Chinese Antarctic Research Expedition

Astronomy at Dome A

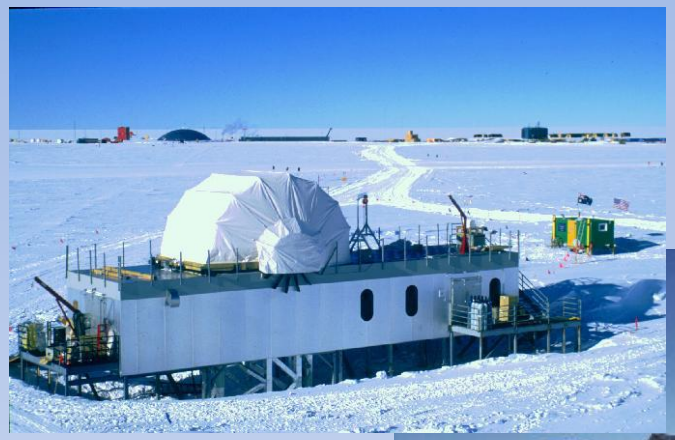
ZHOU,Xu

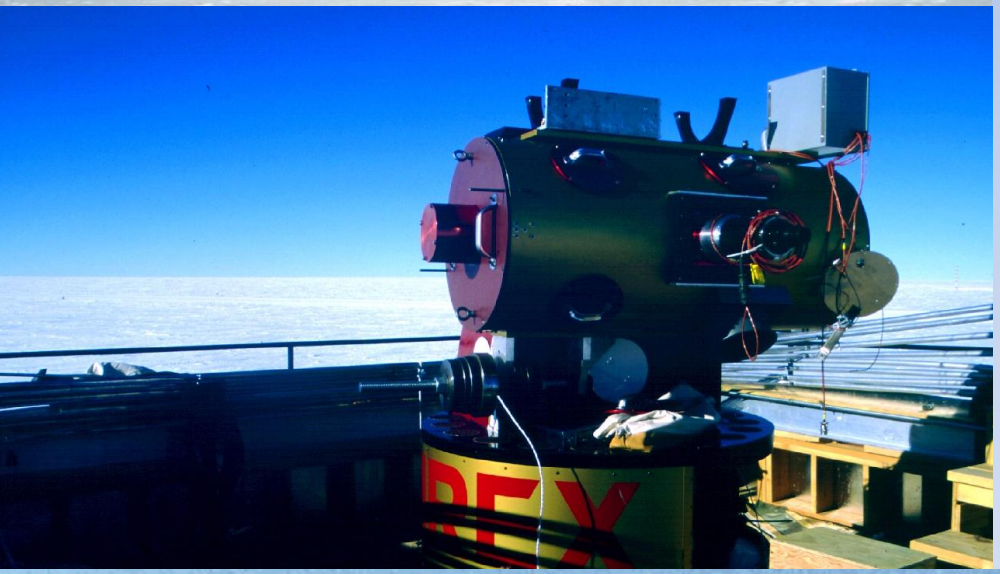
Chinese National Astronomical Observatories

On Behave of

Center of Chinese Antarctic Astronomy

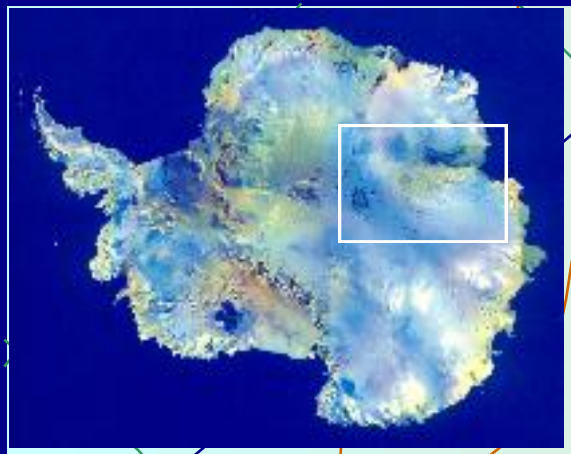
Telescopes






propane bottle
AASTO
G-Mount
AST/RO
DASI
MAPO
new lab (under construction)

