

# Submillimetre Far-Infrared Astronomy from Antarctica

## Objective of the workshop

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# Framework: ARENA NA5

## NA5 Which Astrophysics at Dome C?

leader: Hans Zinnecker (Potsdam)

Identifies key astrophysical observational programmes to be carried out in Antarctica that complement those already in progress or planned in conventional ground based observatories or with space missions. A science steering committee will prepare and publish a rationale of the science programmes, instrumental recommendations to reach the scientific objectives and a timeline for instrumental development at Dome C in the context of space and other ground based programmes.

Tasks	Task leader	Title
5.1	M. Busso/M. McCaughrean	Wide field imaging surveys in the thermal infrared
5.2	P.-O. Lagage	New windows in the far Infrared
5.3	H.Rauer	New domains for ground based high precision and long duration time-series photometry and spectroscopy
5.4	F. Vakili	Obtaining the ultimate angular resolution
5.5	C. Abia	Spectroscopy and spectro-imagery

THz/submm

5.3.1	E.Fossat	Asteroseismology and Helioseismology
5.3.2	H.Deeg	Photometric search for extrasolar planets
5.3.3	K.Strassmeier	Solar-stellar connection

Deliverable No	Deliverable title	Deliverable date	Nature	Task
D5.1	Proceedings of Conference 1	10	Proceedings	All tasks
D5.2	Proceedings of Conference 1	22	Proceedings	All tasks
D5.3	Proceedings of Conference 1	34	Proceedings	All tasks
D5.4	Executive summary of recommendations to the National and International Agencies (ESO-ESA) for an astrophysical programme at Dome C	36	Book	All tasks

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But also: NA3 (large astronomical instruments), NA2 (site testing), NA4 (logistics).

# Key questions

**Which science?** As a primary goal, the workshop will identify unique scientific cases for which submm/THz observations with ground-based (large) telescopes would be essential to make a big step in understanding the cold Universe (proto-planetary disk, star formation, high-redshift proto-galaxies and cosmology).

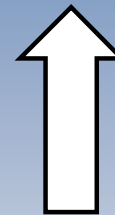
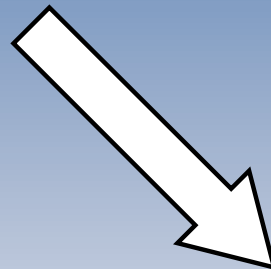
**Which instrument and telescope?** The workshop will therefore aim to discuss the possibility and the feasibility of installing a large (>10 m) single-dish antenna at Dome C and whether this telescope should be a dedicated instrument or an international facility. Logistics and cost vs. benefit in comparison with Chajnantor site will also be discussed.

**Is Dome C the best site?** Present knowledge of the atmospheric transmission in the FIR/submm windows and future site testing campaigns will be presented.

# Aims of the workshop

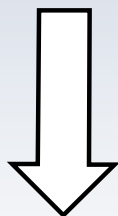
Astrophysics: goals

Assumed transmission:  
Dome C, Chajnantor...



Instrument/telescope

Site testing and modelling:  
South pole known  
Chajnantor known  
Dome C extrapolated



