Spitzer Warm Mission: Distant Universe

- What kind of programs should be done?
- What are we missing?
- Programmatic issues

Strawman Programs

- Ultradeep: 150 sq.arcmin, 2500 hours, 250 hours per pixel, depth ~ 0.04 _Jy
- Deep: 2 sq.degrees, 7500 hours, 15-20 hours per pixel, depth ~ 0.4 _Jy
- Wide: 500 sq.degrees, 4000 hours, 120 seconds per pixel, depth ~ 5 _Jy

Ultradeep Survey

- Current deepest IRAC imaging is 100 hours in the HDF-N of GOODS. These data not yet fully analyzed but there is a concern that going longer will not yield significantly deeper photometry because of confusion and IRAC detector issues.
- Another issue is that if JWST launches and operates as planned that it will be able to more easily investigate a similar parameter space in terms of depth, wavelength, and area.
- This survey currently ranks as a lower priority

Deep Survey

- Science return from a survey going to regular GOODS depth covering a few square degrees is viewed as certain to be very high
- Science already highlighted yesterday by Pieter van Dokkum: identification of significant samples of galaxies and AGN at $z > 6$, detect fluctuations in CIB due to Pop III stars, detailed study of large and well-defined samples of normal galaxies at $1<z<3$
- Several excellent fields including COSMOS, EGS, SDF, E-CDFS which already have ancillary data. Requires adequately deep NIR data which are on the way via UKIDSS, VISTA, and possibly WF3.

Wide Survey

- Rare object survey and could be combined with low-z rare object surveys for i.e. brown dwarfs
- Science: find luminous/distant quasars which would serve as probes of the reionization epoch as targets of JWST, and discover galaxy clusters at $1 < z < 2$
- Mythbuster: current generation of wide area IRAC extragalactic surveys **are** finding rare objects. The IRAC Shallow Survey has discovered one $z > 6$ quasar and 10 galaxy clusters at $1 < z < 1.5$. SWIRE is only now able to do similar science because they are getting the necessary ancillary data.

Wide Survey

- Thus the importance of ancillary public data is clear. In particular we require deep multiband optical imaging over the entire survey area of ~500 square degrees. NIR very useful (e.g. UKIDSS, NEWFIRM, VISTA) but not critical for clusters and unlikely to get deep enough for the high-z quasars.
- Ancillary data will drive the selection of the fields. Large scale structure studies require a very small number, i.e. 2-3, presumably distributed north/south.
- Possibilities include CFHT Legacy (170 square deg), SDSS equatorial strip (250 square deg), BCS (100 square deg), within VISTA/DES

What science are we missing?

- Lensing clusters as a way to find z > 6 galaxies
- Pair-creation SNe at z~10 as a dark energy probe
- Baryon acoustic oscillations

- The science we haven't thought of yet

Operational Concerns

- Allowance should be made during the review process for smaller/targetted/future science programs
- 5 year duration of warm mission not guaranteed
- So we should provide the best high profile science to the SSC Director. The deep and wide programs provide very high profile science such as identifying quasars at z > 7 to probe the epoch of reionization, the study of fluctuations in the cosmic IR background, and the discovery of the first galaxy clusters at z ~ 2

- Also demonstrate that IRAC time would continue to be oversubscribed during the warm mission to help ensure NASA approval of the necessary funding. Oversubscription from **only** the distant universe programs considered here is **not** high: 15000 hours for a 5 year mission.

- Thus some lingering concern: are we thinking big enough? Because of the desire for efficiency combined with the ability of IRAC to reach great depth quickly it is difficult to strongly justify surveying even larger areas. It may be that we need to think harder about the long-term value of eg a larger extragalactic survey to provide legacy science capability in the era of PanSTARRS, LSST, SPT, and ~JDEM.