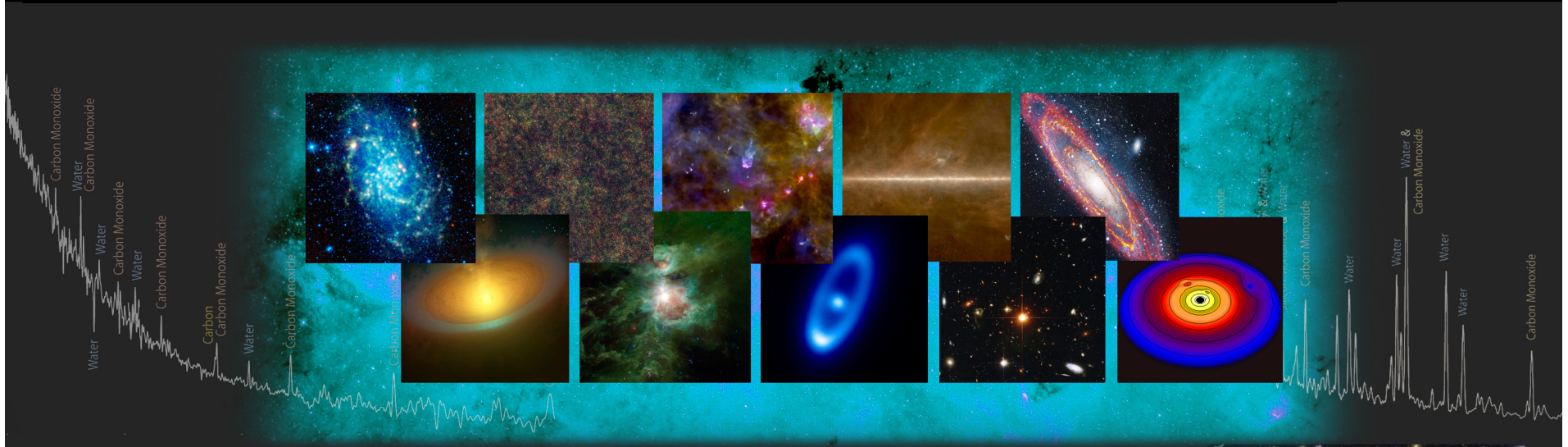


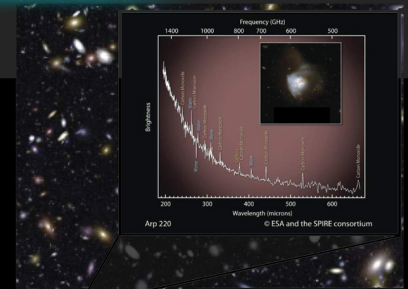
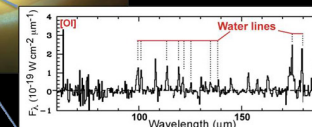
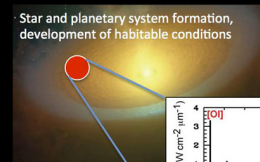
# Bringing Fundamental Astrophysical Processes Into Focus: A Community Workshop to Plan the Future of Far-Infrared Space Astrophysics



## Briefing to COPAG and ExoPAG

Dave Leisawitz

NASA/GSFC



*Goddard*  
Space Flight Center

# Sponsorship



The workshop, held on May 12 – 13, 2014, was sponsored by the NASA Astrophysics Division through the Cosmic Origins Program under the auspices of the Cosmic Origins Program Analysis Group (COPAG).