Feasibility, cost, funding, acceptance

# Aims of the workshop

Primary goal

Astrophysics: goals

Assumed transmission:  
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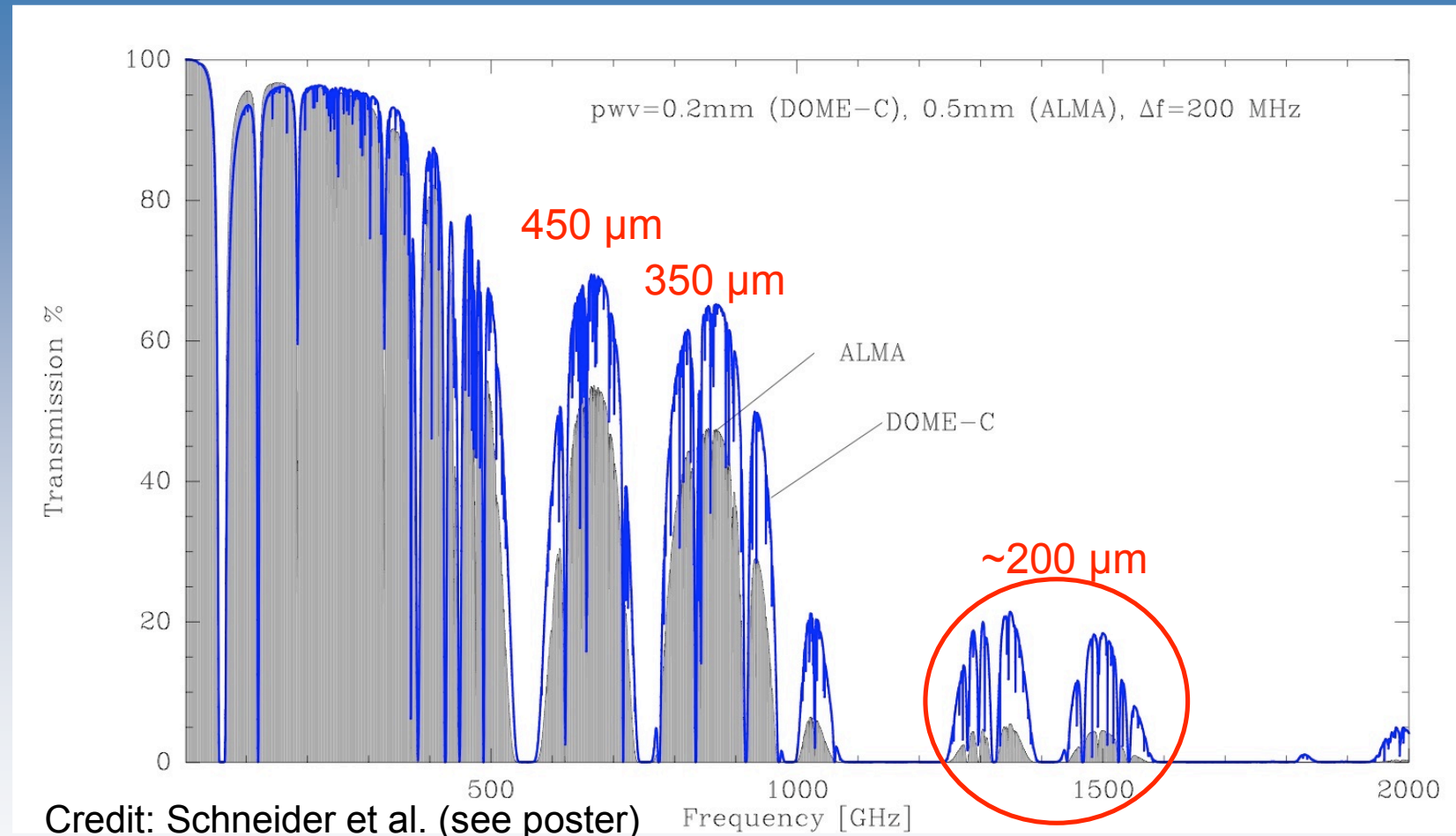
Feasibility, cost, funding, acceptance

