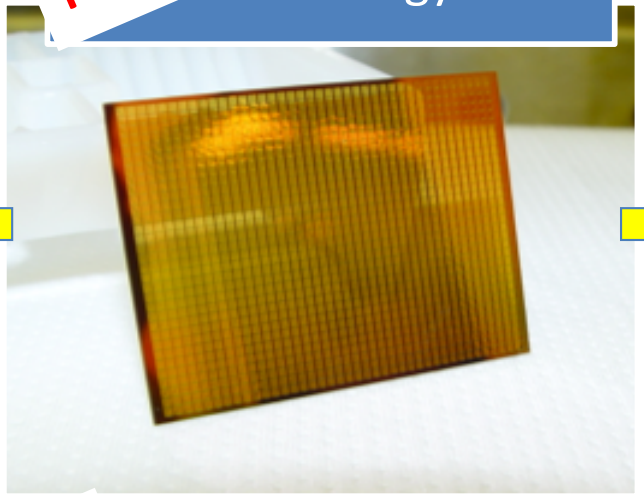
Exploration Opportunities with SOFIA (Next Generation Science Instrumentation)

People

+

NEW Technology



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Platform

=

NEW Science

Dr. Kimberly Ennico Smith
NASA SOFIA Project Scientist
Kimberly.Ennico@nasa.gov

- SOFIA is currently the largest observatory with access to infrared and sub-millimeter wavelengths above 99% Earth's water vapor.

  - SOFIA is an outstanding on-sky laboratory for development of future space-based instruments.

  - SOFIA maintains a working infrared community in preparation for a future IR-submm space mission in the 2030s.

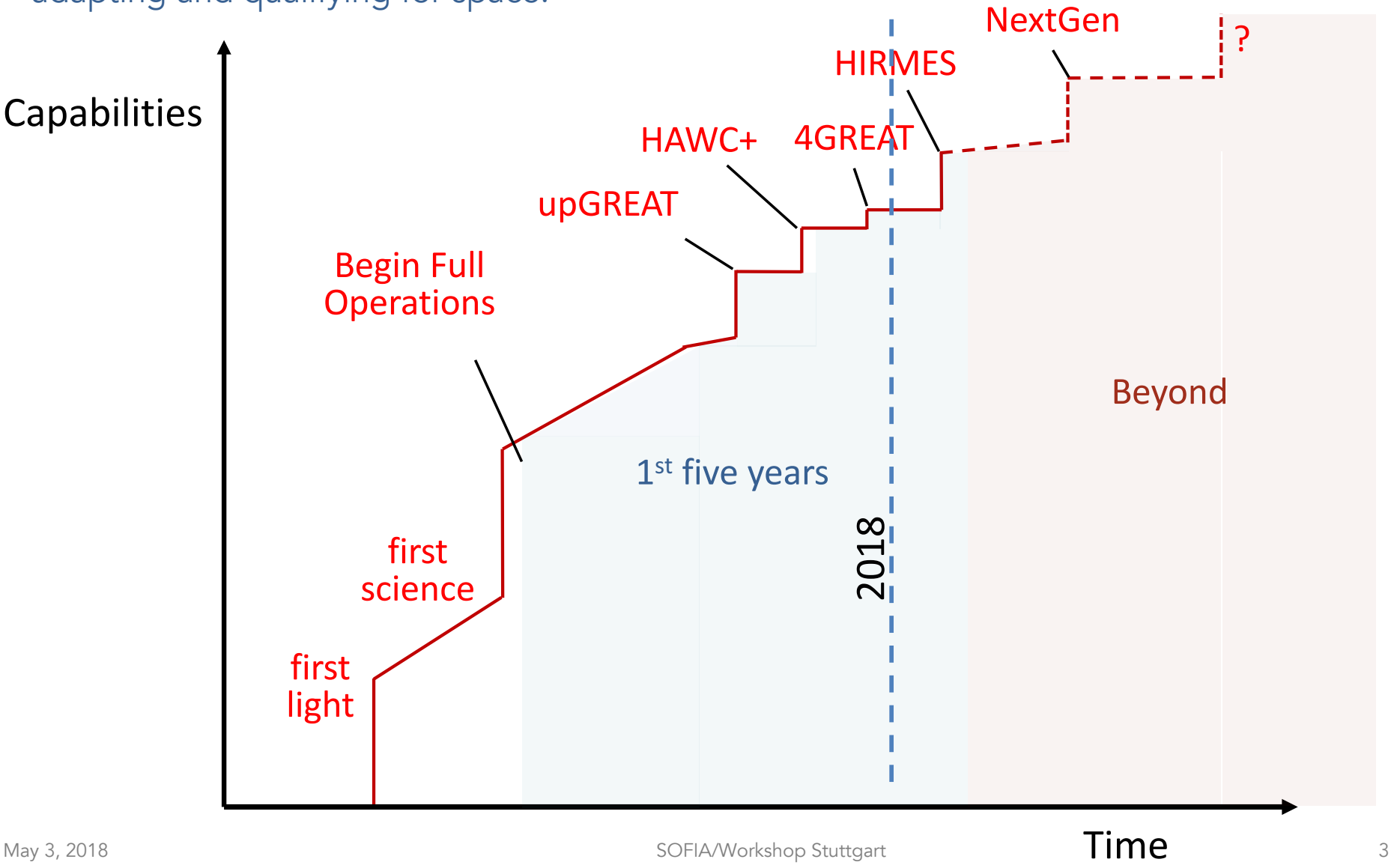

IRAS All Sky Survey


HAWC+ (2ND Gen)

