Galaxy Evolution at the Keck Diffraction Limit

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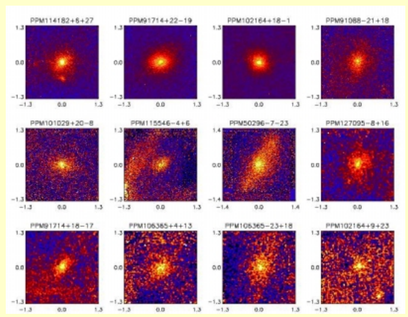
Introduction

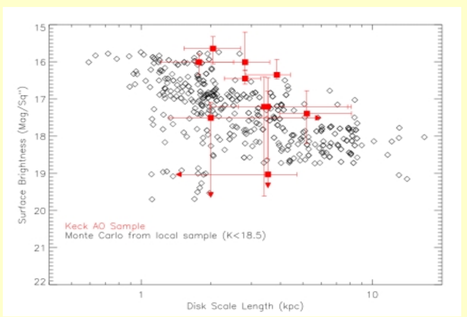
This poster summarizes recent developments in the Keck AO Imaging Survey of Faint Field Galaxies. The combination of NIRC2 and Keck AO has expanded the number of galaxies in the survey by an order of magnitude. The original survey included 12 galaxies brighter than K=18.5 magnitudes observed with KCAM, NIRSPEC/SCAM, and Keck AO. These galaxies had an average redshift of 0.55, and demonstrated the usefulness of AO in measuring galaxy morphologies. From this data, disks were measured to be 0.6 mag/□" brighter than similarly-sized disks of local spiral galaxies, while bulges showed no size evolution relative to their local counterparts.

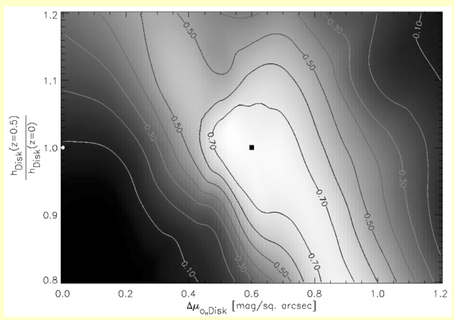
NIRC2's increased efficiency, field of view, and sensitivity will enable us to solidify results from the original survey, and investigate a number of additional questions about galaxy morphology and evolution.

Initial AO Survey

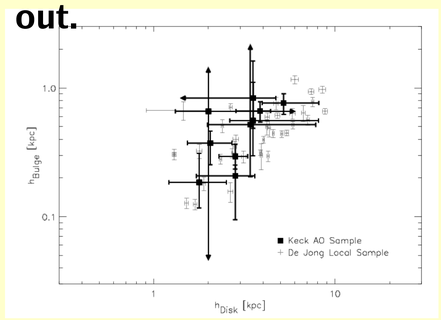


The initial sample of 12 galaxies observed with the first generation of Keck AO cameras (~4" sq. field of view). Brighter than K=18.5, these galaxies have an average redshift of 0.55.





Disks at z=0.55 are brighter than local disks (DeJong sample, 1996) by ~0.6 mag/□", without size evolution. Local sample has been corrected to reflect our selection effects. K-S test shows no disk-evolution case is ruled out.



Bulges do not show significant size evolution at redshift z=0.55. Applying our selection effects to local sample is harder than for disks, since disk brightness is what dominates selection.