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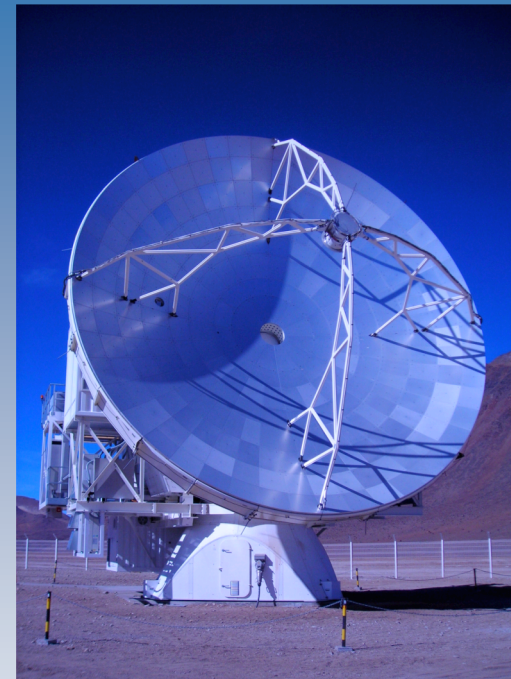
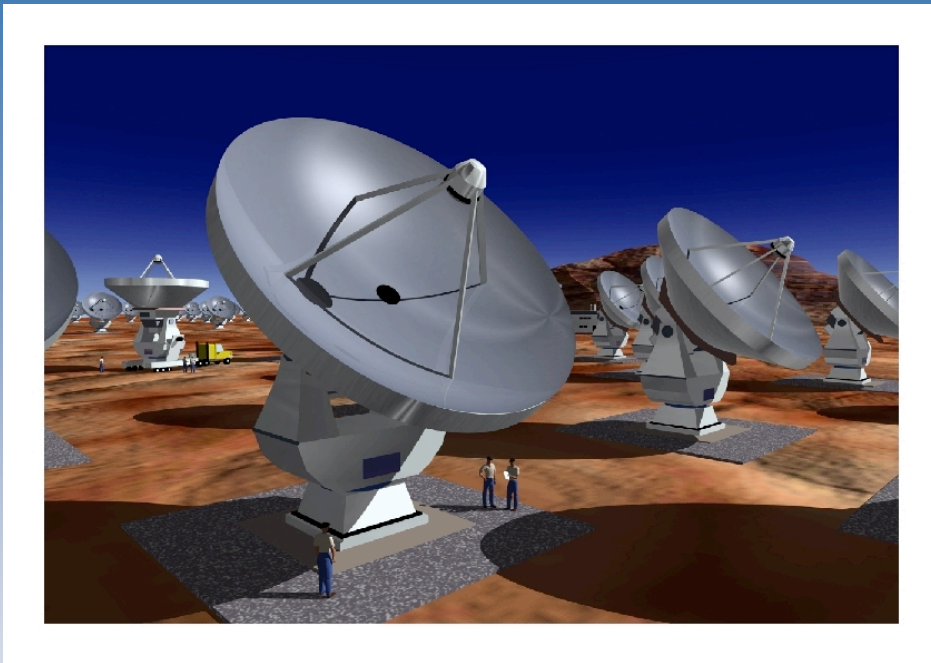
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# Ground: a strong constraint, the atmosphere...



# Ground: a gain, large dish...?



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## Ground: a gain, large dish...?

Millimetron: Russian & ESA space projet for a 12m FIR/submm/mm dish (see Frank Helmich's talk)