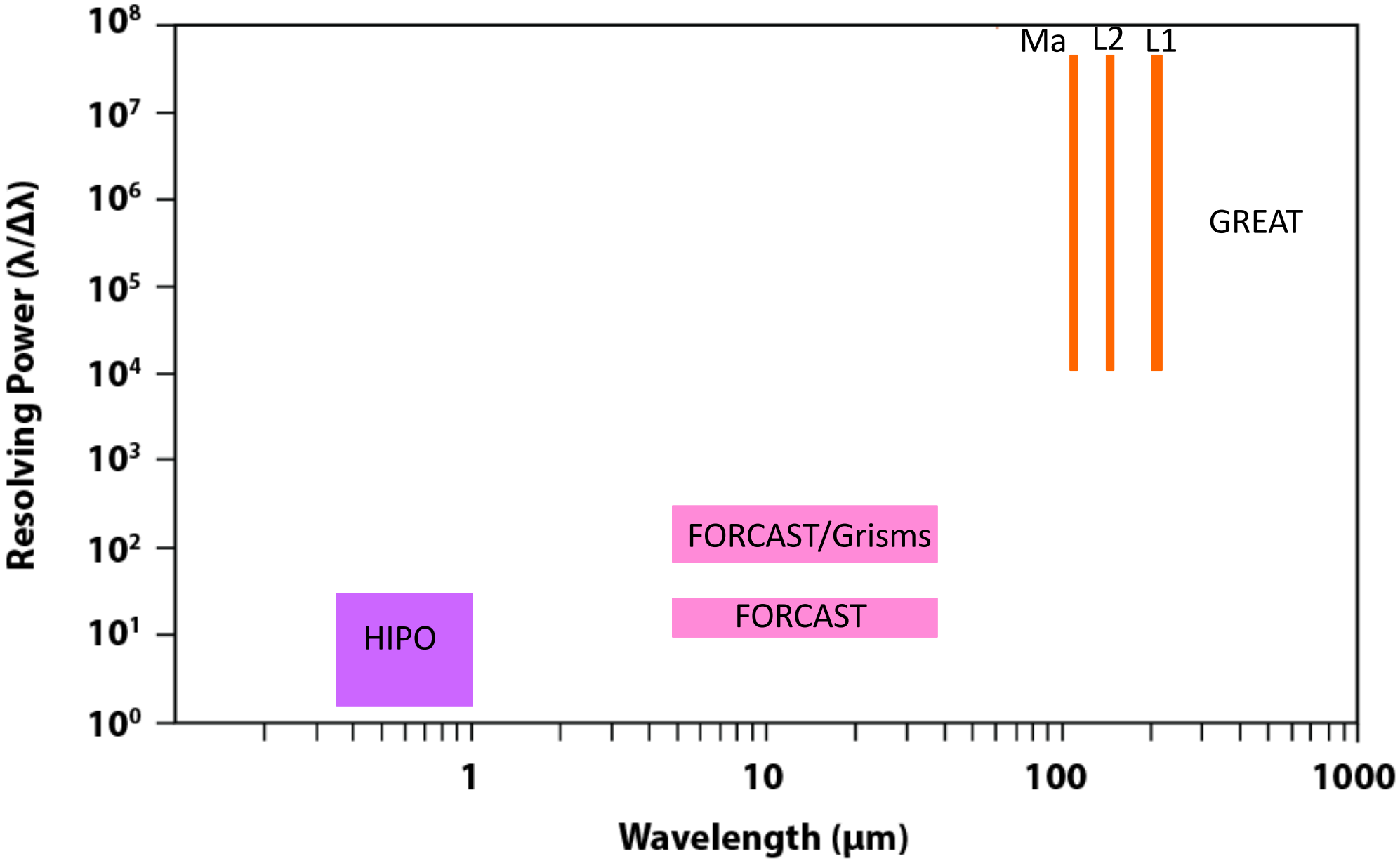

GREAT Flight July 3, 2017

SOFIA's Capabilities Can and Do Evolve

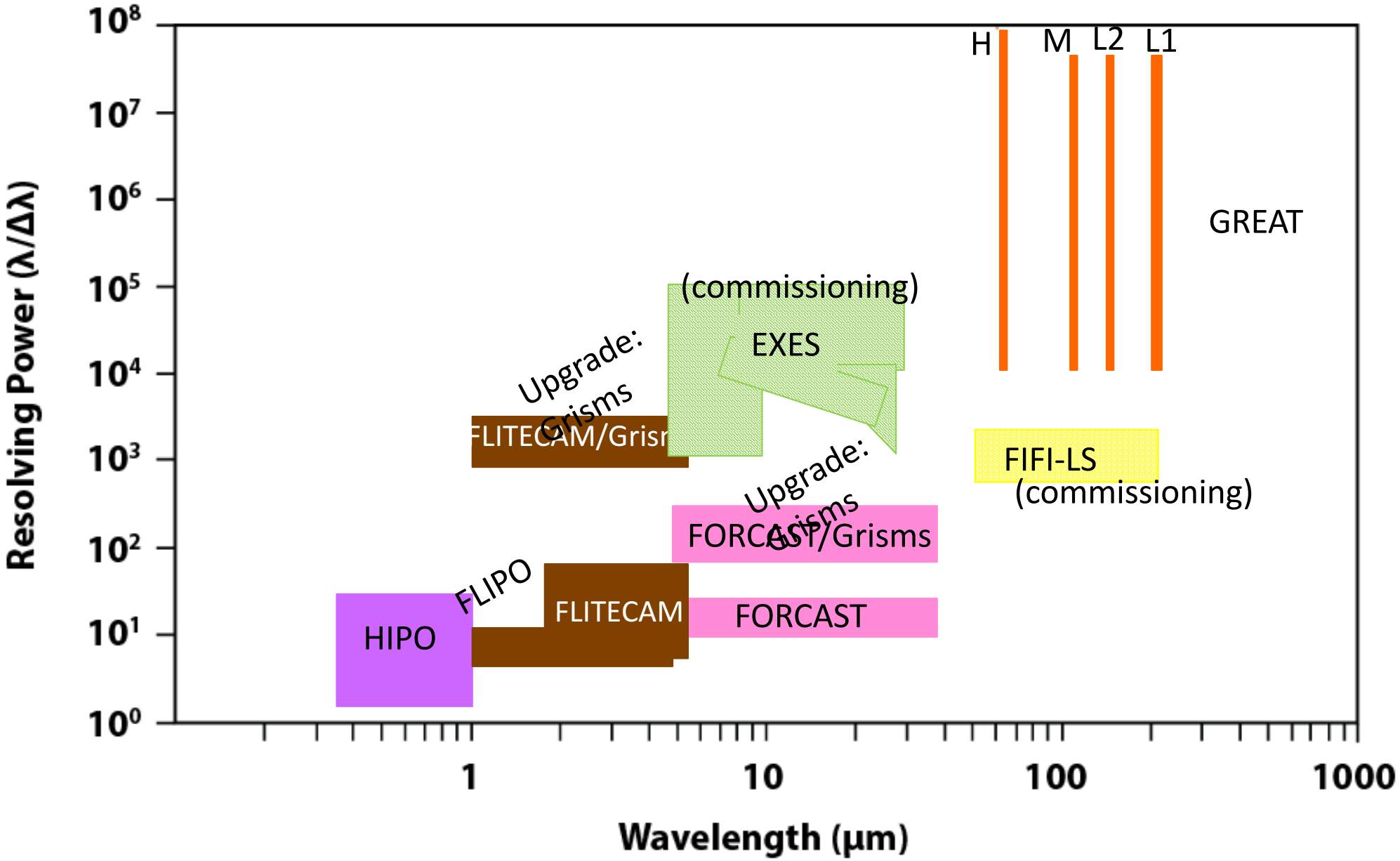
- Ample power, weight, and computing facilities as well as personnel on board allow lower TRL instruments to be designed, built, flown, debugged, used, and perfected before adapting and qualifying for space.