The progress of Chinese Antarctic Research Expedition



E60°

MGA

Mawson

E70°

Prince Charles Mountain

Prydz Bay

Grove Mountain

Zhongshan

1996/1997

Davis

E80°

1997/1998

1998/1999

冰穹A

About 1228km

Princess Elizabeth Land

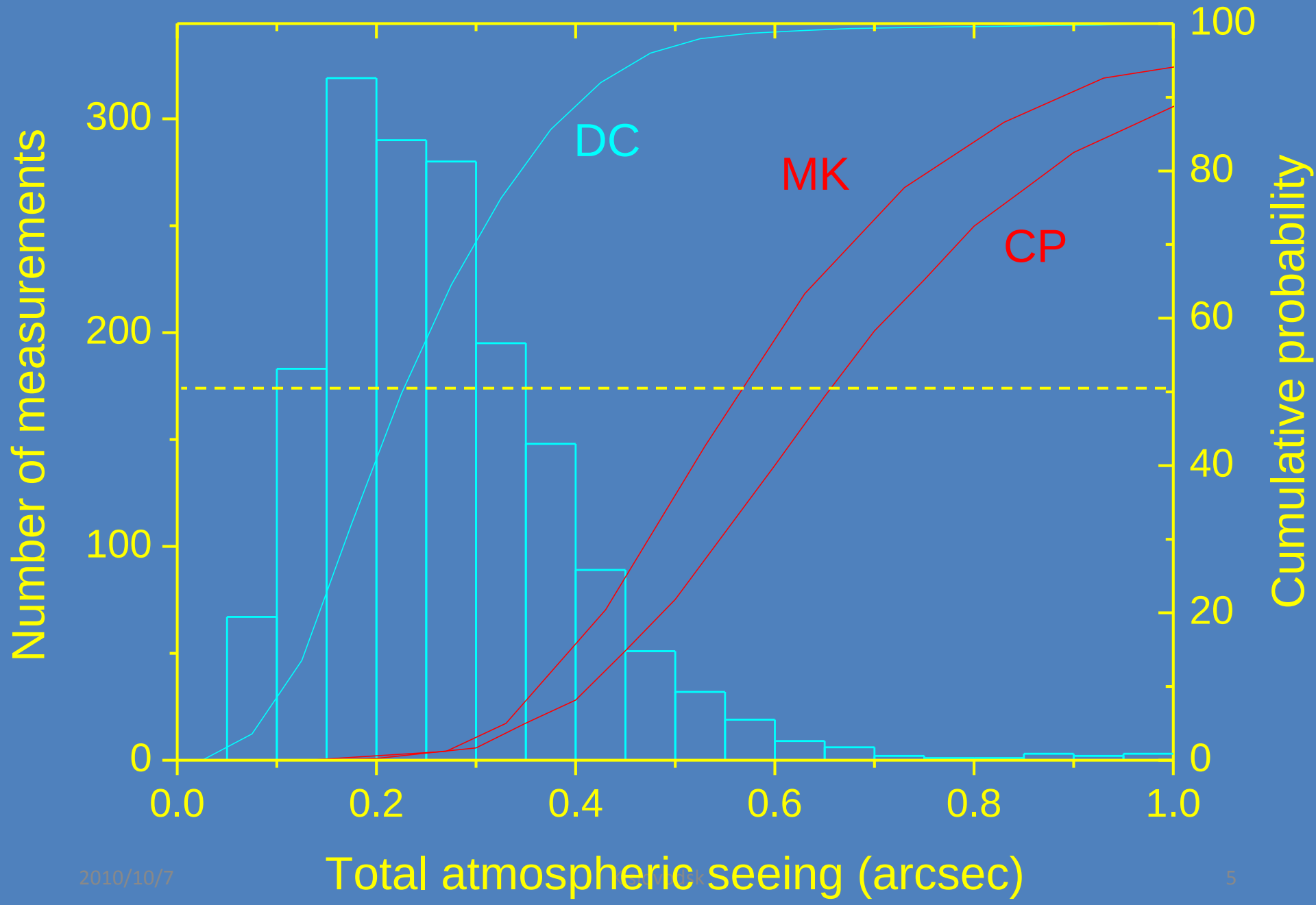
2004/2005

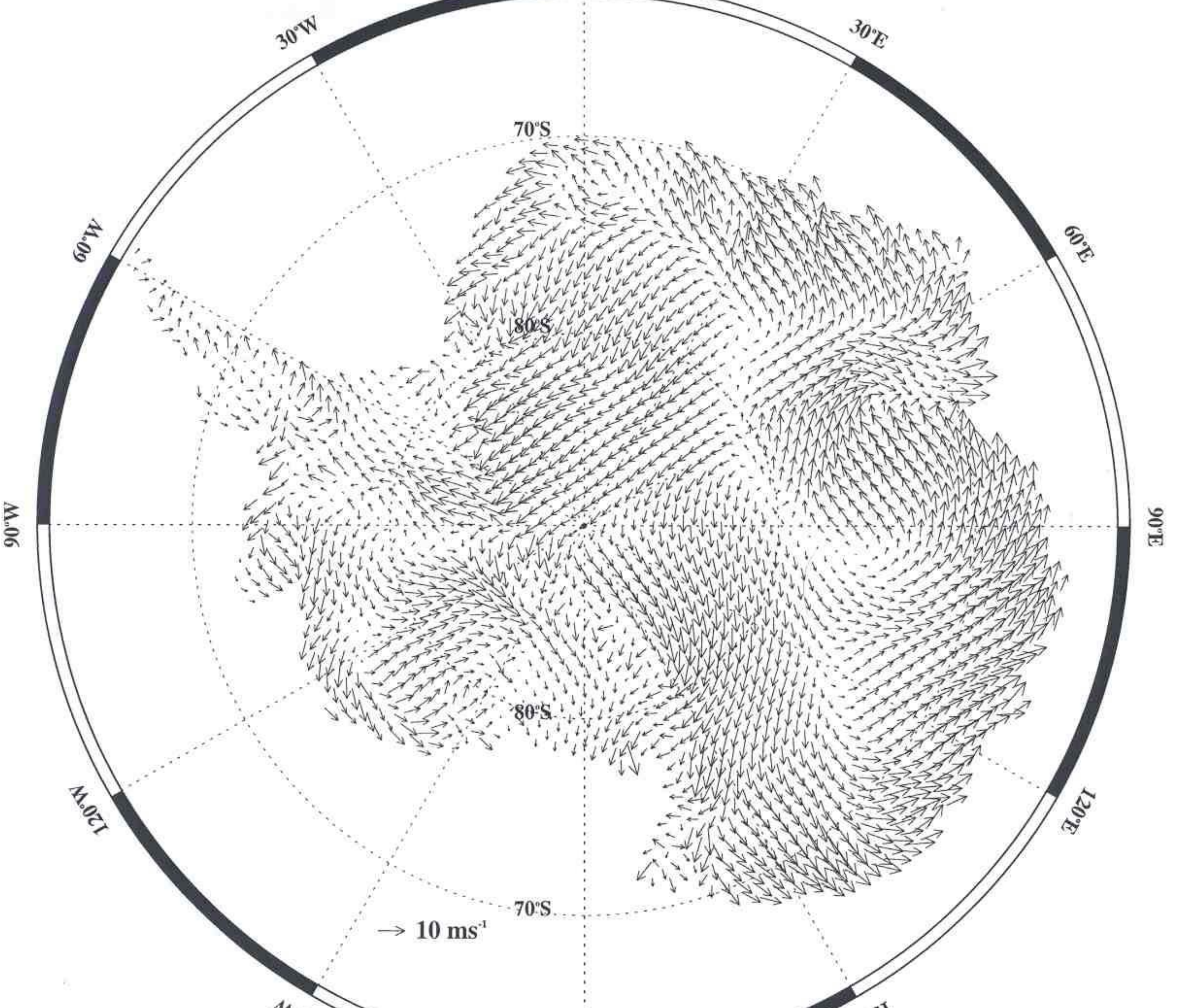
80°

75°

70°

Lawrence, Ashley, Tokovinin, and Travouillon, *Nature,* **431,** 278, (2004)



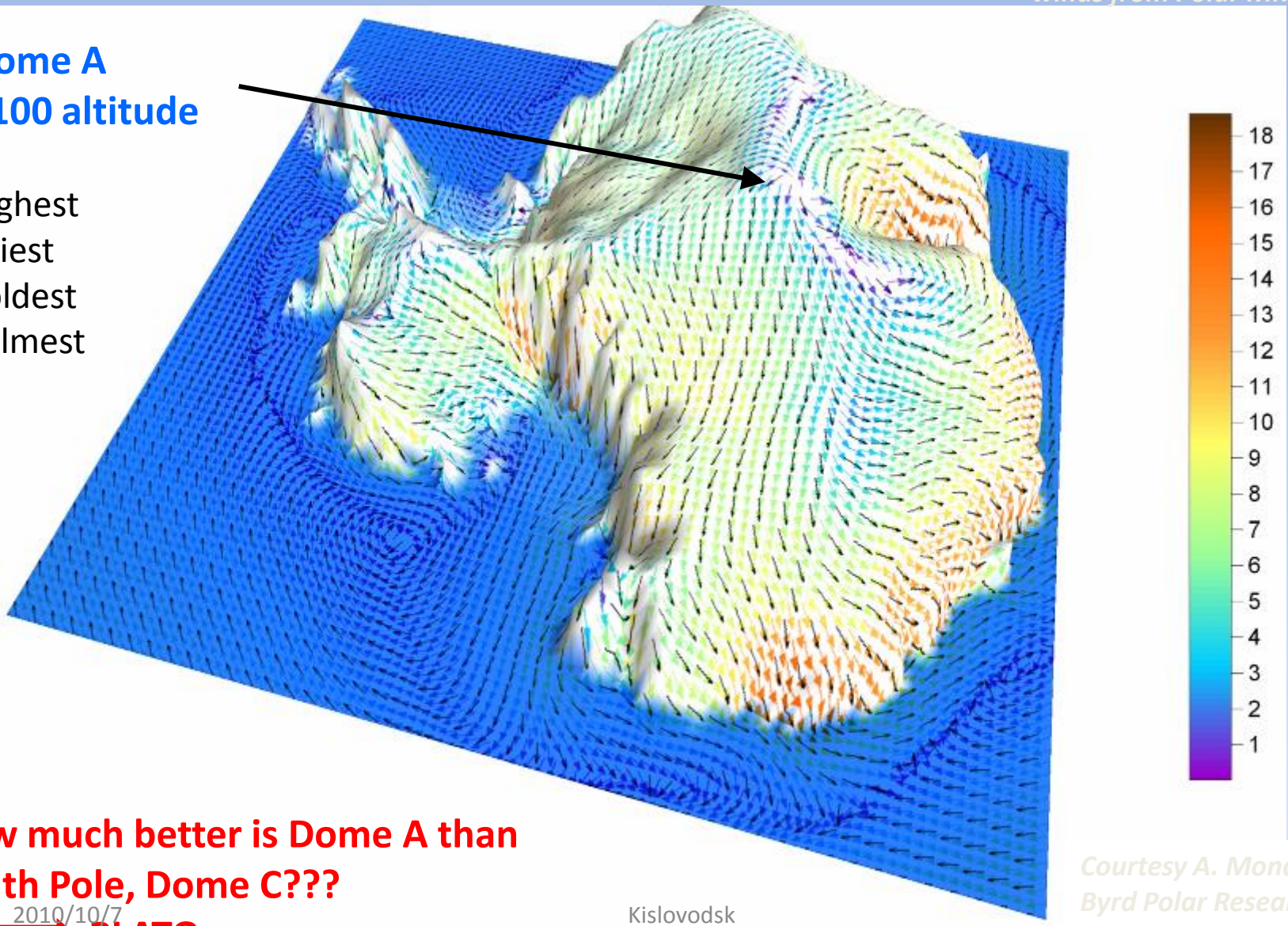

30°W
30°E
60°W
60°E
90°W
90°E
120°W
120°E
70°S
80°S
80°S
70°S
→ 10 ms⁻¹

Dome A

The annual vector mean winds from Polar MM5

Dome A
4100 altitude

highest
driest
coldest
calmest



How much better is Dome A than South Pole, Dome C???