(Glassman et al., ApJ, 2002, in press)

Acknowledgements

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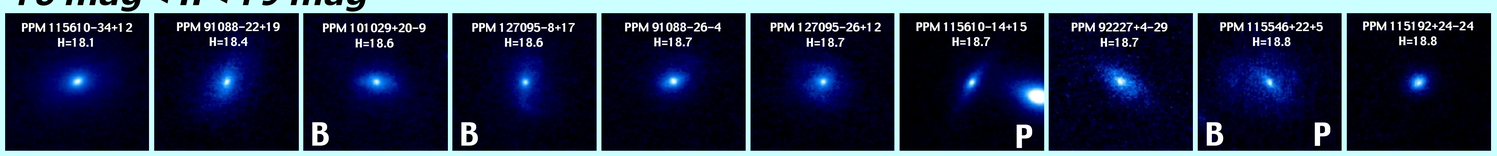
We also wish to recognize and acknowledge the very significant cultural role and reverence that the summit of Mauna Kea has always had within the indigenous Hawaiian community. We are most fortunate to have the

NIRC2 Survey

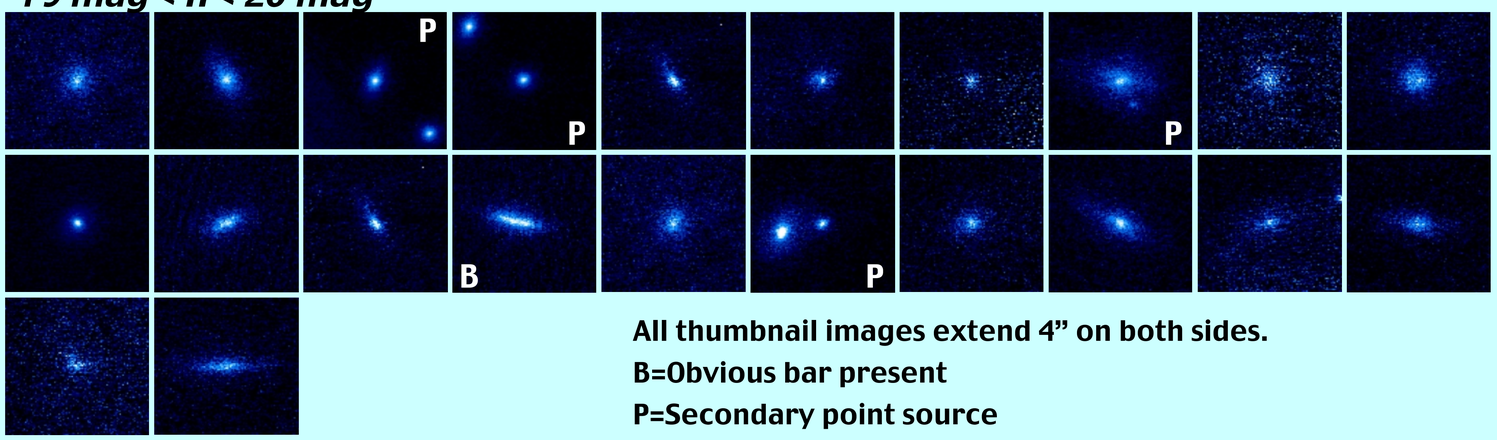
These thumbnails are an incomplete sample of 41 galaxies with H < 20, derived from NIRC2 H-band observations of 17 faint galaxy fields. NIRC2 observations have been made from August, 2001 to June, 2002, and some were carried out in cooperation with the NIRC2 commissioning team. In total, the 17 fields are estimated to contain approximately 300 galaxies to an average sensitivity limit of H=22 magnitudes. This sensitivity limit corresponds to an average exposure time of ~1 hour per field.

H < 18 mag

18 mag < H < 19 mag



19 mag < H < 20 mag



All thumbnail images extend 4" on both sides.
B=Obvious bar present
P=Secondary point source

Preliminary and ongoing analysis of the above (incomplete) sample indicates:

- 20% have close binaries or point sources within 2".
- >20% have bars (20% have an obvious bar).
  - Deep HST imaging shows only 4% have bars at z~0.7 (Van den Bergh 2002).
- Fainter (H > 20) objects seem to lack central core.

Further analysis efforts will utilize developing tools such as:

- Subtraction of azimuthally averaged galaxy from actual galaxy image.
  - Will help to pick out non-radially symmetric structures like bars.
- Spatially-varying PSF estimation throughout the NIRC2 field of view.
- Detailed comparisons with local samples.