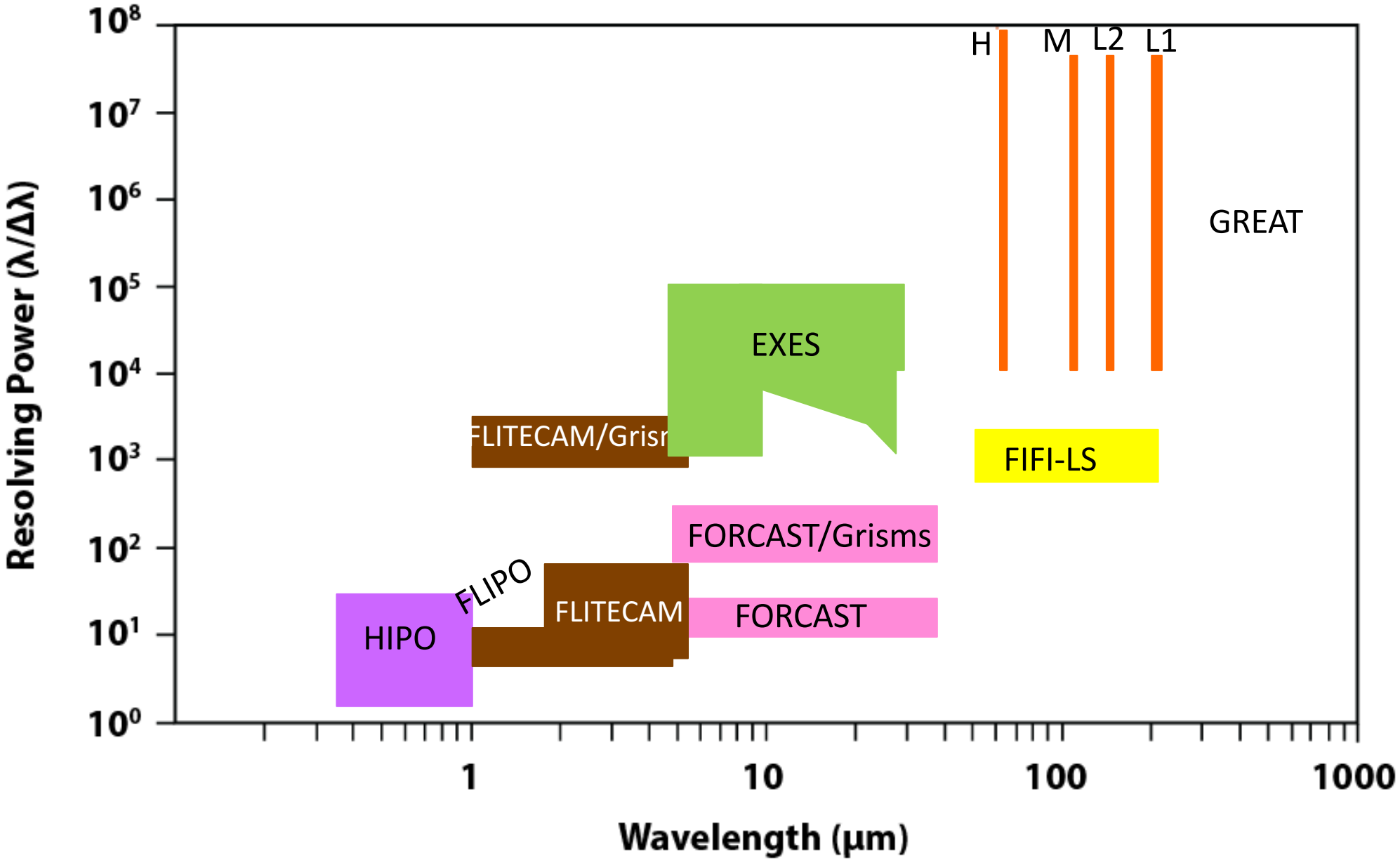
1st Gen – 2011-2013 / Basic Science / Cycle 1



