

Summary of the Last Community Plan



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Community Planning a Decade Ago (1)

- February 8-9, 1999 **Community Workshop**, College Park, MD
 - Objectives were to develop:
 - **Science Requirements**
 - What will be the **big questions** a decade from now?
 - What **instrument capabilities** will be required?
 - **Mission Concepts**
 - What are the possible **approaches**?
 - What are the **technology requirements**?
 - **Technology Roadmap**
 - What are the **tall poles**?
 - How do we get **from here to there**?
 - Unifying theme: high angular resolution and sensitivity needed in the far-IR to answer compelling science questions (a la JWST)
 - SPECS (1 km max baseline interferometry) strawman mission concept introduced (Mather, Moseley, Feinberg)
 - Flowdown from science goals to measurement requirements, engineering requirements, and enabling technologies



Community Planning a Decade Ago (2)

- 2000 **Decadal Survey**
 - Input: oral presentations and two white papers –
 - “Charting the Winds That Change the Universe: The Single Aperture Far-Infrared Observatory (SAFIR)” (G. Rieke et al.)
 - “Probing the Invisible Universe: The Case for Far-IR/Submillimeter Interferometry” (Leisawitz et al.)
 - Community decided to ask for SAFIR *and* SPECS, with SAFIR as a step in the direction of SPECS
 - Outcome
 - “A rational coordinated program for space optical and infrared astronomy would build on the experience gained with JWST* to construct [a JWST-scale filled-aperture far-IR telescope] SAFIR, and then ultimately, in the decade 2010 to 2020, build on the SAFIR, TPF, and SIM experience to assemble a space-based, far-infrared interferometer.”
 - SAFIR new start by end of decade
 - Investment in enabling technology recommended

* then “NGST”



Community Planning a Decade Ago (3)

- March 7 – 8, 2002 “**Second Workshop** on New Concepts for Far-Infrared/Submillimeter Space Astronomy,” College Park, MD
- Delivered a substantive, practical plan to achieve the far-IR community’s objectives as they were outlined in the Decadal Report, *Astronomy and Astrophysics in the New Millennium*
- Two products:
 - White paper presenting the consensus view of the community: the “Community Plan for Far-IR/Submillimeter Space Astronomy,” Feb 2003
 - Proceedings volume (eds. Benford & Leisawitz)
 - compendium of science and technology papers
 - snapshot of where things stood six years ago



More Recent Community Planning

- “From Spitzer to Herschel and Beyond” workshop, Pasadena, June 7 – 11 (2004)
- European workshops in Madrid (2003), Leiden (2005), and Obergurgl (2006)
- Canadian workshop (2008)
- ExoPTF white paper “ExoPTF Science Uniquely Enabled by Far-IR Interferometry: Probing the Formation of Planetary Systems, and Finding and Characterizing Exoplanets” (2007)
- Far-IR community telecon series (Lester)



Highlights of the “Community Plan”

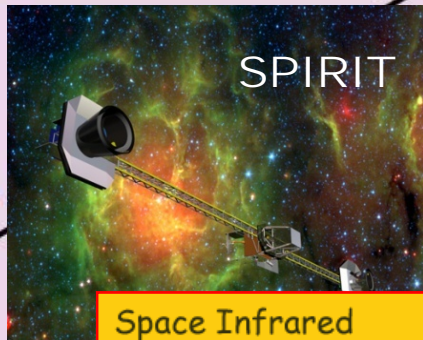
- Information vital to the attainment of major scientific objectives of both of NASA’s astrophysics science themes (Origins and SEU) is uniquely available in the far-IR and submillimeter.
- The first step is to develop the technology and start the planning for a cooled JWST-class far-IR observatory called SAFIR (Single Aperture Far-IR telescope), to be operated like HST for a wide user community with a launch by the middle of the JWST lifetime in 2015.
- Depending on the progress made with other planned instruments, a FIR/SMM all-sky survey mission with a 2 m class cryogenic telescope might be a scientifically compelling precursor to SAFIR.
- The long-range goal is to achieve HST-class resolution in the FIR/SMM, which would require an imaging interferometer with a 1 km maximum baseline.
- If the cost of [the structurally-connected far-IR interferometer] SPIRIT is much less than that of a “roadmap mission” like SPECS, then SPIRIT should precede SPECS.
- Recommended a coordinated technology program and spelled out the requirements
- Recommended that NASA support initial concept studies for SAFIR, SPIRIT, SPECS, and a sensitive FIR/SMM all-sky survey mission.
- Recommended that NASA be receptive to proposals for laboratory and theoretical astrophysics related to far-IR studies.
- Noted that European and Japanese astronomers are eager to collaborate with their US colleagues on SAFIR and FIR/SMM interferometry.