→ **PLATO**

Courtesy A. Monaghan, Byrd Polar Research Centre

PLATO is a collaboration between China, Australia, USA and UK.

Image: ZHOU Xu

Dome A Site Survey

Chinese Center for Antarctic Astronomy

- National Astronomical Observatory of China
- Purple Mountain Observatory
- Nanjing Institue of Astronomical Optics Technology
- Tianjin Normal University
- Polar Research Institute of China

Polar Research Institute of China

University of New South Wales

Texas A&M University

University of Arizona

California Institute of Technology

University of Chicago

University of California, Berkeley

An exceptional team

- Xiangqun Cui, Longlong Feng, Xuefei Gong, Jinyao Hu, Yuansheng Li, Zhaohui Shang, Lifan Wang, Jun Yan, Huigen Yang, Xiangyan Yuan, Yongheng Zhao, Xu Zhou, Zhenxi Zhu
- Michael Ashley, John Lawrence, John Story, Daniel Luong-Van (UNSW)
- Craig Kulesa, Anna Moore, Carlton Pennypacker, Nicholas Tothill, Tony Travouillon, Christopher Walker, Lifan Wang, Donald York

The PLATO Collaboration

- National Astronomical Observatories, Chinese Academy of Sciences, Beijing, China
- Graduate University of Chinese Academy of Sciences, Beijing, China
- Chinese Center for Antarctic Astronomy
- University of New South Wales, NSW, Australia
- Nanjing Institute of Astronomical Optics and Technology, Nanjing, China
- Purple Mountain Observatory, Nanjing, China
- Steward Observatory, University of Arizona, Tucson, USA
- Macquarie University, NSW, Australia
- Anglo-Australian Observatory, Australia
- California Institute of Technology, Pasadena, USA
- Polar Research Institute of China, Shanghai, China
- Tianjin Normal University, Tianjin, China
- Texas A&M University, USA
- Thirty Meter Telescope Project, USA
- University of Chicago, Chicago, USA
- University of Auckland, New Zealand
- European Space Agency, Noordwijk, The Netherlands

M.C.B. Ashley, S. Bradley, Xiangqun Cui, Longlong Feng, Xuefei Gong, Jingyao Hu, C.A. Kulesa, J.S. Lawrence, Zhaoji Jiang, Gemrong Liu, D.M. Luong-Van, Jun Ma, M.J. McCaughrean, A.M. Moore, C. Pennypacker, Weijia Qin, Zhaohui Shang, J.W.V. Storey, Bo Sun, N. Suntzeff, N.F.H. Tothill, T. Travouillon, C.K. Walker, Jiali Wang, Lifan Wang, Jianghua Wu, Zhenyu Wu, Hong Xia, Jun Yan, Ji Yang, Huigen Yang, Yongqiang Yao, Xiangyan Yuan, D.G. York, Zhanhai Zhang, Xu Zhou, Zhenxi Zhu, Hu Zou

The Brief History of Astronomy at Dome A

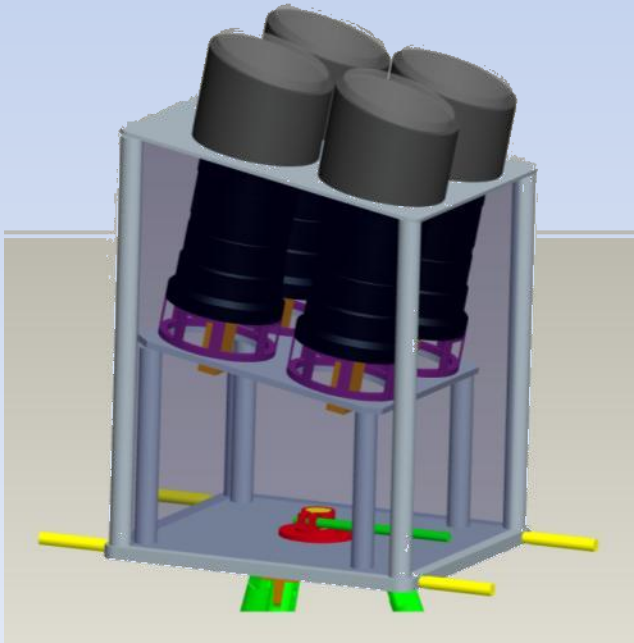
2005 Jan., A traverse team led by Yuansheng Li (李院生）reached Dome A from Zhongshan Station
2005, May, Beijing, Workshop on Wide Field Astronomy at Dome A (Organizer: Xiangqun Cui & Lifan Wang, with the LAMOST collaboration)
2005, May Nanjing, PMO, Continuing meetings on Antarctic Astronomy at Dome A, Antarctica (Hosted by Jun Yan, organized by Xiangqun Cui & Lifan Wang)
2005 Nov., Wide Field Astronomy at the Antarctic Plateau (Padua, organized by Lifan Wang & Enrico Cappellaro)
2006 May, Continuing dialogs between PMO & PRIC, Jun Yan, Xiangqun Cui, Longlong Feng & Lifan Wang visited Shanghai
2006 Nov., MoU on USNW-PMO-PRIC-NIAOT collaborations on Antarctic research signed.
2007 Jan., PLATO/CSTAR started
2007 May, NSF Approval of funding on three instruments to participate astronomical site survey effort
2007 Jul., Conference on International Polar Year (Organized by Polar Research Institute of China)
2007 Oct., CSTAR/GATTINI/DASLE shipped to Sydney
2007 Nov., Xuelong left for Dome, A
2008 Jan., PLATO/CSTAR installed at Dome A.
2008 Jan. 11, PLATO in operation
2008 Mar. 20, First Light from CSTAR

2007/2008 Dome A Traverse

The 24th Chinese Antarctic Research Expedition Inland Team

Chinese Small Telescope Array (CSTAR)

- 4 telescopes with diameter 15cm, 1Kx1K CCD each, 5x5 square degrees view, all point to the south pole (near the zenith).
- With g, r, i and none filters, without any mechanical moveable instrument.



Science Purposes

- SNe, Novae, Orphan afterglows of γoutburst.
- Search for extrasolar planets.
- Statistic of the variables in this area.
- Light curves of the variables
- Site survey: Transparency, background light, cloud, etc.