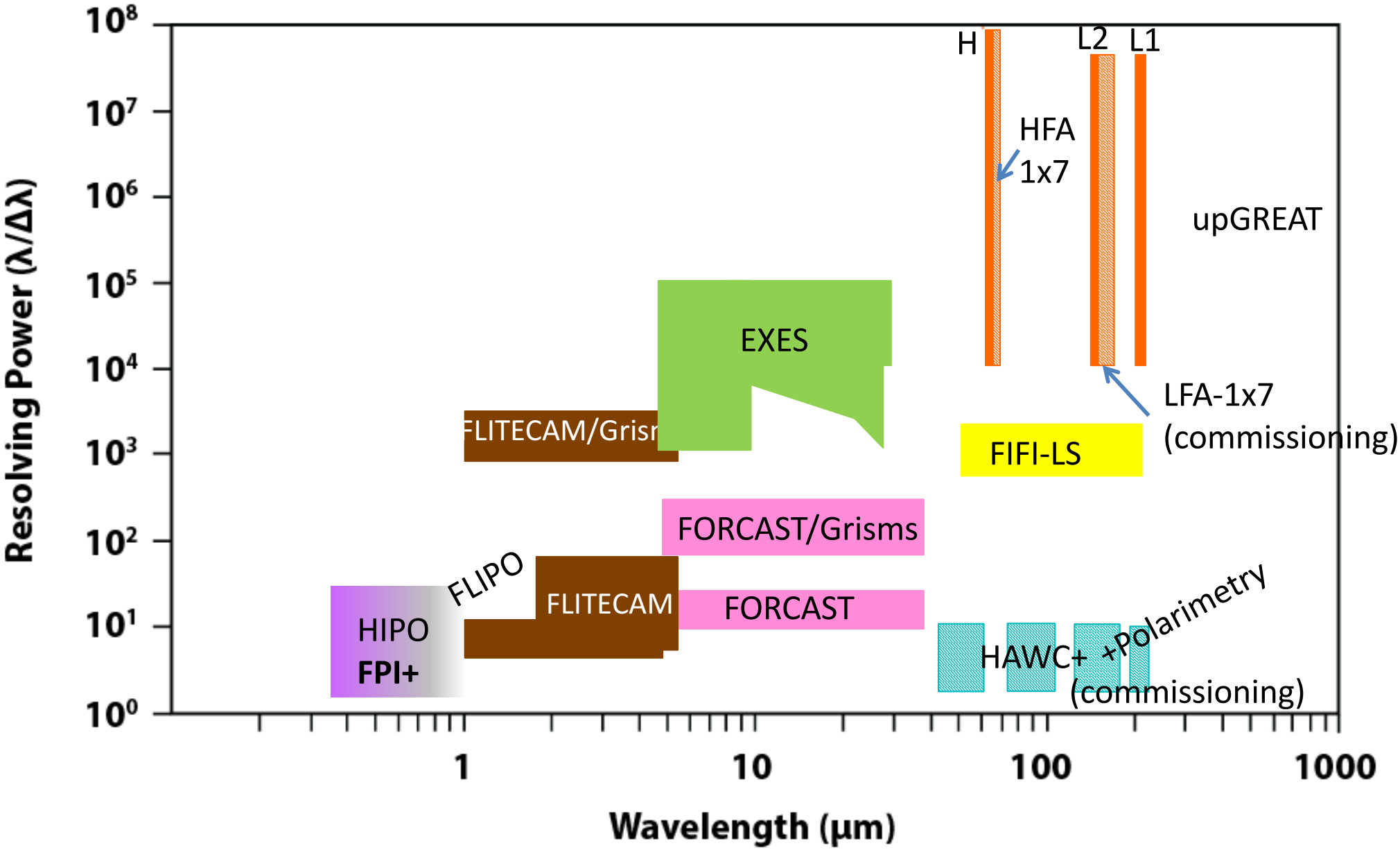
1st Gen cont. – 2014 / Cycle 2



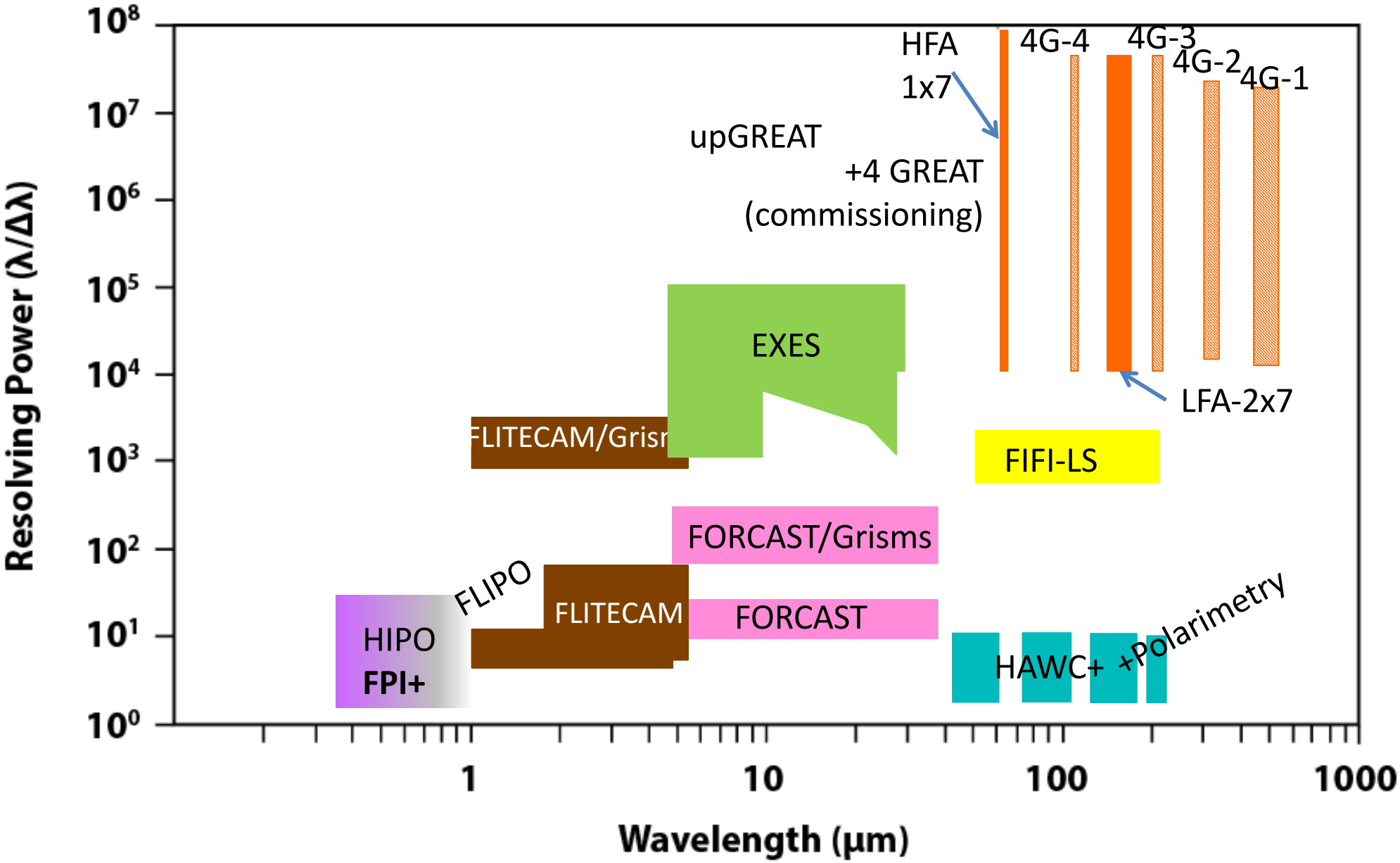
1st Gen cont. – 2015 / Cycle 3



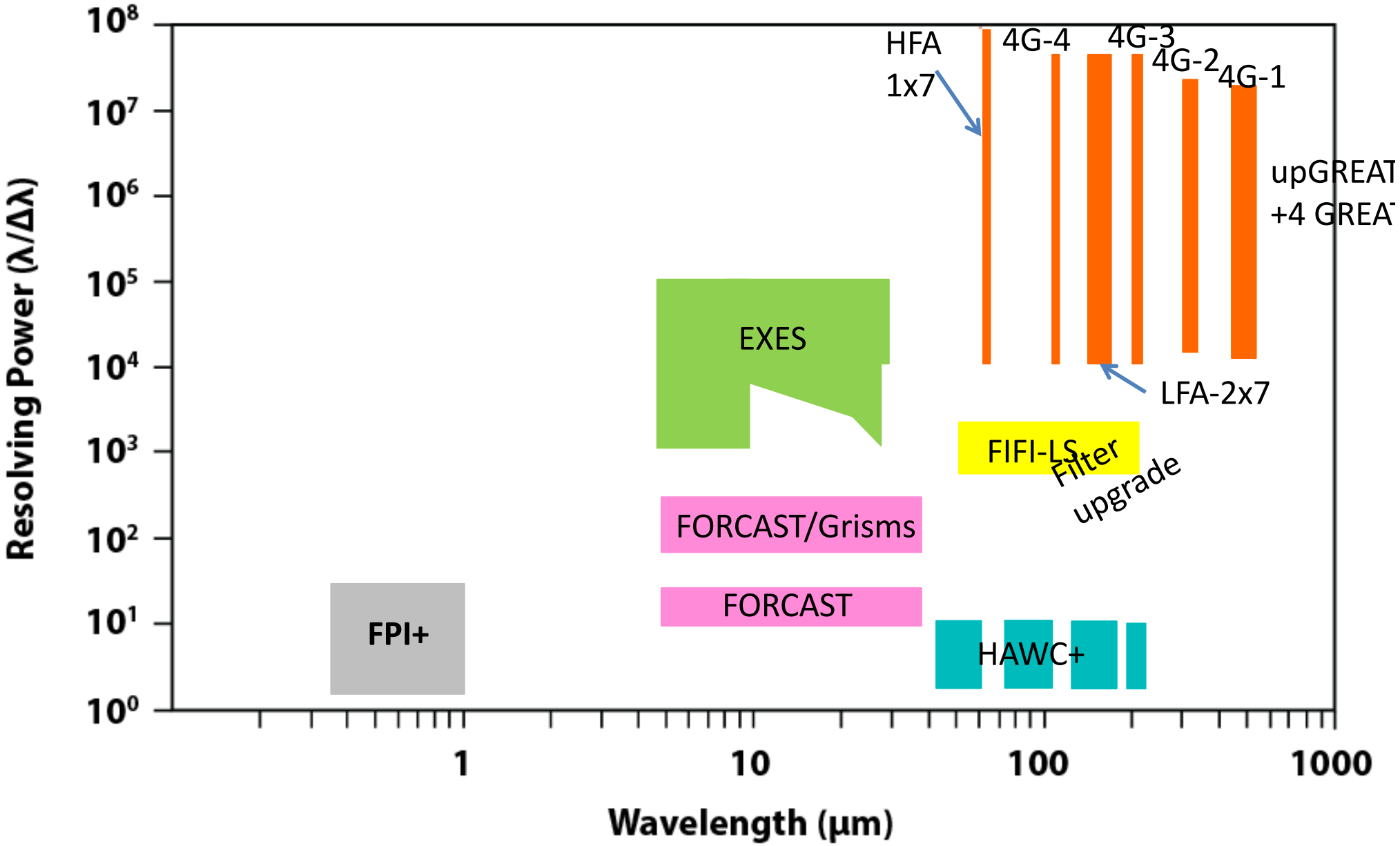
2nd Gen – 2016 / Cycle 4



2nd Gen cont. – 2017 / Cycle 5



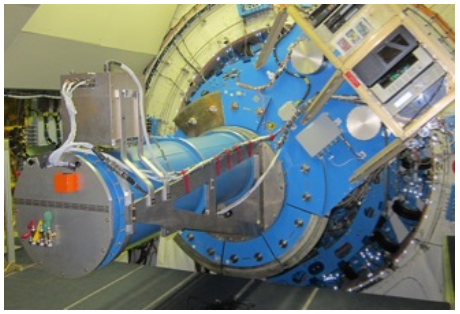
– 2018 / Cycle 6 / This year!



Wide Range of Interchangeable Instruments Available

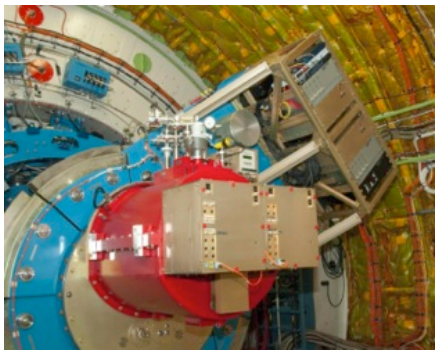
FPI+
Focal Plane
Imager