SPECS
Submillimeter Probe of the Evolution of Cosmic Structure



SAFIR
Single Aperture Far-IR Telescope



SPIRIT
Space Infrared Interferometric Telescope

IRAS
COBE
Akari
Spitzer
ISO
SOFIA
Herschel
SPICA



How are we doing?

- The science goals we identified in 2002 are
 - as compelling now as they were then
 - essentially unchanged, because much higher (sub-arcsecond) angular resolution is needed in the far-IR to achieve the objectives
- Significant advances in far-IR detector technology, cryocooling, wavefront sensing and control, THz coherent receivers, some driven by JWST, Herschel, Planck and SOFIA, but only modest funding for the most critical, longest lead time technology: detectors. SAFIR launch >>2015.
- A FIR/SMM all-sky survey mission may still be a good idea (incorporated into CALISTO concept for SAFIR)
- A 1 km maximum baseline interferometer, SPECS, is still the long-term goal, but most of us now consider it to be beyond our retirement horizons
- Studies have shown that SPIRIT (Origins Probe) is less expensive than a typical “roadmap mission,” such as SPECS.
- The recommended “coordinated technology program” for far-IR space astronomy was largely neglected due to the chicken (= mission) and egg (= enabling technologies) dilemma in NASA SMD
- NASA did support initial concept studies for SAFIR, SPIRIT, and SPECS!
- NASA has supported laboratory and theoretical astrophysics research related to far-IR studies (e.g., Herschel proposal call)
- Progress around the world:
 - Three European far-IR community workshops led to involvement in Japan’s SPICA and a Far-IR Interferometer (FIRI) proposal to ESA under Cosmic Visions
 - SPICA progress and balloon far-IR interferometer (FITE) in Japan
 - CSA’s Far-IR Science Discipline Working Group shares European interests in SPICA and interferometry
 - The international far-IR community is eager to collaborate with the US community



The Value of a Community Plan

- A yardstick for measuring progress
- Gives us a sense of direction, purpose, vision
- Demonstrates our willingness to prioritize
- Enables us to prioritize our work as individuals and to compete more effectively for limited resources
- **Enables us to speak with a coherent voice** when we communicate with
 - the wider astronomical community,
 - technologists,
 - funding agencies, and
 - the public



Recommendations

- Adapt the 2003 Community Plan to current circumstances (don't abandon it)
 - The essence of the Plan is still good
 - Continuity is better than discontinuous change in this case
- Summarize the progress we've made relative to the previous version of the Plan
- Summarize the lessons we've learned and are continuing to learn from other missions (e.g., JWST technologies and I&T plan)
- Engage the wider astronomical community
 - "far-IR" science is science anyone can love
 - Give a talk in your Department or away from home and describe the information-rich far-IR sky and the future missions designed to probe it
 - Exchange thoughts about exoplanets with our next-door neighbors (we can find 'em, characterize 'em, and learn how they form)
- How can we exploit transiting exoplanets?
- Keep SPECS in the Plan as our long-term goal
 - It's easy to rally around something so visionary and far away, and the rationale for the mission is well-founded
 - Don't forget the SPECS-unique technology requirements
- Reassess the need for a far-IR all-sky survey mission
 - What are the measurement requirements (sensitivity, angular resolution, spectral resolution)?
 - Is it SAFIR or a unique mission? If not SAFIR, then how will SAFIR be different?
- Present SPIRIT and SAFIR as concepts for a mission designed to provide the measurement capabilities yearned for by the far-IR community, principally high angular resolution with ample sensitivity and spectroscopy, sufficient to address the key science questions
- Continue to promote international collaboration (e.g., SPICA, FITE, FIRI)
- It's a new world, and getting newer all the time
 - Look for opportunities in times of change
 - A recipe for success: have a really, really good idea ... and be ready

We do!

That's why we're here