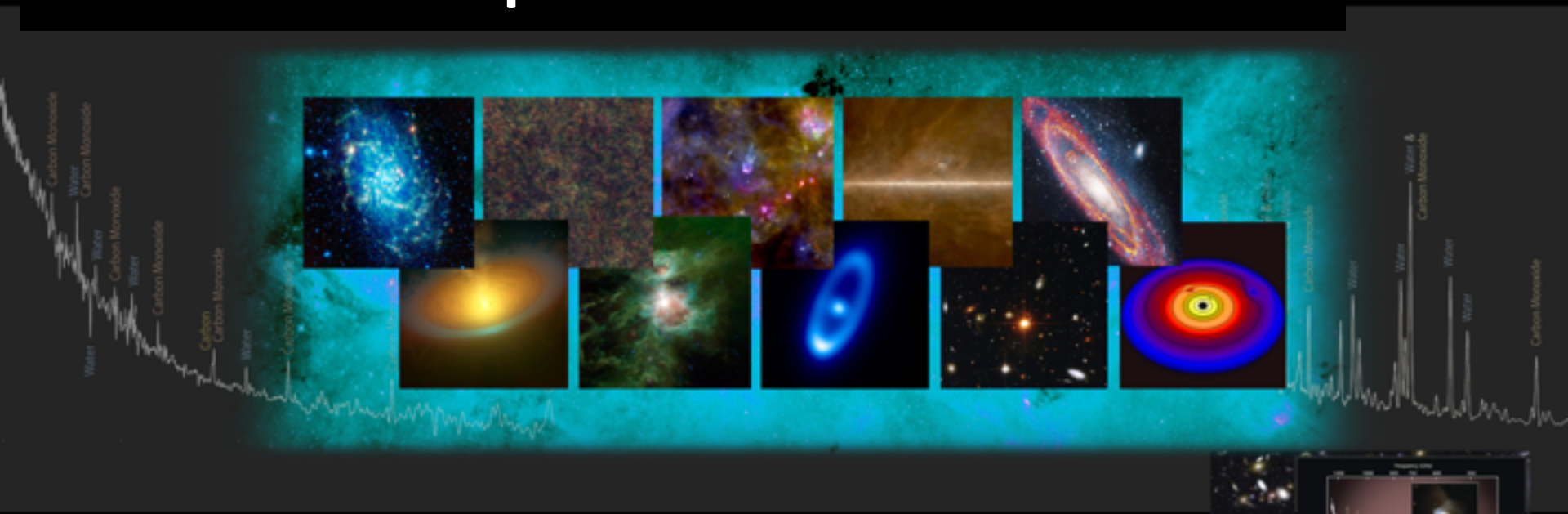
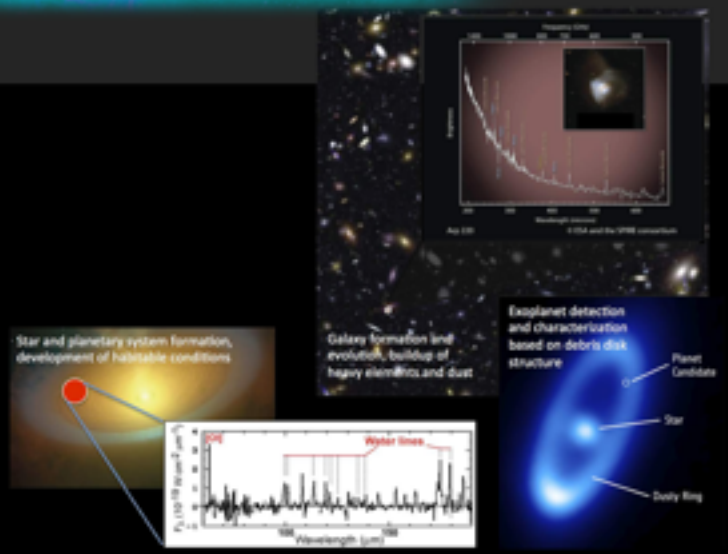
Satellite Meeting 2: Mission Concepts and Measurement Requirements for a Future Far-Infrared Space Mission



