Summary: KPAO Galactic Science telecon 01/31/06

==========
Telecon: KPAO Galactic Science sub-group
01/31/06

Liu, Macintosh, Ghez, Metchev, Weinberg, Hillenbrand
==========

>>>>> Action Items <<<<<

GHEZ, WEINBERG:
- send draft science text for Galactic Center
  include science goals a.f.o. astrometric errors
- using KPAO baseline, do simple estimate for confusion limit

MACINTOSH:
- develop tractable simulation plan w/Neyman for KPAO contrast
- circulate TMT science case for Taurus imaging, if possible

LIU:
- discuss crowded field simulations with Technical sub-group,
  potential overlap between Gal Center & Extragalactic needs
- talk with Metchev

HILLENBRAND, GREENE:
- send top-level science case for scattered light imaging of protostars

For the science cases, please be sure to highlight the following
- are the KPAO baseline requirements sufficient?
- any special requirements on the science instrument and/or AO?
  (e.g. IR tiptilt)

Suggested completion date: in 3 weeks time (~Feb 20)
next telecon week of Feb 20-24

Possible list of science topics to pursue
- Galactic Center
- Direct imaging of massive planets
- Debris disks
- Circumstellar environment of protostars
(- Brown dwarf multiplicity)

Possible science requirements raised:
- IR tiptilt
- AO telemetry and PSF reconstruction
- High contrast: small internal WF errors, calibration, coronagraphy
  large contrast @ moderate separation (~0.5") VERSUS
  modest contract @ very small separations (~few lambda/D)

- High spectral resolution IFU for Galactic Center orbits

Greene: must achieve the promise, esp. compared to JWST
  very stable & high Strehl

Galactic Center (Ghez & Weinberg)
  dynamics of central arcsec
  confusion limited at ~16 mag
  for very accurate measurements (distances & dynamics), need high Strehl
    currently limited by astrometric biases
    need deeper maps, resolve individual sources
  NGS: astrometry not that much more useful compared to Speckle
    LGS has been a big gain
  distance to Galactic Center (R_0)
    error in halo shape figures into R_0
    need proper motions & RVs
  general relativistic effects
    BH spin --> 30 microarcsec
    extended central mass (low-mass stars, remnants) --> 50 microarcsec
      (depends on assumed mass distribution)
    dark matter cusp
  Hard to quantify confusion issues --> need simulations
    ** may be overlap with extragalactic needs **
    TMT paper: simple treatment - computed confusion limit
                and then used as hard floor.
               did not account for astrometric errors from
                objects brighter than confusion limit
  KPAO much preferred over Keck Interferometer b/c crowded field
  could give: {x,y}, magnitudes, and epoch to simulators
    then process the image for astrometric accuracy

Imaging planets around VLM stars & brown dwarfs
Macintosh: Faint point source detection
  "non-trivial" simulations needed
    overall AO system performance ("least important")
      need to run simulation for 10-30 seconds (very intensive)
    static errors:
      internal calibration (alignment, non-common path)
      primary mirror errors
    residual diffraction (segment gaps)
  can make "order-of-magnitude" guesses based on work to date
  static effects **dominate**
    pay a lot of attention to small internal errors
    not focus on increasing the Strehl
    "very good contrast" system could have big science payoff
  Neyman does not have a good model yet for 120 nm LGS system
  Metchev: what about real-time telemetry
    Macintosh: not an issue for this pt source case
        b/c these PSF features are caused by things invisible to WFS
        would help for debris disks, where PSF subtraction important

Metchev: dmag(J)~13 mag at ~0.5 arcseconds --> planets in the Hyades
        for G stars, so will be done with Gemini/GPI
Liu: M stars in Hyades, nearby young M stars
    solar neighborhood census will be much advanced in ~5 years
** ExAO vs KPAO comparison needed **
need to do primary mirror modeling
** planned Feb 8/9/10 meeting with Neyman **

larger contrast at large angles vs
  smaller contrast @ moderate angles (~few lambda/D) ??
    matters for science instruments
    e.g. BD binaries, Taurus multiplicity

Debris disks: Liu, Macintosh
would benefit from dual-channel polarimetry
current systems have only been able to study edge-on systems
  if optical performance is similar to current near-IR,
  may also be restricted to edge-on systems
  higher Strehl in IR may be more favorable to finding non-edge-on systems
optical scattering brighter than near-IR
how many sources to be imaged?

Scattered light imaging of protostars: Greene, Hillenbrand
model amount of mass, evolutionary/circumstellar state
** IR tiptilt needed **
some systems are seen in the visible
Hillenbrand: sources are large in Taurus (up to 40")
        have done seeing-limited studies & modeling
        see Eisner et al 200x
            AO PSF issues may be problematic
Liu: could extend to regions at larger distances with AO
unlikely to be "flagship" science, but interesting to do

Dying stars
Wolf-Rayet: e.g. aperture-masking stuff by Tuthill etal

~~~~~~

Michael C. Liu
Assistant Astronomer
Institute for Astronomy   email: mliu@ifa.hawaii.edu
University of Hawaii   phone: 1 808 956 6666
2680 Woodlawn Drive   fax : 1 808 956 9580
Honolulu, HI 96822, USA   WWW : www.ifa.hawaii.edu/~mliu

~~~~~~