pin down life cycles?

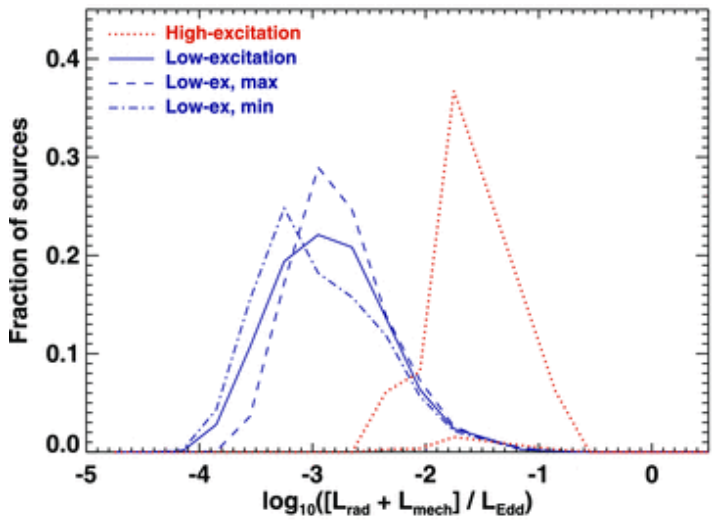


Local 1.4 GHz luminosity functions of radio sources powered by star-forming galaxies (filled circles) and by AGNs (open circles) derived from the UGC/NVSS sample. Abscissa: log10 1.4 GHz spectral luminosity (W Hz^{-1}). Ordinate: $\log_{10}$ space density of radio sources per "magnitude" = dex(0.4) in radio luminosity (mag^{-1} Mpc^{-3}). (Condon, Cotton & Broderick 2002, AJ, 124, 675).

Two Accretion Modes

- At low radio power the LEGs dominate. These low powers are characteristic of FRIs. Thus, at the lower powers, LEGs have higher duty cycle (i.e., have longer lifetimes or are active more frequently) than HEG.
- At the higher radio powers the numbers of HEG and LEG are more comparable.
- Radio jets produced in both accretion modes.

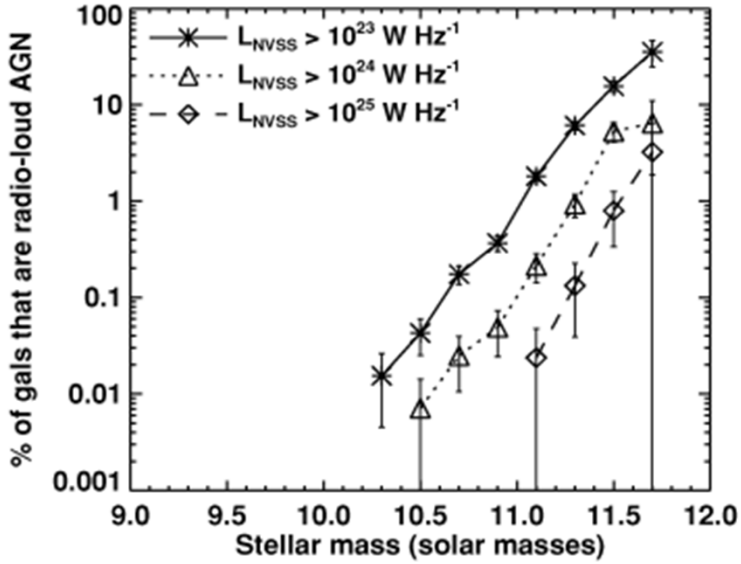




(Top) The local radio luminosity function at 1.4 GHz, derived separately for the HERG and LERG populations. (Bottom) the distribution of Eddington-scaled accretion rates for the LERG and HERG populations separately. For the LERGs, the solid line shows the best estimate distribution, using the calculated values of the radiative luminosity. For the HERGs, the dotted line is plotted with two different normalizations: the upper line shows the fraction of sources relative to the total number of HERGs, while the lower line shows the fraction relative to the total number of LERGs to allow direct comparison of numbers with the LERGs. (Best & Heckman 2012).

Duty Cycle Scales with Radio Power and Galaxy Mass

- Massive galaxies are radio sources more frequently.
- Galaxies are active more often at lower radio power.



The fraction of galaxies which are radio-loud AGN, as a function of stellar mass (Best+2005).