Dave Leisawitz
NASA/GSFC
Pathways 2015
17 July 2015



This workshop is sponsored by the NASA Astrophysics Division through the Cosmic Origins Program under the auspices of the Cosmic Origins Program Analysis Group (COPAG)

Participants

- Bill Danchi, NASA Goddard Space Flight Center, US
- Steve Ertel, ESO, Chile
- Antonio Garcia Munoz, ESA/ESTEC, The Netherlands
- Jane Greaves, University of St. Andrews, UK
- Satoshi Itoh, Osaka University, Japan
- Grant Kennedy, University of Cambridge, UK
- Dave Leisawitz, NASA Goddard Space Flight Center, US
- Laura McKemmish, UCL, UK
- Mike Meyer, ETH Zurich, Switzerland
- Eugenio Schisano, IAPS/INAF, Italy
- Feng Tian, Tsinghua University, China
- John Trauger, Caltech-JPL, US
- Steve Unwin, Caltech-JPL, US
- Joachim Wiegert, Chalmers Univ. of Technology, Sweden
- Siyi Xu, ESO, Germany
- Hans Zinnecker, Universität Stuttgart and NASA-Ames, US

16+ people
10 nations

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Purpose of the meeting

NASA

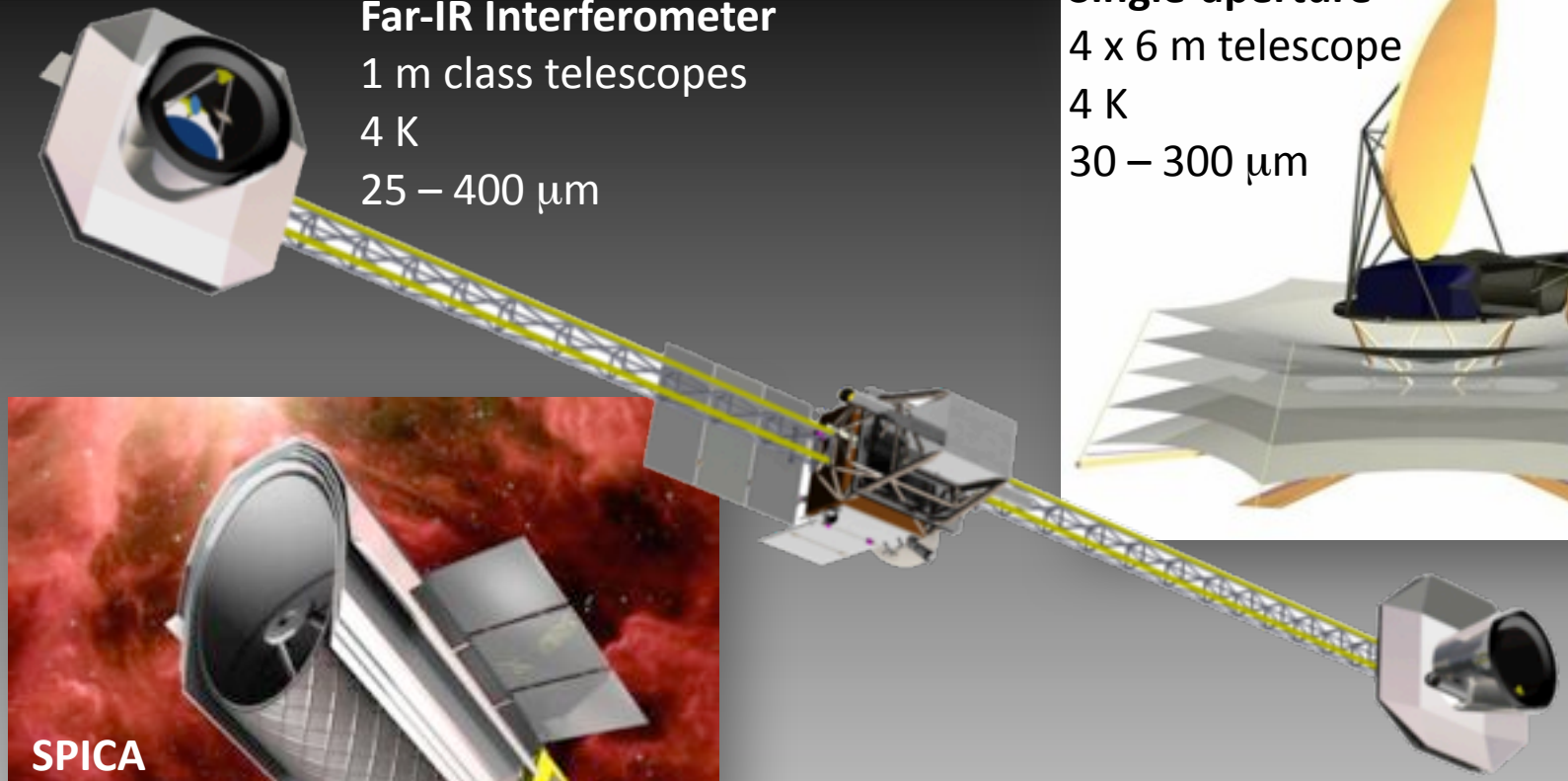
To serve as an opportunity for the participants to …