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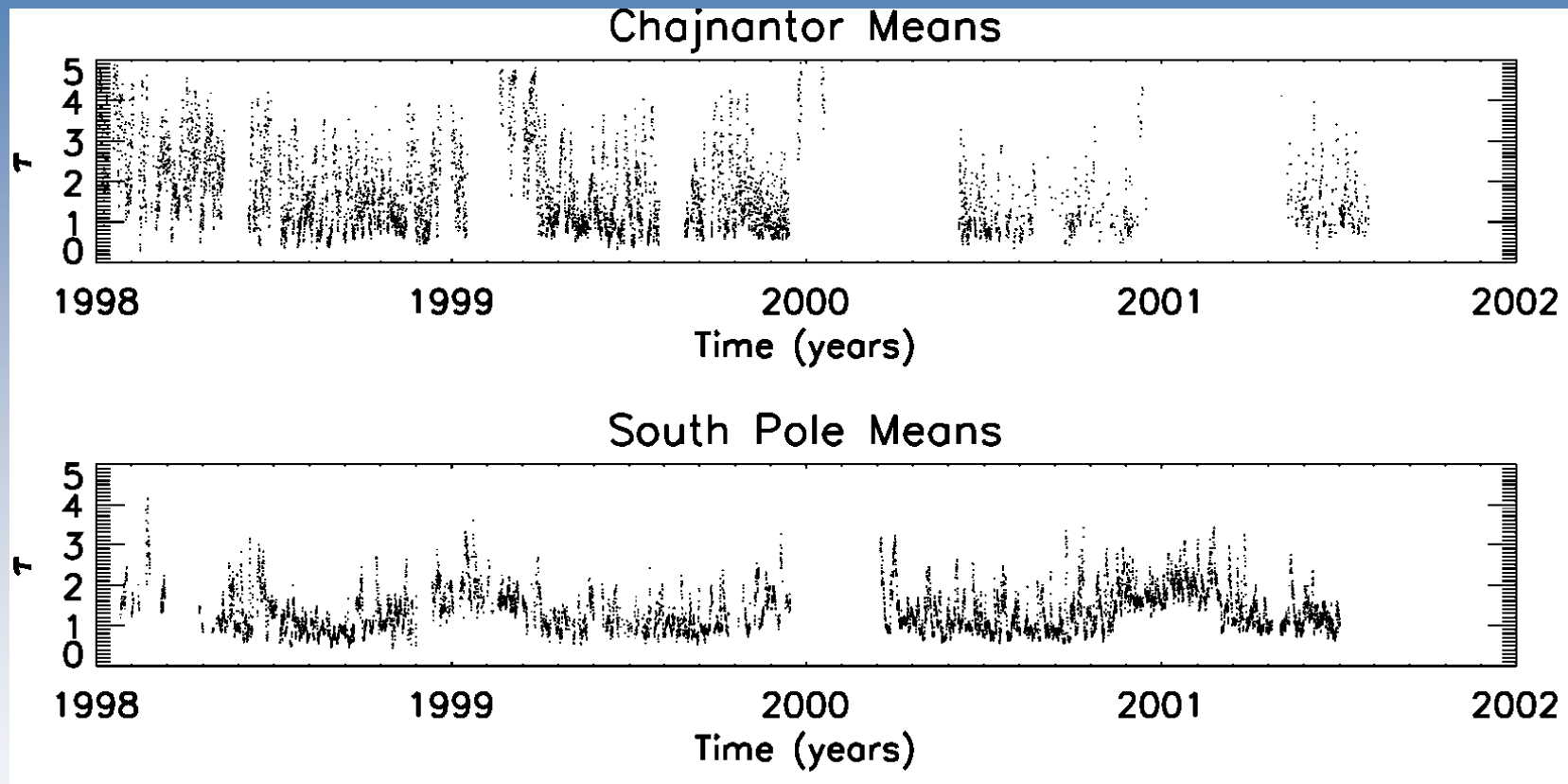
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# Assumption: Dome C, a very good site