声雷达 SNODAR

(Surface layer Non-Doppler Acoustic Radar)

- **Supplied by UNSW / Univ Aukland**
- **Measures: high resolution (1 m) Cn2 in boundary layer (5-100/800 m)**
- **Mounting: externally on snow surface**
- **Power: 30 W (internal) + 10 W (external)**
- **Weight: 30 kg (total)**
- **Installation: 1 day**

天光云量监视仪
Gattini Dome A

Gattini Dome A

Supplied by Anna Moore (CALTECH)

Wide and narrow field lens with Apogee CCD array

Measures: cloud cover, optical sky brigl aurora, variable star photometry

Mounting: on 2 PLATO roof ports

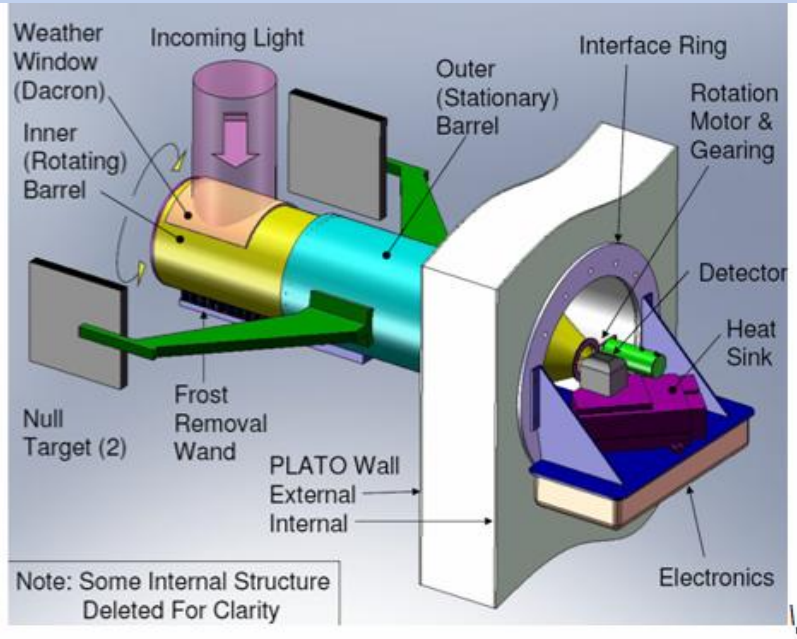
Power: 80W (instrument) + 20W heat

Weight: 30 kg (total)

亚毫米波望远镜
Pre-HEAT

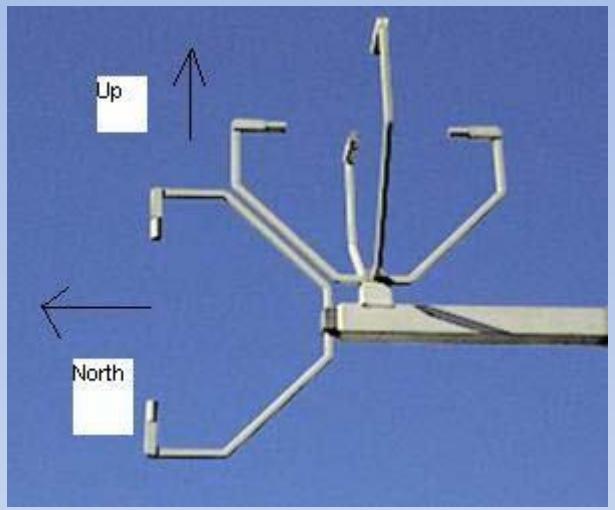
Pre-HEAT

- Supplied by University of Arizona (Kulesa, Walker et al.)
- 450 micron sky-dipping radiometer using Schottky receiver
- Measures: opacity, galactic plane line emission
- Mounting: through PLATO wall port
- Power: 70W (instrument+ heating)
- Weight: 50 kg (total)

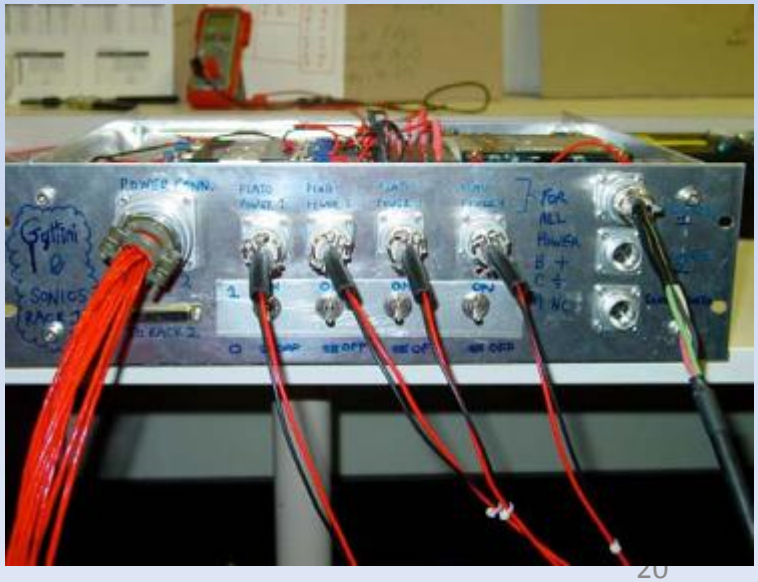


声波风速计 Sonics Anemometer

Caltech: Travouillon et al.