λ = 0.36–1.10 µm
R = 0.9–29.0



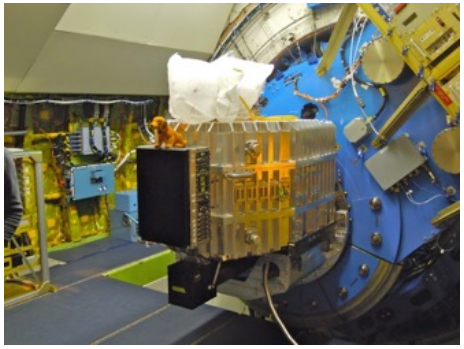
EXES
Echelon-Cross-Echelle
Spectrometer

λ = 4.5–28.3 µm
R = 1,000–10^5



FORCAST
Faint Object Infrared
Camera for the SOFIA
Telescope

λ = 5–40 µm
R = 100–300
Grism Spectrometer



FIFI-LS
Far Infrared
Field-Imaging Line
Spectrometer

λ = 51–203 µm
R = 600–2,000
Grating Spectrometer

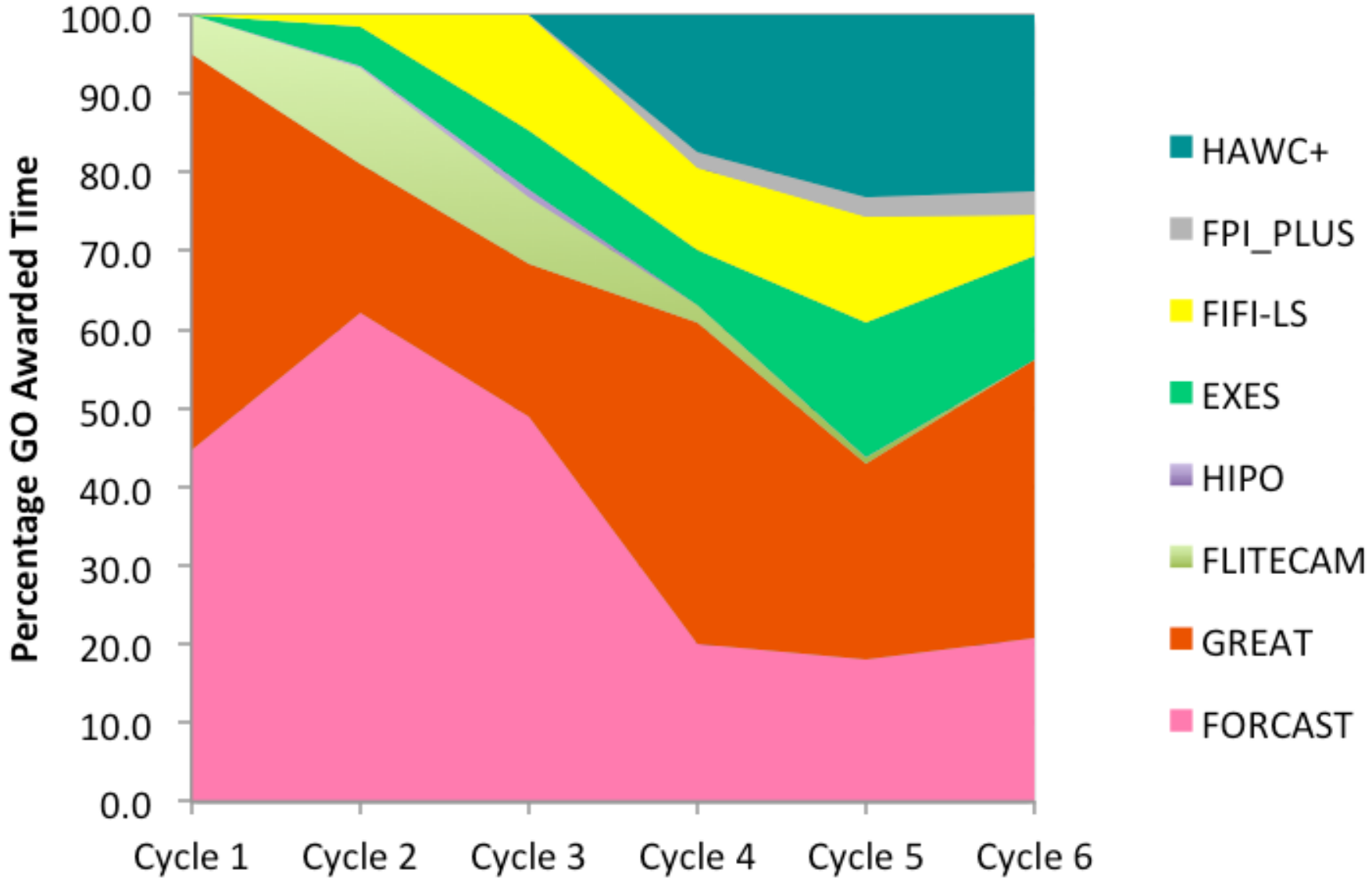
HAWC+
High-resolution
Airborne Wideband
Camera Plus