<http://asd.gsfc.nasa.gov/conferences/FIR/>

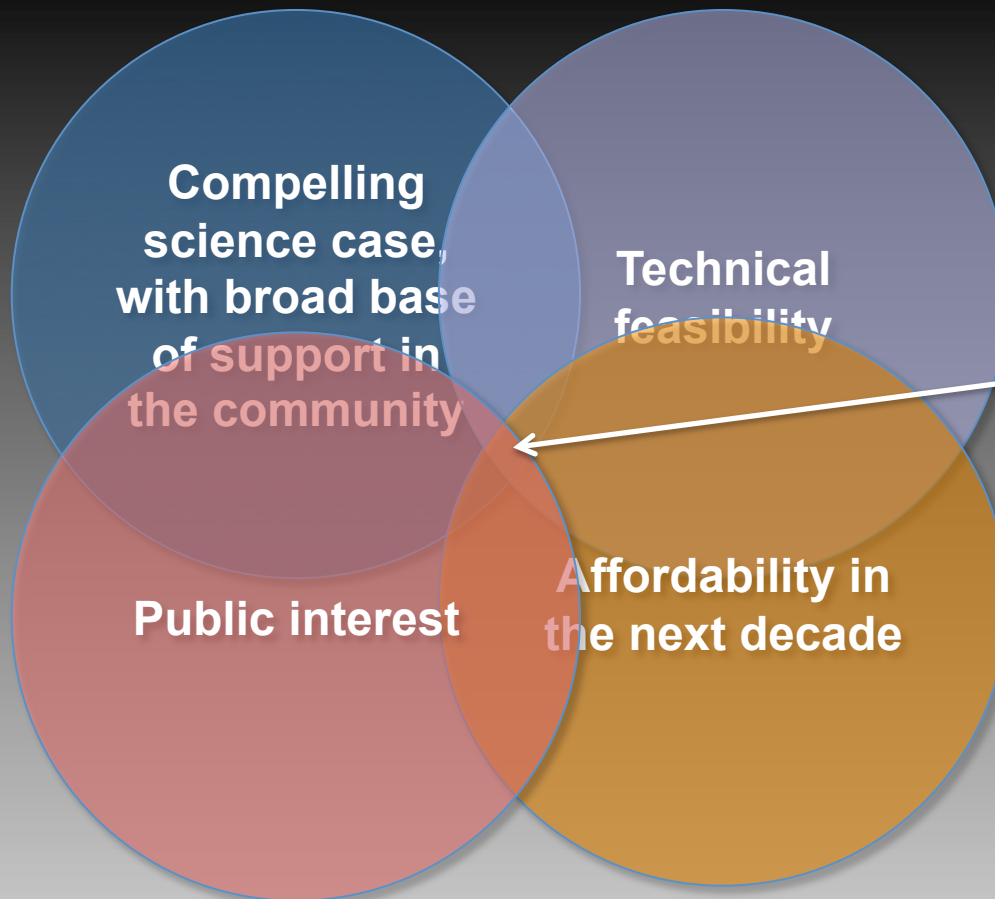
- **Lee Armus**, Spitzer Science Center, Caltech
- **Daniela Calzetti**, University of Massachusetts, Amherst
- **Jackie Fischer**, Naval Research Laboratory
- **Paul Goldsmith**, Jet Propulsion Laboratory, Caltech
- **Meredith Hughes**, Wesleyan University
- **Dave Leisawitz**, NASA Goddard Space Flight Center
- **Hiroshi Matsuo**, National Astronomical Observatory of Japan
- **Phil Maukopf**, Arizona State University
- **David Neufeld**, Johns Hopkins University
- **Isa Oliveira**, Observatorio Nacional, Brazil
- **Debbie Padgett**, NASA Goddard Space Flight Center
- **Alexandra Pope**, University of Massachusetts, Amherst
- **Stephen Rinehart**, NASA Goddard Space Flight Center
- **Giorgio Savini**, University College London
- **Kartik Sheth**, National Radio Astronomy Observatory
- **JD Smith**, University of Toledo
- **Alycia Weinberger**, Carnegie Institution of Washington
- **Mike Werner**, Jet Propulsion Laboratory, Caltech
- **Jonas Zmuidzinas**, Jet Propulsion Laboratory, Caltech

# The goal



Reach timely consensus on a recommendation to the 2020 Decadal Survey Committee regarding the future of the US in far-infrared space astrophysics.

# The Sweet Spot



Expensive (Decadal) missions only happen if they live here

The scientific motivation for the mission will have to be compelling, and the mission will have to be technically feasible and affordable in the next decade.