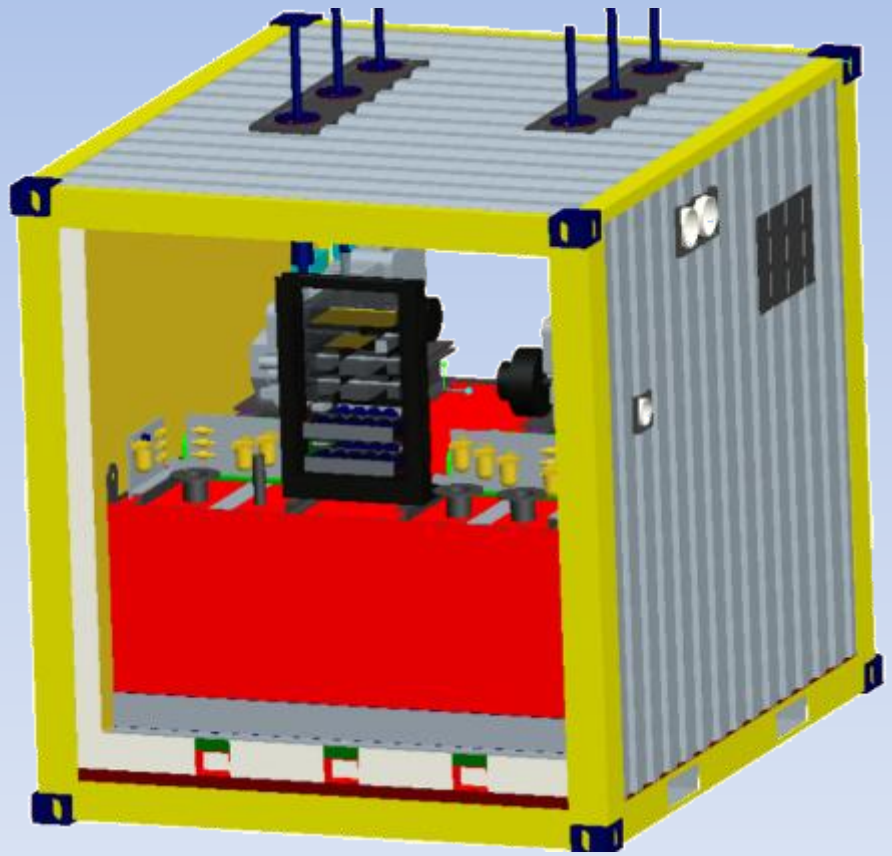


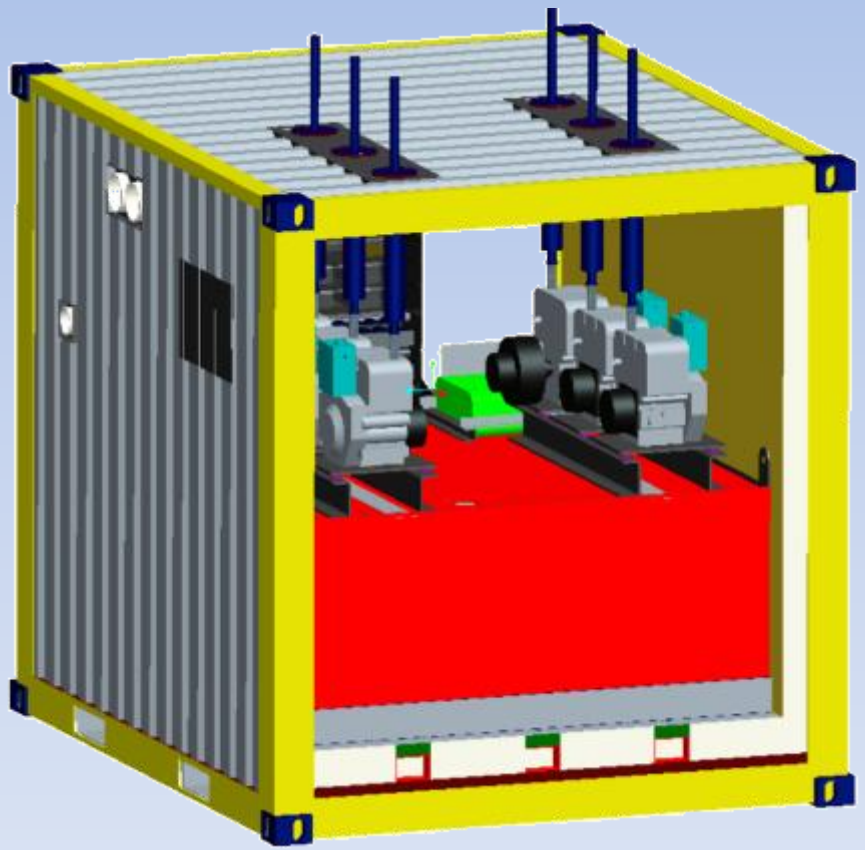
DASLE : measure the intensity and vertical extent of the boundary layer using three fast sonic anemometers.



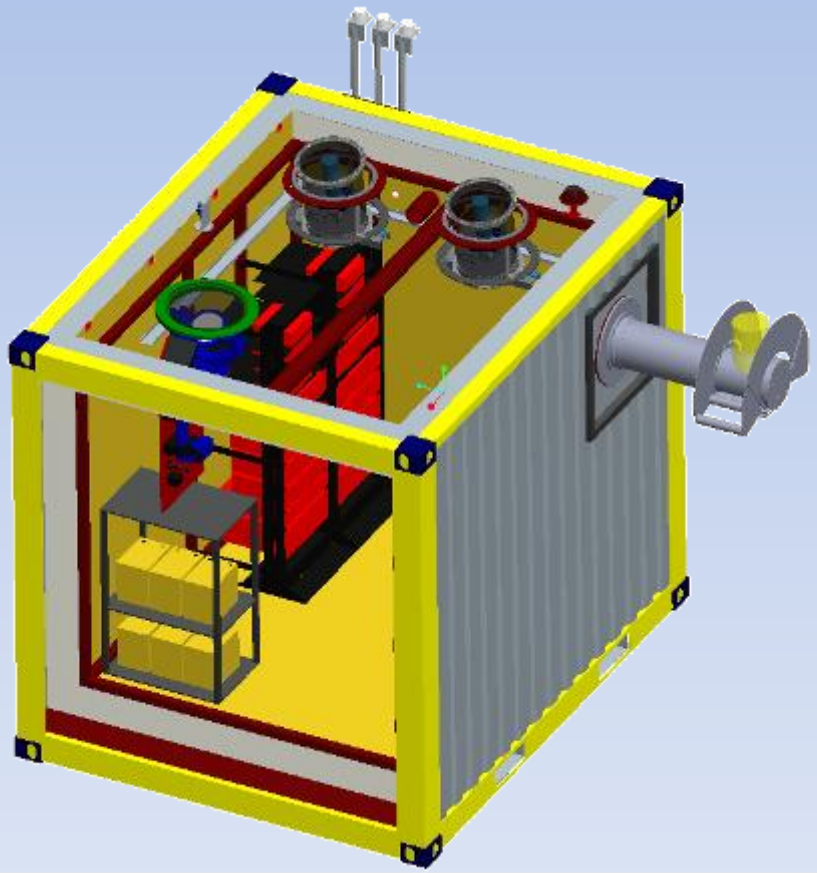
These instruments measure temperature and 3D wind velocity from which the turbulence can be deduced