- **learn about concepts for future far-infrared space missions, and learn what is technically feasible and affordable in a mission that could begin in the 2020s; and**
- **discuss measurement requirements for the mission, including angular resolution, spectral resolution, and sensitivity.**

Mission concepts

Far-IR Interferometer
1 m class telescopes
4 K
25 – 400 μm

Single-aperture
4 x 6 m telescope
4 K
30 – 300 μm



SPICA
2.5 m telescope
8 K
17 – 230 μm

- Different measurement capabilities
- Different costs
- All have spectroscopic capability

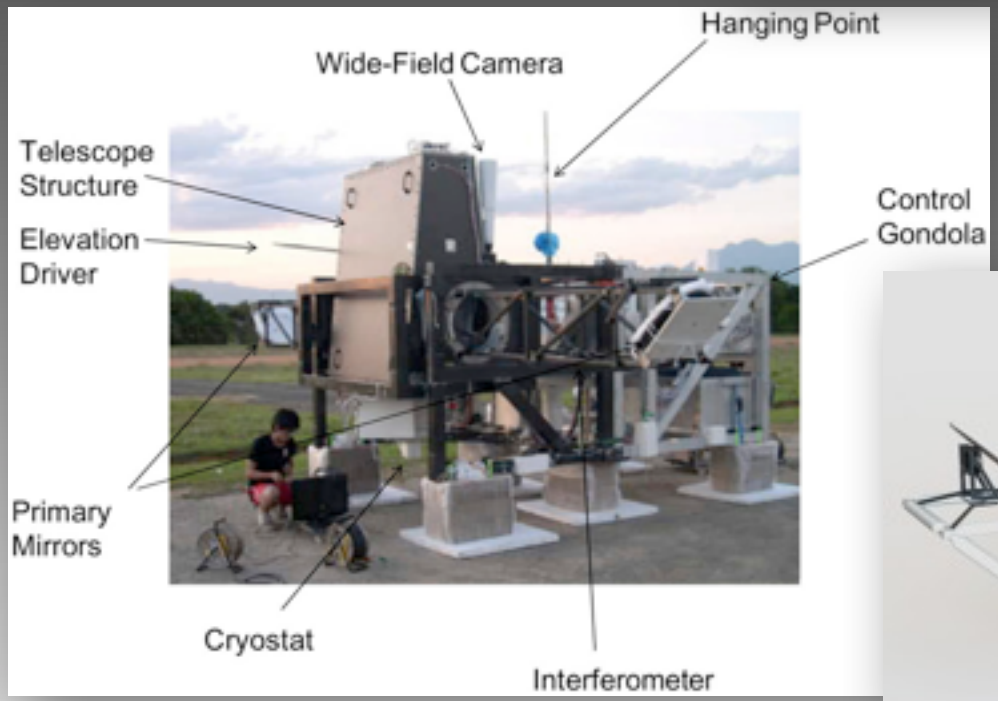
Happening now

SOFIA

FITE

H. Shibai, Osaka Universtiy , PI

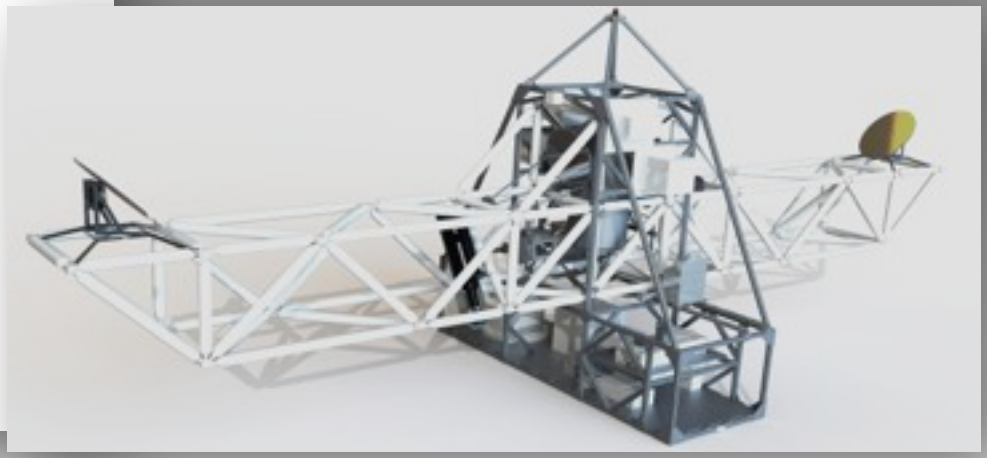
8 m Fizeau far-IR interferometer



BETTII

S. Rinehart, NASA GSFC, PI

8 m “double Fourier” interferometer for spatially resolved spectroscopy



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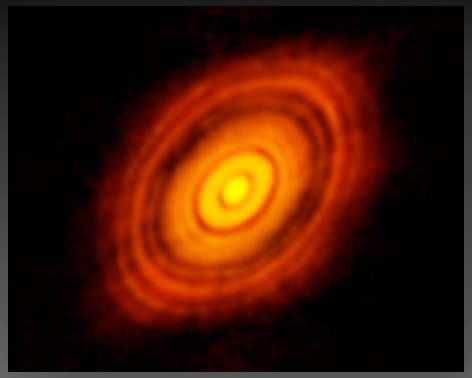
Single-Aperture Apps

- Most disks would not be resolved, but many would be detected, and one could:
  - measure the total molecular gas (H_2, HD) and water (gas phase and ice) in disks, from protostellar to protoplanetary to transitional to debris disks.
  - put the solar system in context by measuring the debris disk luminosity function down to solar system level
  - characterize the contents of debris disks (grain size distribution and composition)