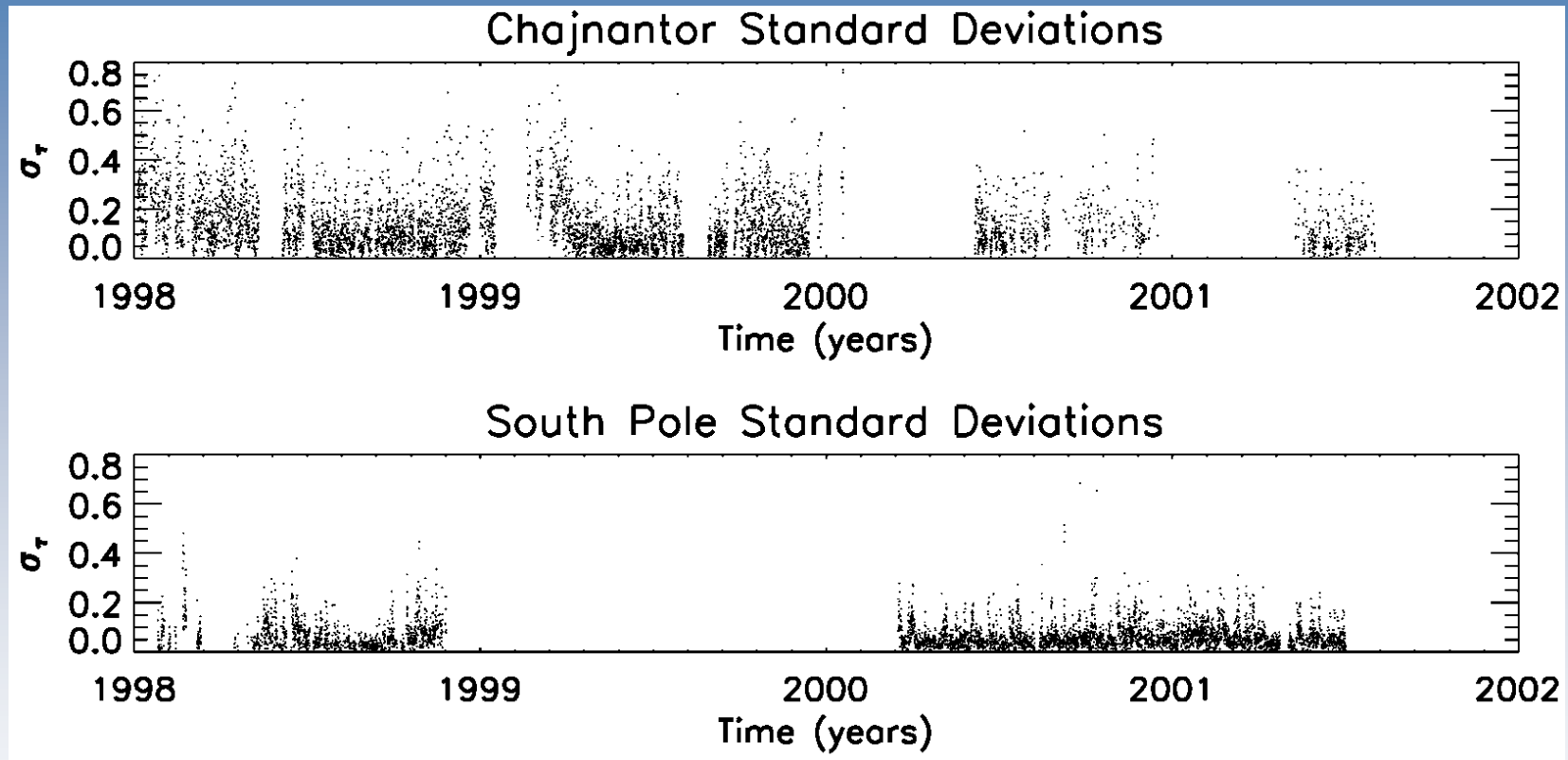
Opacity at 350  $\mu\text{m}$ : Peterson, Radford et al. 2003



Transmission at Dome C should be  
as good as at South Pole

# Assumption: Dome C, a very good site

Stability at 350  $\mu\text{m}$ : Peterson, Radford et al. 2003



Stability at Dome C should be  
as good as at South Pole

# Which Science ?

Sessions: Monday and Tuesday

Primary goal of the workshop: to identify unique scientific cases for which submm/THz observations with ground-based (large) telescopes would be essential to make a big step in understanding the cold Universe:

- Need for an instrument complementary to Herschel and ALMA ?
  - Wide field mapping ( $1^\circ \times 1^\circ$ ) in a realistic amount of time
  - Sufficient angular resolution ( $\sim 1''$ )
- Planet formation and proto-planetary disk
- Star formation in our Galaxy and beyond
- High-redshift proto-galaxies and cosmology