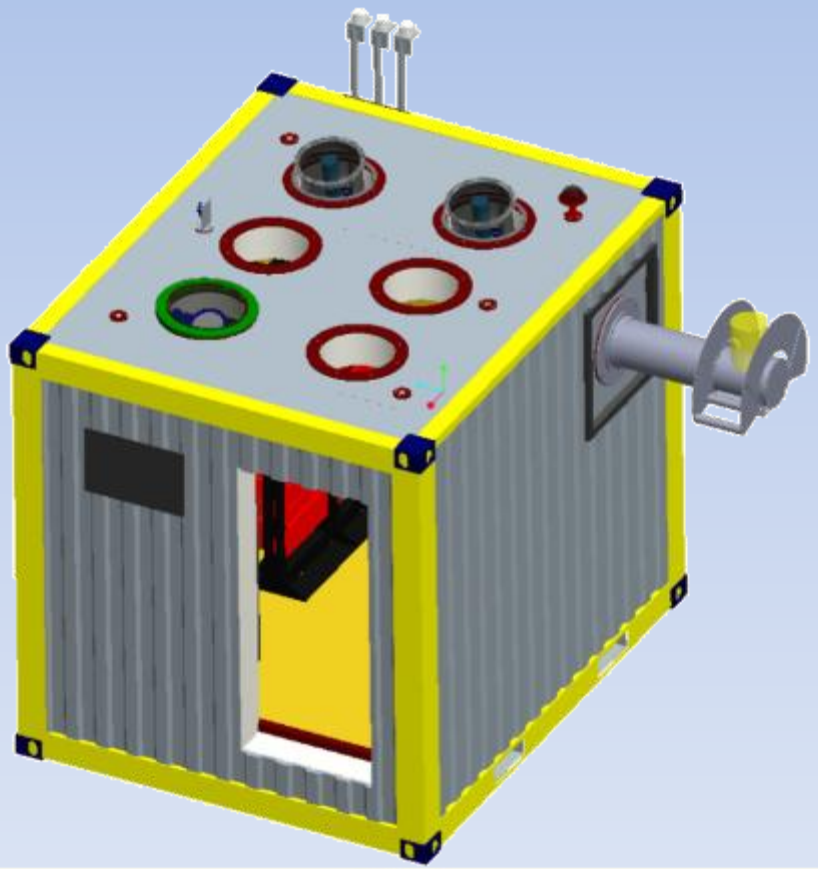
PLATO engine module





PLATO instrumental Module






PLATO
PLATO

The Instruments are transport from Xuelong Ship to the departure place

Astronomical Instruments at Departure Station

CSTAR

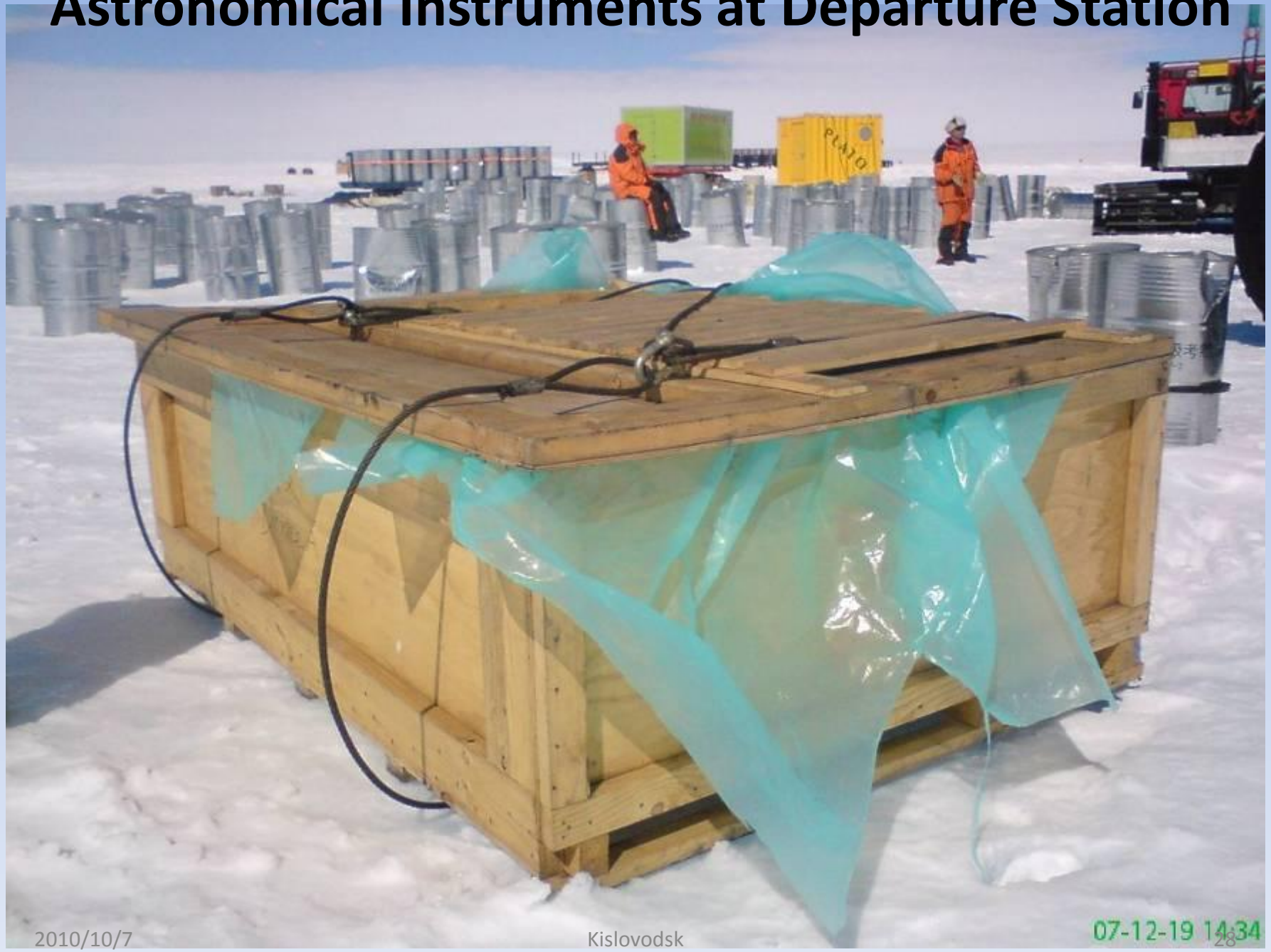
Astronomical Instruments at Departure Station

