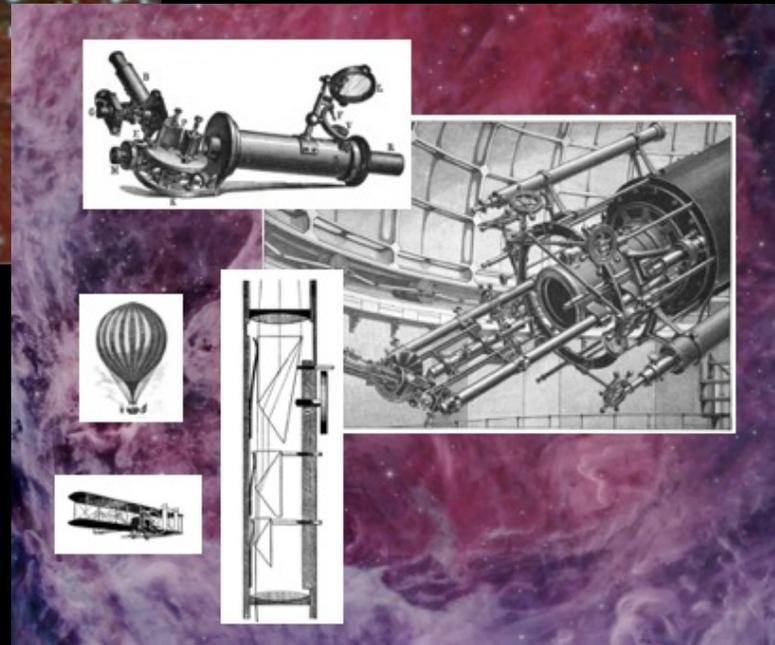


# German Instrumentation Workshops

Bernhard Schulz

6-Dec-2021



# Plan for Germany/Europe

- Use the opportunity to change the SOFIA paradigm
  - NASA does senior reviews but that is a normal process
  - No serious alternatives for Infrared/Submm on the 10 year horizon
  - Long term NASA vision makes termination less likely!
- The German/European community can create a complementary 10 year vision for Infrared/Submm astronomy
  - SOFIA is a working observatory
  - Future lighter-than-air observatories are good additional options
- First determine science interests and requirements (July 26-28, 2021) ✓
  - Get German and European Infrared Astronomy together and determine scientific interests
- Second discuss instrumentation and funding (Nov 17-19, 2021) ✓
  - Talk about how to make this science happen
  - New SOFIA instruments, new and planned balloon missions, instrument/detector development, funding opportunities
- Write white paper summary (by end Jan 2022)
  - Reference for proposals to build new instrumentation.

# Science Workshop 26-28 Jul 2021



- 231 registered participants
- 3 days @ ~4.5h per day
- typical online attendance 80-90
- 56 Presenters
  - 10 invited speakers
  - 32 Contributed talks
  - 14 Poster presentations
- Summary presentation by Karl Menten
- Main Themes: ISM, PDRs, shocks, star formation, astrochemistry

# Science Workshop 26-28 Jul 2021

- **Main Themes:** ISM, PDRs, shocks, star formation, astrochemistry
- 1/3 of presentations extragalactic
- High resolution spectroscopy MIR and FIR
- Trade spectral resolution for sensitivity
  - extra galactic work
  - large scale line mapping
- Polarimetry in FIR
- MIR/FIR broadband photometry
- Specific lines
- Time sampling

## Specific requests:

- Fine structure lines, HD, CO ladder, oxygen compounds
- large scale mapping of [NII] 122 $\mu$ m / 205 $\mu$ m
- 350 $\mu$ m filter
- NIR capabilities for occultation obs.