- ... **If Science cases then which telescope...**

# Which Instrument and Telescope ?

Session: Tuesday afternoon

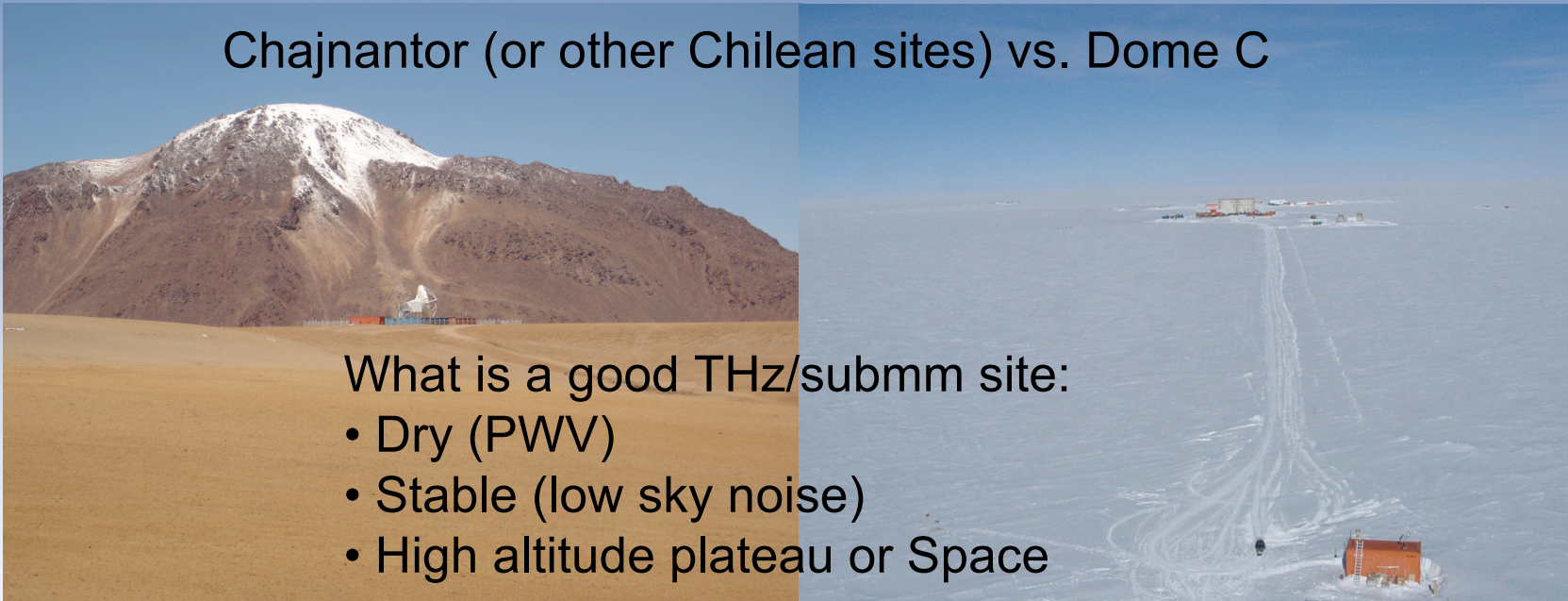
- Sizes and performances for achieving Science goals;
- Preliminary specifications on size, surface accuracy, observing modes...
  - ➔ A telescope design as simple as possible (e.g. ALMA 12m dish) ?
  - ➔ A more sophisticated 12m design (e.g. submm + mid-IR dish) ?
  - ➔ Larger telescope: 20, 30m ?
- Feasibility at Dome C:
  - ➔ Design study cost
  - ➔ Manufacturing cost
  - ➔ Logistics support
- Telescope management
  - ➔ A dedicated instrument ?
  - ➔ An international facility ?
- **Benefits/cost (Dome C) > Benefits/cost (other sites)?**