λ = 50–240 µm
R = 2.3–8.8
Far Infrared Camera
& Polarimeter

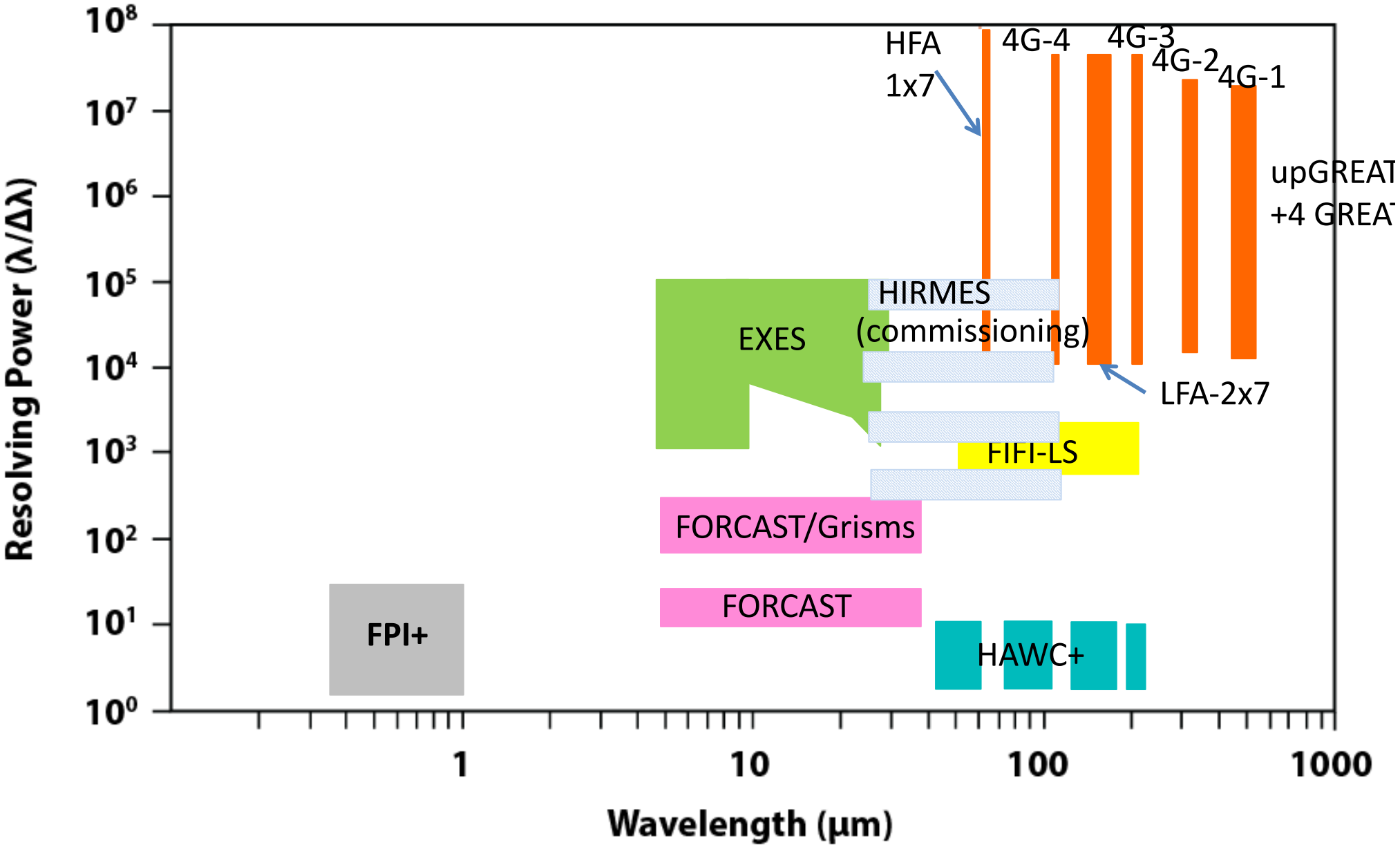
GREAT
German Receiver for Astronomy
at Terahertz Frequencies

λ = 63–612 µm
R = 10^6–10^8
Heterodyne Spectrometer

Evolution of Science Instrument Awarded Time

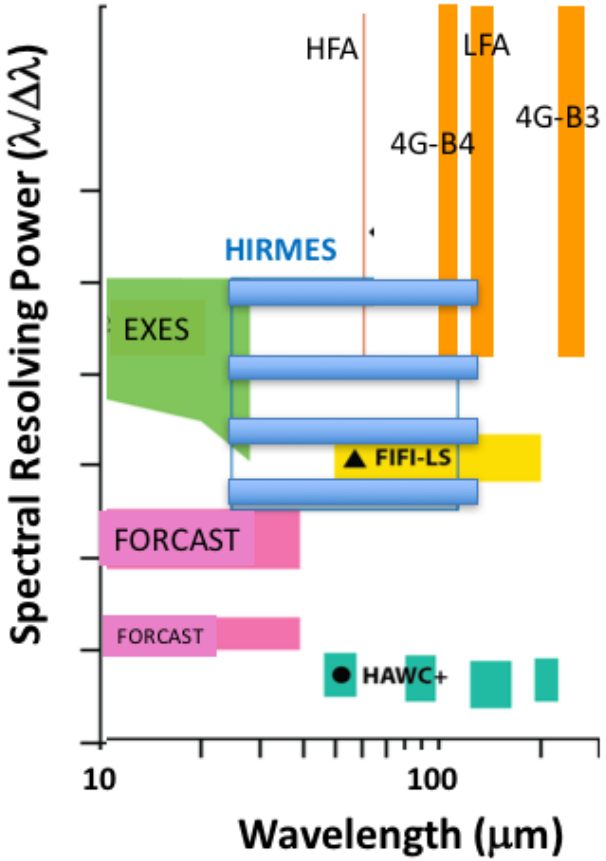


3rd Gen. cont. – 2019 / Cycle 7



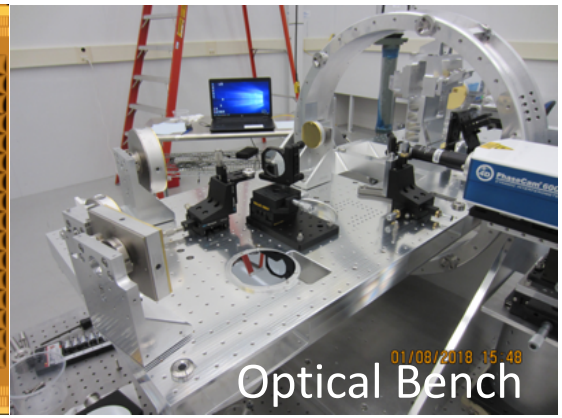
HIRMES Update

- Four spectroscopic modes to HIRMES –
  - High-res mode R ~ 100,000
  - Mid-res mode R ~ 10,000
  - Low-res mode R ~ 300-600
  - Imaging spectroscopy mode R ~ 2000
- Background limited bolometers –
- Combination of Fabry-Perot Interferometers and gratings
- I&T at Goddard begins in spring 2018
- Delivery to Observatory in 2019