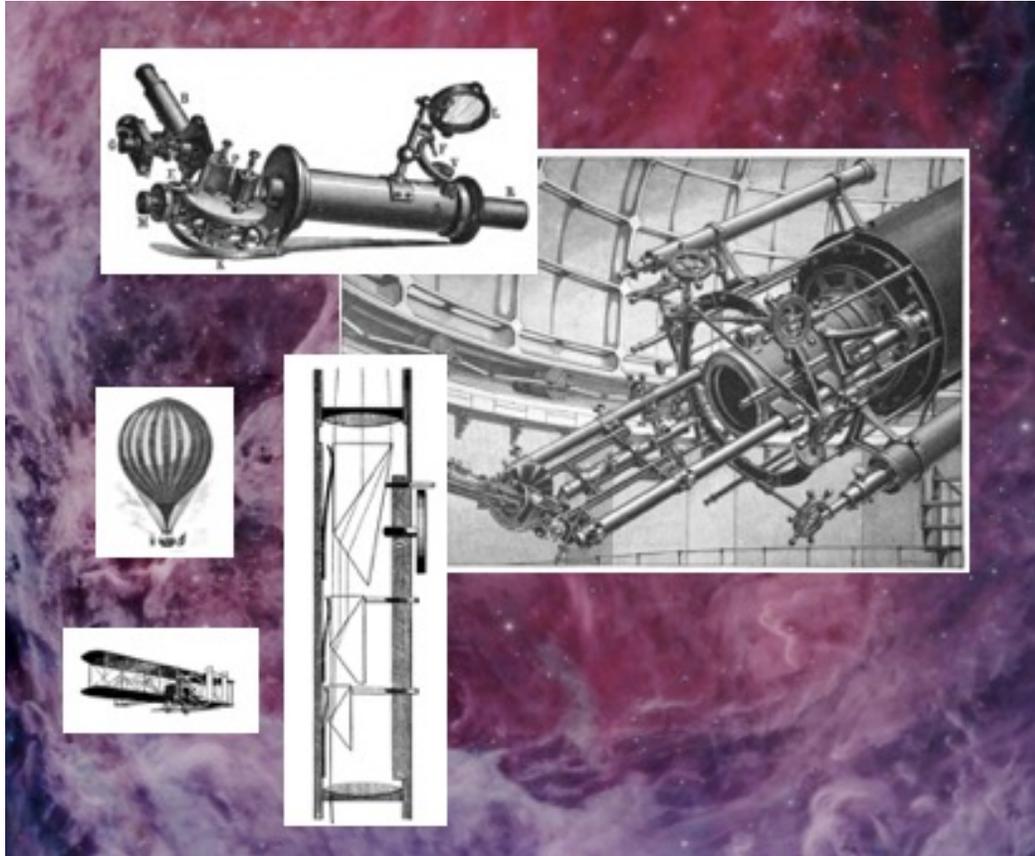
Session	Talks	Posters
Solar System	5	
Star & Planet Formation	6	
Interstellar Medium	15	8
Late Stellar Evolution	2	
Nearby Galaxies	8	3
High-Redshift Galaxies	3	4

## Instrumental Requirements

Spectrometer	46	73%
Photometer	15	24%
Heterodyn	32	51%
R=5000 FIFI	13	21%
FIFI-LS	19	30%
EXES	4	6%
FIR camera	12	19%
MIR camera	2	3%
NIR camera	3	5%
Pol.	7	11%
Time sampling	5	8%
balloon	6	10%
single pointing	21	33%
maps	37	59%
<b>Total Science Cases</b>	<b>63</b>	<b>100%</b>

Version: 14-Oct-2021

# Instrument Workshop 17-19 Nov 2021



- 156 registered participants
- 3 days @ ~5h per day
- typical online attendance 50-80
- 31 Presenters
  - 21 invited speakers
  - 6 Contributed talks
  - 2 Poster presentations
- Final discussion
  - Short summaries (Heinz Wilhelm Hübers and Leslie Looney)
  - Including representatives of DLR, DFG, DESY
- Main Themes: Heterodyne- and direct detection systems, balloon platforms, funding opportunities

# Instrument Workshop 17-19 Nov 2021

## First impressions:

- Balloon options look promising for specific programs
  - Scalable gondola developments
  - Survivability of payload remains a big issue
  - Low flight cadence
  - France has a dedicated balloon budget line
- SOFIA is the only regular platform for at least the next 10 years
  - Roadmap first step is in a 6 months formulation phase now
- Heterodyne HEB mixers, SIS mixers, Schottky diode mixers discussed
  - HEB mixers mature
  - High frequencies still hard to reach because no space missions
  - 100 pixels in focal plane considered very ambitious

**Preliminary!!!**  
**Very**

# Instrument Workshop 17-19 Nov 2021

## First impressions:

- Direct Detectors: Kinetic Inductance Detectors (KID), Transition edge detectors (TES), polarimetric Si-bolometers, Cold-electron bolometers
  - Expertise in UK, France, The Netherlands, Germany
- Instrument presentations: upGREAT, FIFI+LS, HERO, Millimetron, HIRMES, pHD, SOFIA Chopper, FPI++, ArTeMis/CoPilot/B-BOP
- Heterodyne:
  - 100 pixels array hard --> better modular approach
  - spectrometer power issue
- Direct Detection:
  - Many solutions exist, pushing to blue side no easy quick solutions, complex instruments will delay the next instrument
- Funding opportunities in Germany and Europe exist but managers need more awareness of researcher's needs

**Preliminary!!!**  
**Very**