Engine and Instrumental Module

Astronomical Instruments at Departure Station

Tripod of CSTAR and 30 tower of Sonic

Astronomical Instruments at Departure Station

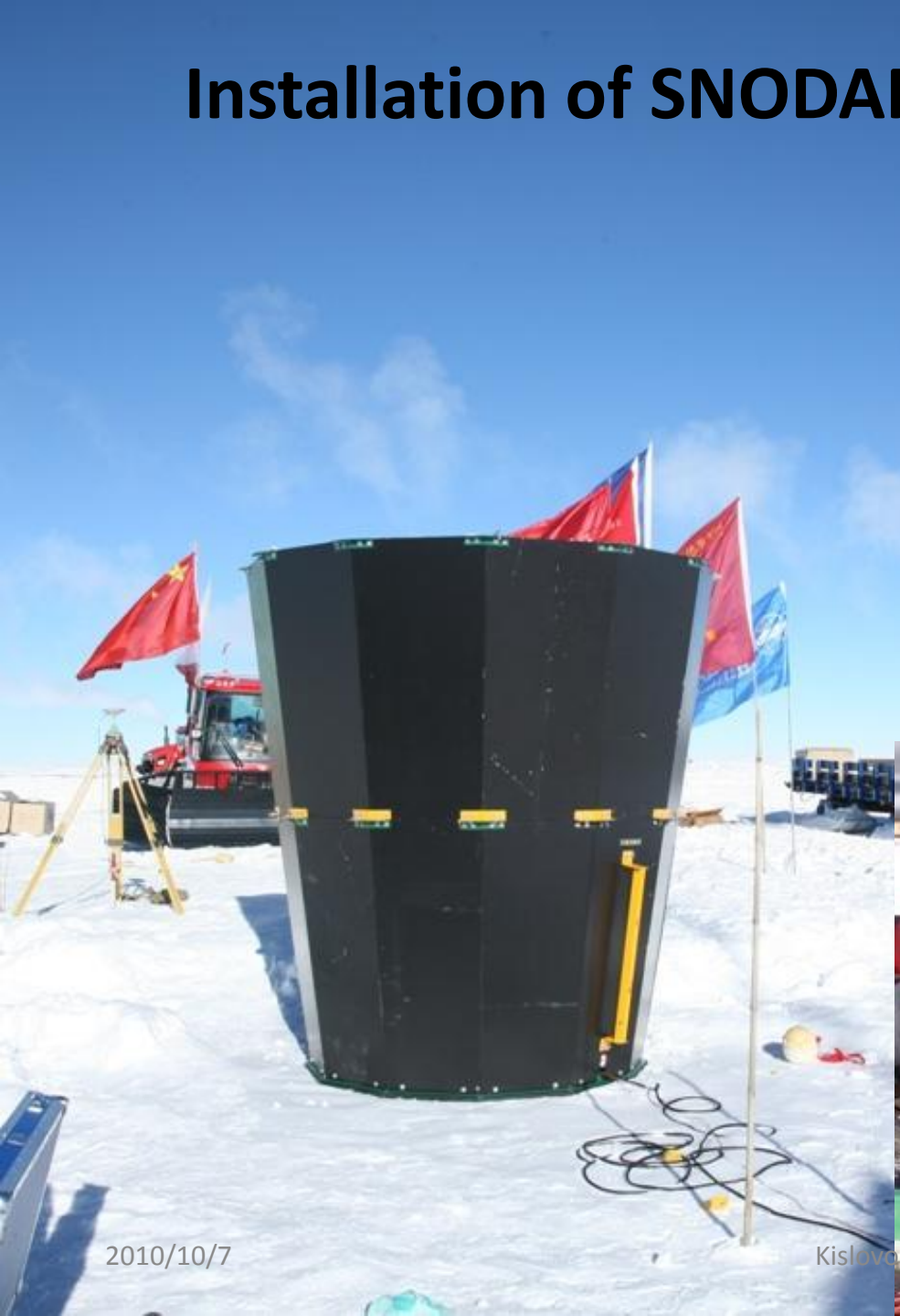


The instruments arrive Dome A on Jan 11, 2008

CSTAR installed at Dome A

Pre-HEAT installed at Dome A

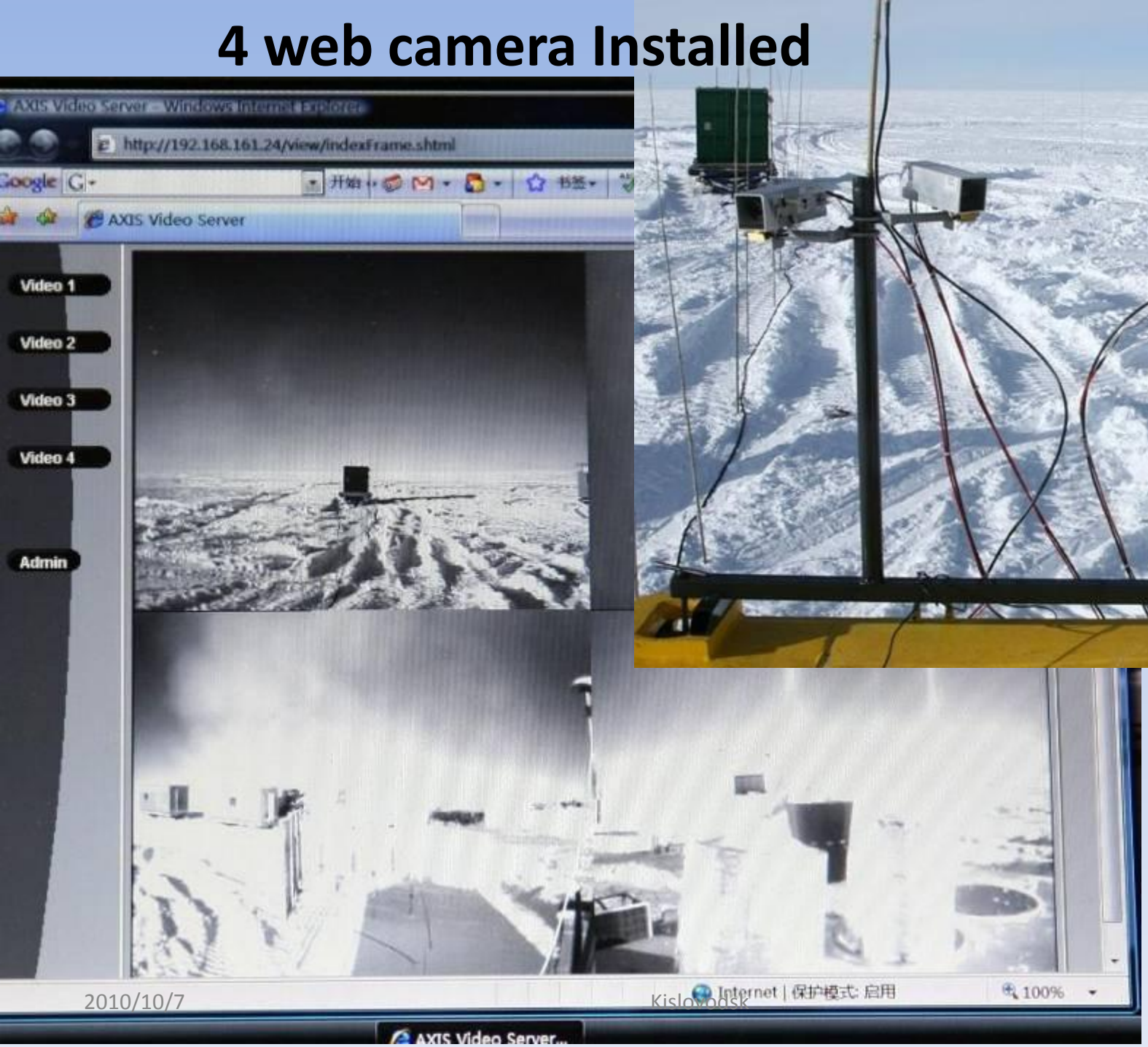
Installation of SNODAR

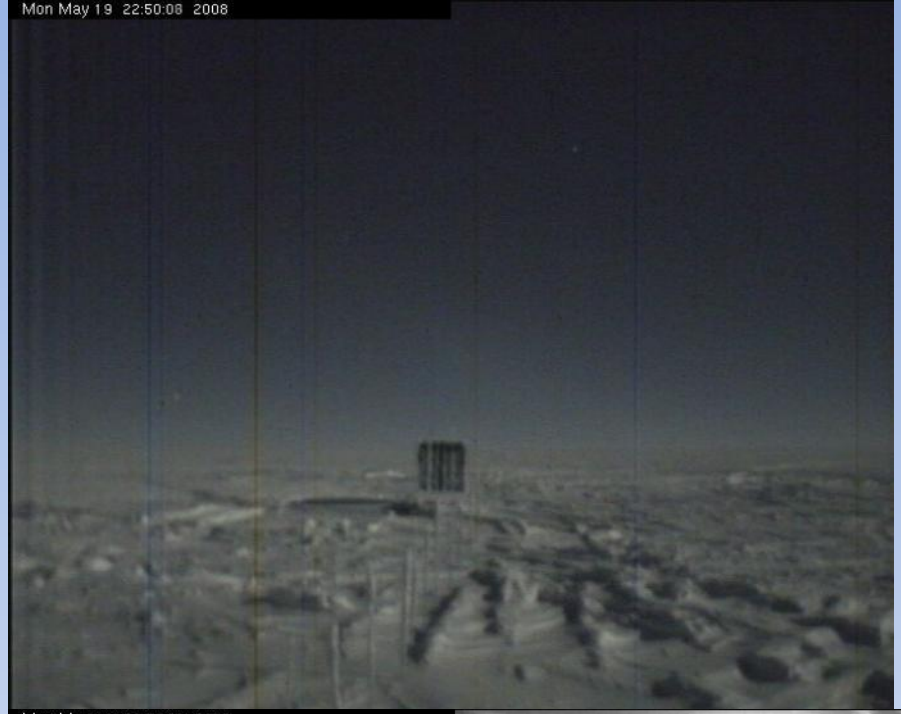


Gattini installed at Dome A

Sonics Anemometer installed at Dome A

4 web camera Installed



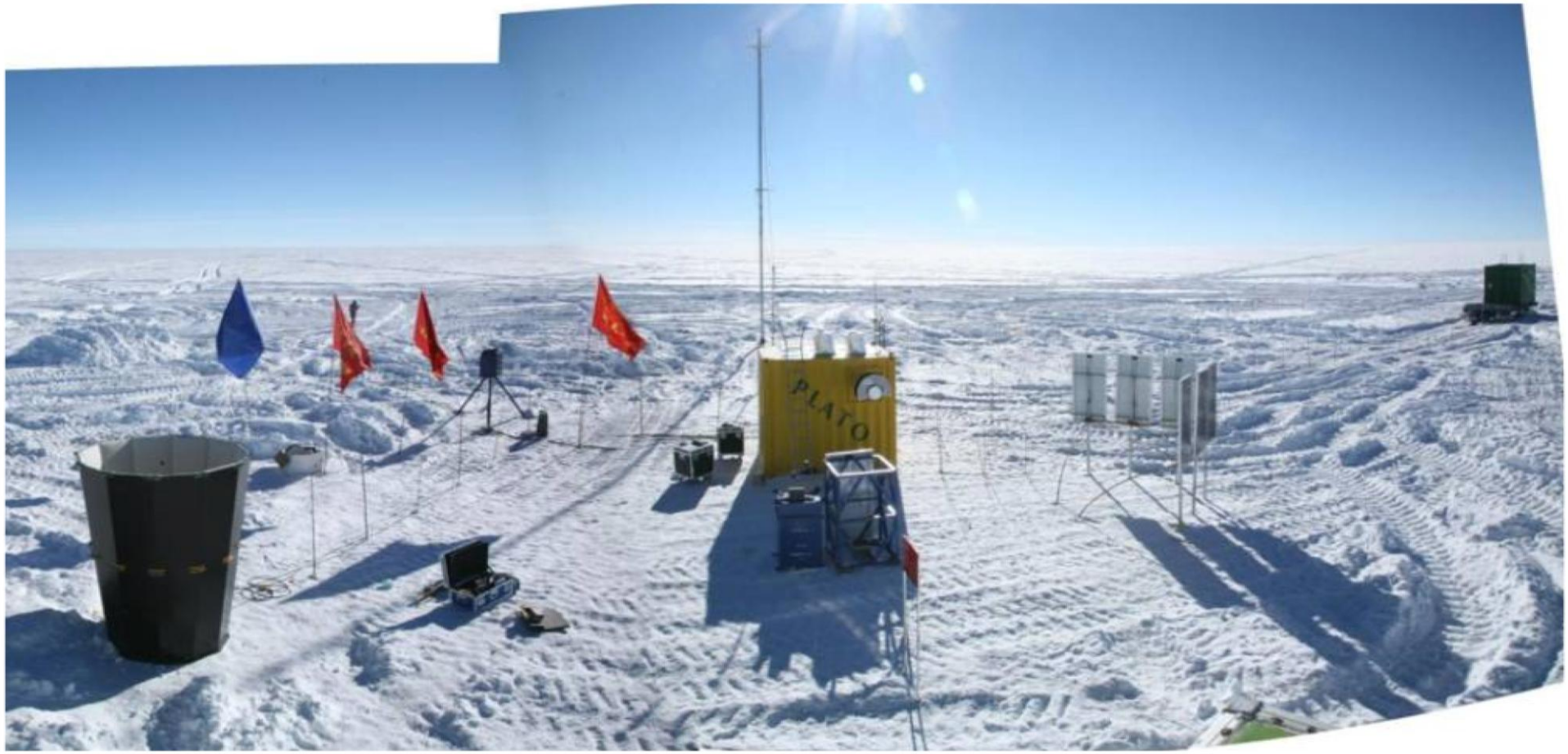

Mon May 19 22:50:08 2008


Mon May 19 22:50:28 2008