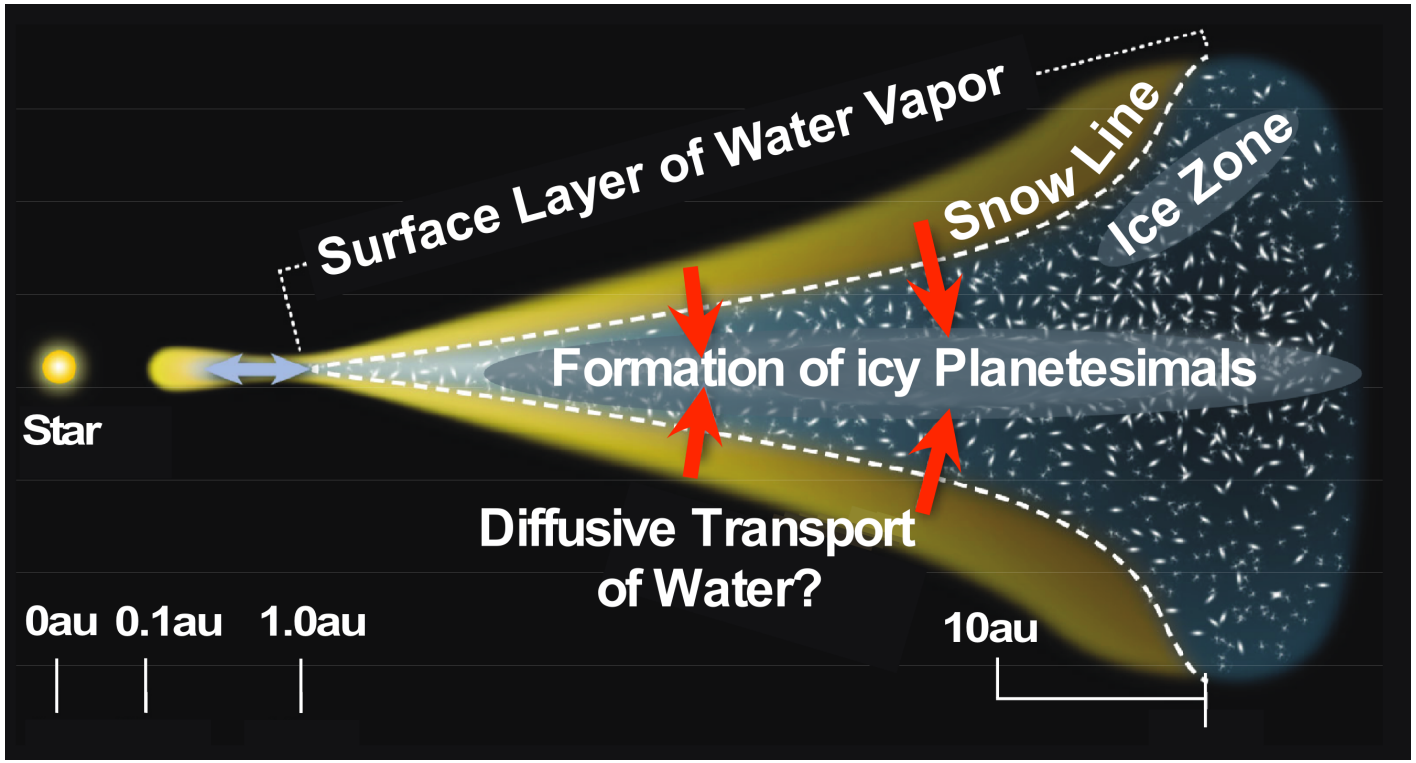

Cryostat Feb 28, 2018


Detectors for Low-Res


Optical Bench

HIRMES Enables New Science Inquiries

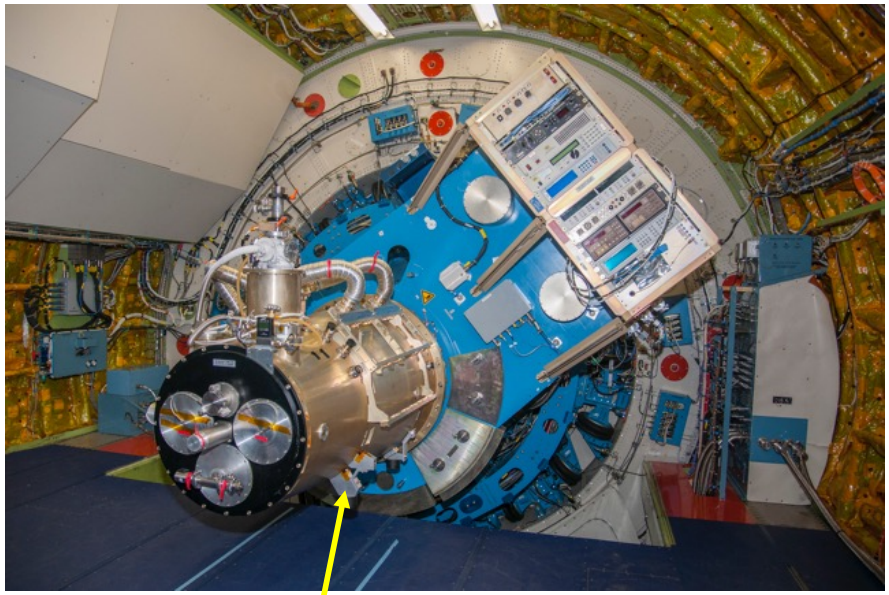
- Protoplanetary Disk Science



- Observations with SOFIA can provide key quantitative measurements of
  - (1) oxygen (63 μm) as a tracer of spatial structure, not available from direct imaging,
  - (2) water ice (43, 47, 63 μm) to determine the mass of water ice in the system and explore its crystalline mass fraction that can provide strong constraints on the disk thermal evolution, and
  - (3) numerous water vapor (over 30-100 μm) probing "transition region" 200-300 K

New Instrument for SOFIA for 2022+

- NASA has officially opened solicitation for the next instrument for SOFIA



See your instrument right here!

What has NOT changed from prior NASA Instrument Calls

- Solicitation issued and selections made by NASA HQ
- Instrument development overseen by the NASA SOFIA Project
- Proposals are solicited from universities, industry and NASA centers
- Instrument upgrade proposals are encouraged

- "All foreign investigators, whether proposing as PI from a foreign organization or Co-Is participating on proposals from U.S. organizations, must be endorsed by a funding/sponsoring institution or agency in the foreign country to demonstrate that resources are available to support the proposed investigation. Proposals from non-US participants should adhere to Section III(a) of the **ROSES-2018 Summary of Solicitation**."