Killer (?) Apps



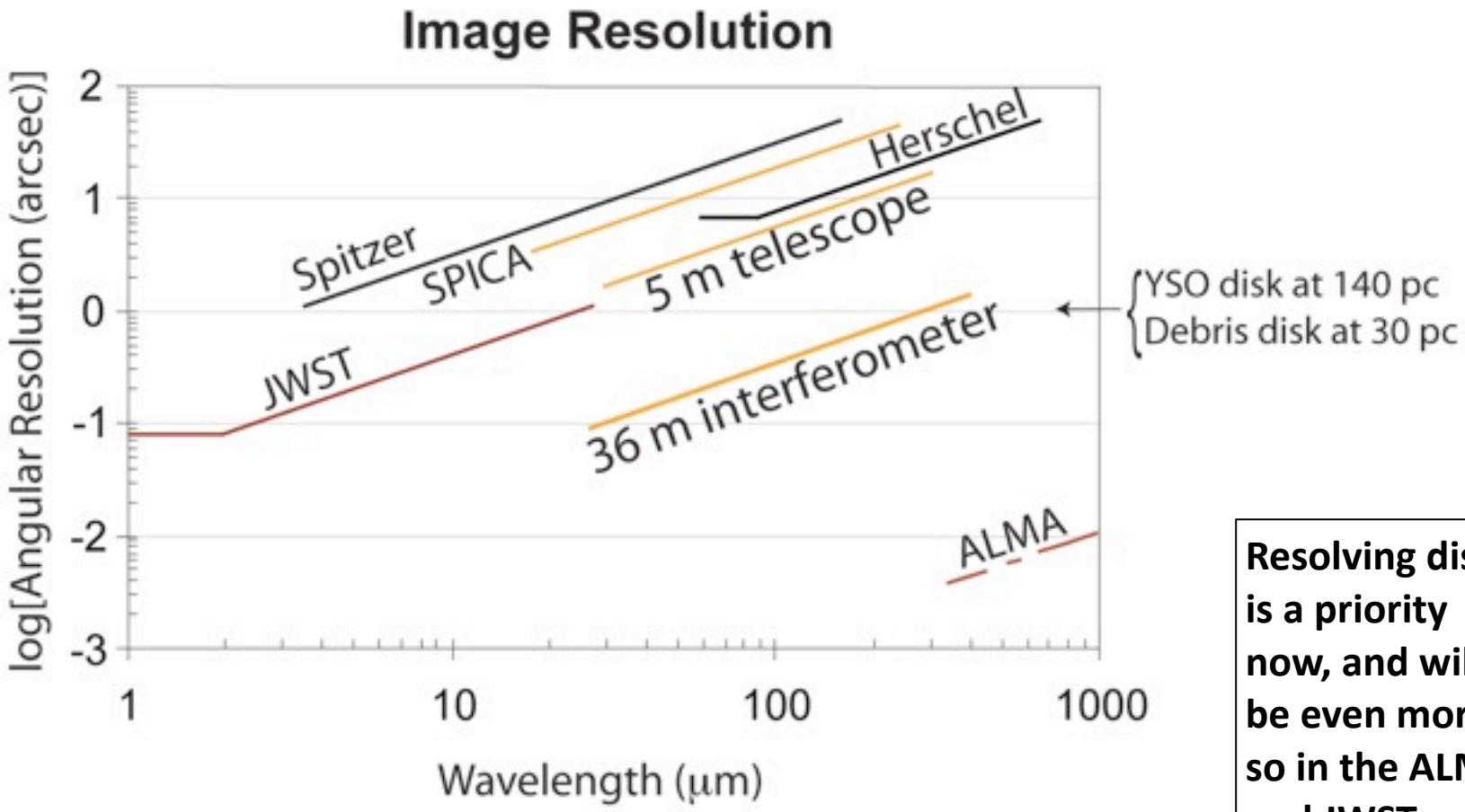
ALMA, HL Tau

Image protoplanetary disks and measure the distributions of H_2, HD, water vapor, ice, and dust to learn how the conditions for habitability arise during the planet formation process.

Image structures in a large number of debris disks to find and characterize exoplanets through their interactions with the disks.

Herschel, Fomalhaut

Desired measurement capabilities of the Satellite 2 meeting group tend to favor interferometry



Resolving disks is a priority now, and will be even more so in the ALMA and JWST era.

Complex Landscape

- The NASA Astrophysics Roadmap calls for a "FIR Surveyor" to deliver "crucial science" in the Formative Era (2020s), where it would serve as "a logical starting point" and "a training ground" for more ambitious shorter-wavelength interferometers in the Visionary Era (2030s and beyond).
- Members of the far-IR community met last month and voted for a 4 x 6 m single-aperture telescope
  - "Galaxy evolution" (extragalactic spectroscopy) was the dominant science driver
  - Mission cost ostensibly <$2B
  - Chief objective was to convince NASA to invest in an STDT study of the "FIR Surveyor"
- This and other STDTs will develop mission concepts that are considered most likely to succeed in the Decadal Survey.