The Stanford Cluster Search (StaCS): Spectroscopic Cluster Confirmation

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Generation of the cluster catalog:

- Using deep R-band images from the Lawrence Berkeley Lab Supernova Cosmology Project (SCP) data base ($R_{lim} \gtrsim 23.5$)
- Process images to produce galaxy catalogs (using FOCAS, IRAF, local software), feed these into a matched filter algorithm to generate likelihood maps (see companion poster: Willick, Mathiesen, & Thompson)
- Cross-check candidates with:
  - visual inspection of the images
  - inspection of the (apparent) luminosity distribution in the region (see plots)
  - check for known clusters (!)
- Confirm candidates with Hobby-Eberly Telescope (HET) spectroscopy

Initial Results:

- First cluster, STACS J0104.8+0430, confirmed with 7 $z \sim 0.40$ redshifts using the HET Marcario Low-Resolution Spectrograph (see image and plots)
- ~ 1.5 square degrees analyzed with matched filter algorithm, a growing number of candidates (currently > 20) await HET observations; we are getting significant signal for intermediate richness clusters, so our completeness will be high
- STACS acronym registered with the IAU

Near-term work:

- Process entire SCP data base to establish candidate list and procede with HET spectroscopic confirmation
- Fully correct for drop-outs in the galaxy distribution caused by edge effects and saturated stars in the images
- Refine matched filter, K-correction, and richness estimator using confirmed clusters; this can make use of previously-known clusters in our fields, such as the $z = 0.83$ rich cluster MS 1054.4−0321 (=STACS 1056.9−0337)
- Calculate accurate effective co-moving volume and completeness for the survey including corrections and refinements identified above

Long-term work:

- Mass determination
  - Velocity dispersion determination: 100-200 redshifts per cluster
  - X-ray observations
  - Sunyaev-Zel'dovich effect microwave measurements
- Use other deep image databases to increase the comoving volume at high redshift
- Track cluster properties through high redshift to refine matched filter for trans-$z = 1$ searches