Palomar Proposal: Star Formation Rates of Faint Radio Galaxies

Frank Masci, Tom Barlow, Jim Condon, Jason Surace, Dave Shupe, Glenn Morrison, JoAnn O'Linger, Carol Lonsdale, Perry Hacking

We are proposing to use the COSMIC multiobject spectrograph to obtain spectra of about 100 faint radio sources from a deep 1.4GHz survey. The sources are detected to microjansky flux levels and are from recent VLA imaging of two $33' \times 33'$ fields, initially planned for deep follow-up with WIRE. Previous studies show that faint extragalactic radio sources are predominately associated with star formation activity rather than active galactic nuclei. Their radio flux density is known to be a reliable indicator of star formation rate for local galaxies (eg. Cram *et al.* 1998; astro-ph/9805327) and is now starting to provide strong constraints on the history of star formation at redshifts $z \gtrsim 0.5$. Radio emission has the advantage of being independent of extinction by dust, which has severely hampered determinations of star formation history from optical/UV data.

Our deep radio data covers ≈ 0.6 square degrees and is $\sim 100\%$ complete to a limiting RMS sensitivity of 20μJy. This is the deepest so far with which to explore the star formation history (cf. Mobasher *et al.* 1999 who reach an RMS 60μJy; astro-ph/9903293). The exact number of radio sources detected to this flux limit in our fields is uncertain, however extrapolating from existing surveys, we estimate of order 150-200 sources per $33'$ square field. Previous work suggests that our faint radio sources will sample the bulk of star forming galaxies at redshifts $z \lesssim 1$. We initially plan to obtain spectra of about 100 of these sources corresponding to one $33'$ square field. The spectra will allow us to estimate three quantities: first, a 1.4GHz luminosity function (pending on sufficient statistics); second, the star-formation rate density at $z \sim 0.5 - 1$ from radio luminosities using an appropriate calibration, and third, the star formation rates implied by Hα(λ6563) (or [OII]λ3727) line luminosities. This latter measurement will check whether the optical and radio derived SFRs are consistent and whether extinction by dust is important.

We already have deep R-band imaging for our radio fields to $R \sim 26$. Our targets will be carefully selected to ensure inclusion of the faintest (and highest z) radio sources accessible to COSMIC's spectroscopic limit of $R \sim 23$. With typically 20-30 objects per spectroscopic exposure in COSMIC's $13.65'$ square field of view, we will require about 5 separate spectroscopic fields. We will aim for a signal-to-noise ratio of ~ 10 which will require about 5 hours integration on each field. Our fields will be accessible during the second-half of nights in the July 5-12 period. We envisage needing at least 7 (half-)nights (including overheads) to complete one of our radio fields. An attempt will be made to obtain spectra of our second radio field in future observing runs.