# Which site on Earth ?

Session: Wednesday morning

## Is Dome C the best site for THz/submm (200-450 $\mu\text{m}$ ) astronomy ?

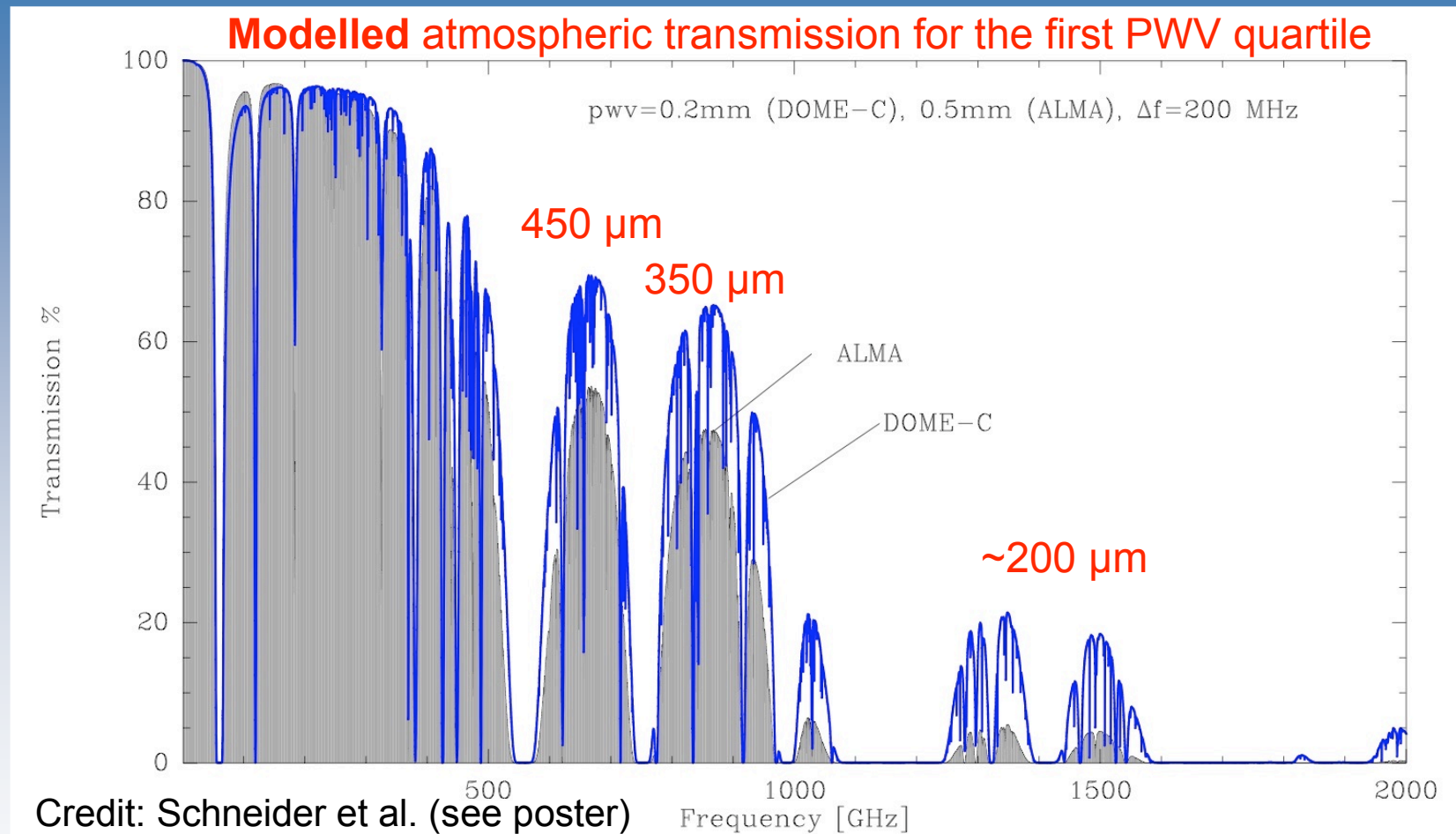
Chajnantor (or other Chilean sites) vs. Dome C



What is a good THz/submm site:

- Dry (PWV)
- Stable (low sky noise)
- High altitude plateau or Space

# Dome C vs. Chajnantor plateau...



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But at Cerro Chajnantor PWV=0.75 of PWV on the plateau

# Some conclusions on Wednesday

Antarctica, South Pole



South Pole Telescope

Chile, Cerro Chajnantor



Cornell Caltech Atacama Telescope  
Cerro Chajnantor, Chile

CCAT project