– See Slide 22 for German Participation (specific item for SOFIA)

Philosophy for the Next Gen Science Instrumentation

- Science Leads the Way
  - Dream Big / Be Ambitious
  - Selected team(s) must execute and deliver well-defined Legacy Science Program(s)
  - Prioritize instruments that enable broad community usage and/or data of high archival value, but also allow for agile, "niche" instruments to solve important / outstanding science questions
- Technology to Meet the Needs of Science
  - Solicitation allows for:
    - New instruments
    - Upgrades/modifications to existing facility instruments
  - Allow for flexibility for future enhancements and modifications

Philosophy for the Next Gen Science Instrumentation

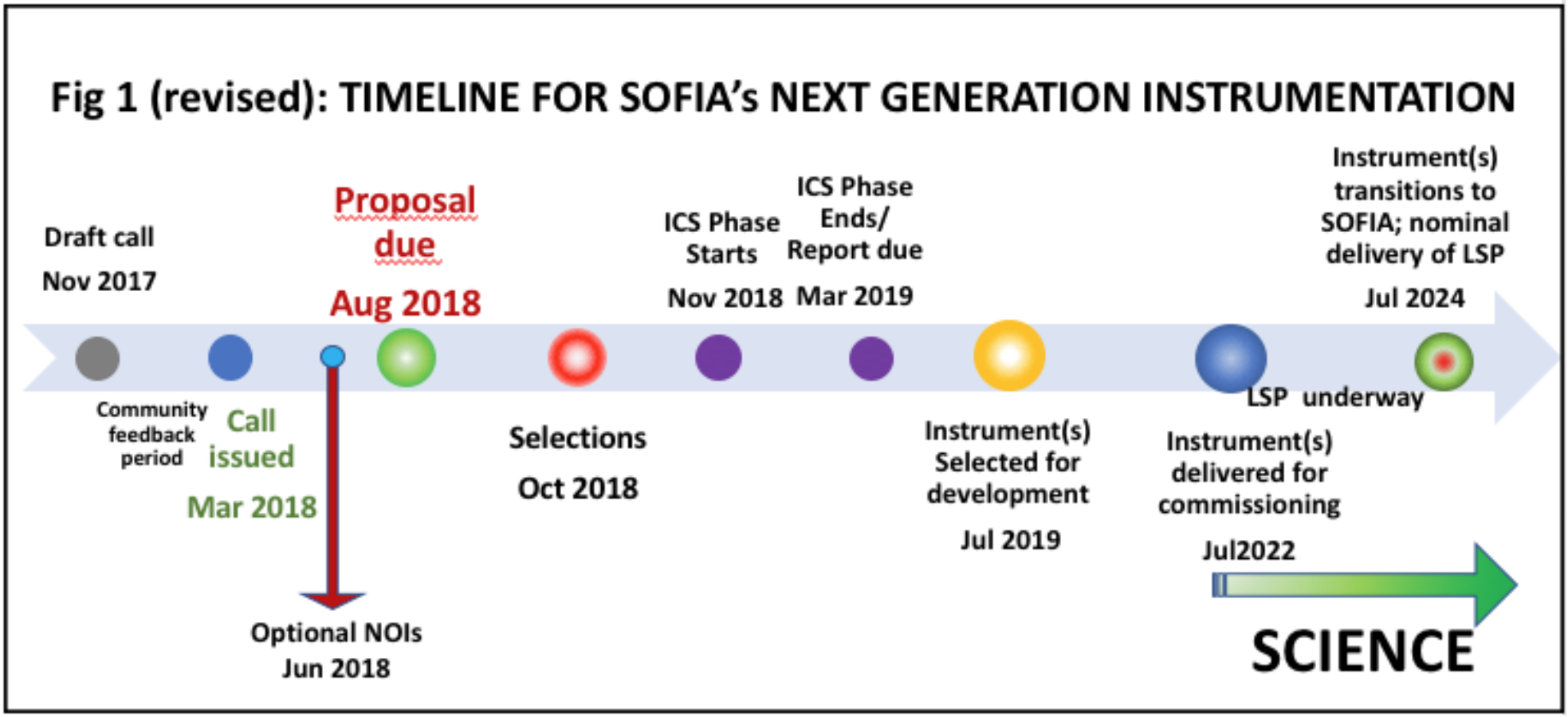
- Flexibility to Propose What The Science Needs
  - Allow for nominal three-year development period after funding begins but also allow for longer or shorter development timescales for optimal science return
  - Allow for schedule and budget flexibility; make selections based on science return on investment
  - Reduce requirements for the Instrument Concept Study phase compared to previous solicitations
  - Make instrument development and acceptance process easier for teams (using lessons learned from past experience)

NGSI Legacy Science Program

- Legacy Science Program (LSP) must contain a detailed scientific justification and an observing plan which clearly describes the science targets, instrument modes and the time required to achieve the scientific goals, as well as the roles and expertise of the science team that will execute the LSP.
  - "SOFIA will accommodate observing plans that require up to half of the available U.S. observing time in any given year for all LSP observations."
  - It should be executable within a two year period following commissioning.
- Nominally LSP data have no period of exclusive use.
- In the Instrument Concept Study phase and after commissioning, the proposing team(s) may refine the needed observing time (possibly based on a better understanding of the instrument) but may not change the scope of the scientific investigation.

What legacy will your science leave?

US Next Gen Science Instrument Timeline



NOI DUE JUNE 1, 2018

Step 1 PROPOSALS DUE AUG 1, 2018

The First Three Steps

- Step 1
  - 25 Pages due Aug 1, 2018
  - Focus on the science
  - Propose whatever the science needs
  - Help us understand this idea is possible
  - Due: 1 AUG 2018
- Step 2 – (pending down selection)
  - Larger proposal due ~March 2019
  - Pull together the team
  - Develop the detailed plan
  - Where are we going to explore?
  - Resources become available (funded study)
- Step 3
  - Carry out the plan from Step 2

German Participation in Instrumentation Calls

- NASA Next Gen Science Instrument Call 2018
  - "As the Memorandum of Understanding (MOU) between NASA and Deutsches Zentrum für Luft und Raumfahrt (DLR), the German Aerospace Center, gives the authority for selection of German participants in the SOFIA Project to DLR, German institutions are not eligible to submit proposals as PI to NASA in response to this program element (see also Section 12.3)."
  - German scientists wishing to participate in the instrument solicitation can partner with PIs of non-German institutions.

- Looking Ahead
  - In the future NASA welcomes discussion towards more cooperation between the US and Germany -- for instance joint proposal calls and a joint TAC. Having this would be a good first step to also then doing something similar (but on a no funds exchange basis) for building an instrument.

Please Review the Solicitation

- Solicitation at: ROSES-18, Appendix D.14 NNH18ZDA001N-SOFIA
  - https://nspires.nasaprs.com/external/
  - https://science.nasa.gov/researchers/sara/grant-solicitations/ROSES-2018
  - Apply through NASA NSPIRES* on-line system

*NSPIRES – NASA Solicitation and Proposal Integrated Review and Evaluation System

- SOFIA Science Instrument Library and frequently asked questions (more information on SOFIA & Instrument Development Requirements)
  - https://www.sofia.usra.edu/science/instrument-call

- Questions:
  - Specific to Solicitation – send to Kartik Sheth: kartik.sheth@nasa.gov
  - General SOFIA or Instrument Development – send to SOFIA Science Instrument Development: arc-sofia-sidev@mail.nasa.gov

Tell you friends and colleagues!