# How did we get here?



- A variety of single-aperture and interferometric missions have been studied to varying depths (SPICA, SPIRIT, CALISTO, ESPRIT, Millimetron, SPECS, TALC)
- The enabling technology needs are reasonably well understood
  - SAG 4 report, [http://cor.gsfc.nasa.gov/docs/COPAG\\_SAG4\\_report\\_final\\_Nov2013.pdf](http://cor.gsfc.nasa.gov/docs/COPAG_SAG4_report_final_Nov2013.pdf)
  - Technology development underway with support through APRA and SAT
- The community submitted an over-arching white paper (the “Community Plan,” available under Quick Links from workshop web page) and two mission white papers (CALISTO and SPIRIT) to the 2010 Decadal Survey. Key “Community Plan” recommendations:
  - The US should participate in the Japanese-led SPICA mission
  - NASA should invest in the enabling technology for a future far-IR mission
  - NASA should invest in studies of interferometric and single-aperture missions and choose one to go first, but both are ultimately needed
- 2010 Decadal Survey outcome:
  - Invest in SPICA, but only if NASA can afford it after other priorities

# How did we get here?



- NASA implementation:
  - No room for SPICA in the budget
  - With Herschel over, the community may soon be deprived of far-IR measurement capability needed to accomplish high-priority science
  - Far-IR SIG created for sustained community involvement in planning
- The NASA Astrophysics Roadmap envisions a “FIR Surveyor” mission and an important role for interferometry in space astrophysics that would begin in the far-IR

# What did the workshop

# accomplish?

- May 12 - 13 workshop was first step in planning in the post-2010 Decadal era
- Workshop program:
  - 14 science talks
  - 2 technology talks
  - talks on the measurement capabilities and trade space associated with single-aperture and interferometric missions
  - 6 splinter groups followed by discussion in plenary session
  - 46 posters on motivating science; balloon projects, and space missions and instruments; and enabling technology
- Most talks and some posters are online
- Need for “killer apps” is understood, but no consensus yet exists
- Diverse science goals drive toward various measurement capabilities, with common interest in high sensitivity, angular resolution better than ever before, and moderate to high spectral resolution



# What did the workshop

# accomplish?

- Japanese SPICA mission requires European commitment to proceed
  - First hurdle (M4 mission proposal) in 2014 will likely lead to 4 missions chosen for study
  - Second hurdle is ESA's 2017 selection of the M4 (medium-class) mission
  - Will know in time for 2020 Decadal Survey if SPICA will happen
  - Uncertainty will likely reign until 2017, so must plan for two possible outcomes

# Where we are now



**Many goals, many possibilities, no clear path**

**SPICA no**



**SPICA yes**

- Two European hurdles for M4: 2014 and 2017
- By 2017 we'll be preparing for the Decadal Survey
- At this stage, plan for both possibilities – maintain agility

# Converging



## the way forward

Path A



Path B

The path ahead: to succeed, the community will have to unite behind a single major recommendation (plan two paths, then choose one)

# What can you do?



- To get the lay of the land, read
  - the 2009 “Far-IR Community Plan”
  - the NASA Astrophysics Roadmap
  - presentation files on recent workshop web sites
    - “Bringing Fundamental Astrophysical Processes Into Focus: A Community Workshop to Plan the Future of Far-Infrared Space Astrophysics,”  
<http://asd.gsfc.nasa.gov/conferences/FIR/>
    - “Science Goals of a Sub-arcsecond Far-infrared Space Observatory,” <http://fisica.iaps.inaf.it/wp/>
  - about studied mission concepts and their measurement capabilities
  - the SAG 4 technology roadmap, and recommend changes if deemed important

# What can you do?



- Recommend “killer apps”\* for the next far-IR space observatory
- Get involved in the Far-IR Science Interest Group (SIG) and participate in studies
- Encourage your colleagues to participate in the SIG

\* Possible “killer apps”:

- “Tracing our origins from ‘stardust’ to the formation of habitable planets,” or, more succinctly,
- “Why are there habitable planets?”