Mon May 19 22:50:38 2008


Tue Apr 1 22:53:58 2008

The panorama of PLATO site at Dome A



2008/2009 Dome A Traverse

Xuelong Voyage

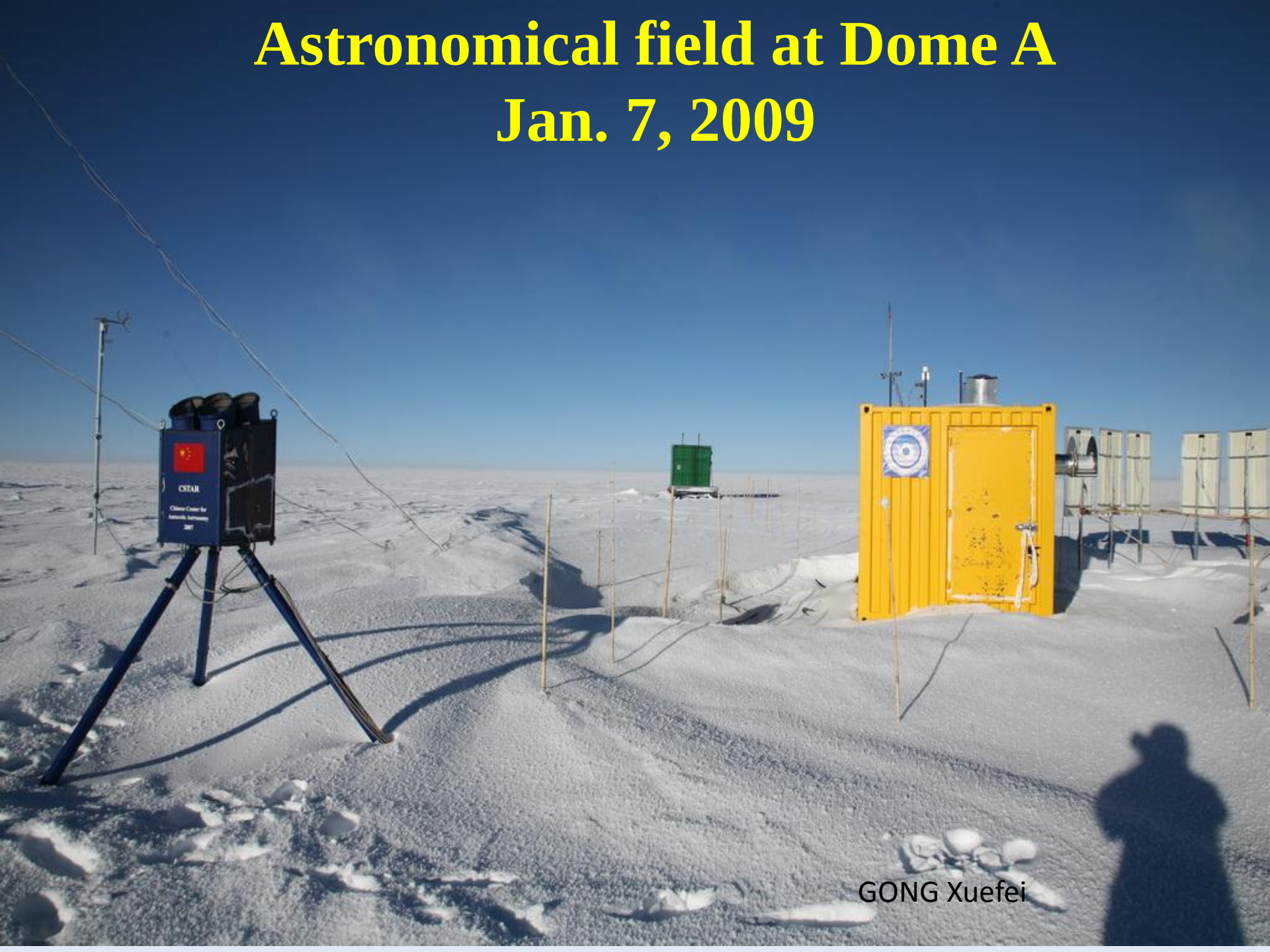
2008,10,20 Depart from Shanghai
2008,10,22 Korea for Ka-32
2008,11,4 Fremantle
2008,11,17 Ice break
2008,12,18 Start for traverse
2009,1,6 Arrive at Dome A
2009,2,2 Retreat from Dome A
2009,2,23 Back to Zhongshan
2009,3,10 Xuelong leave Zhongshan
2009,3,20 Fremantle
2009,4,10 Shanghai

11 Vehicle, 44 sledge, 28 person, 570 ton cargo

Vehicle and Sledge

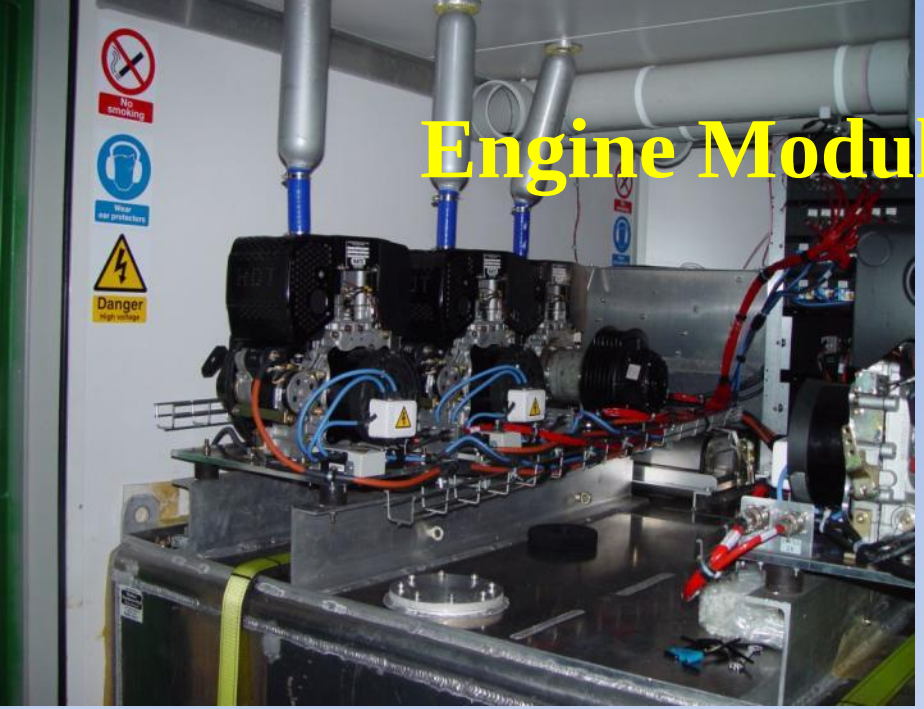
Accident!

Astronomical field at Dome A
Jan. 7, 2009

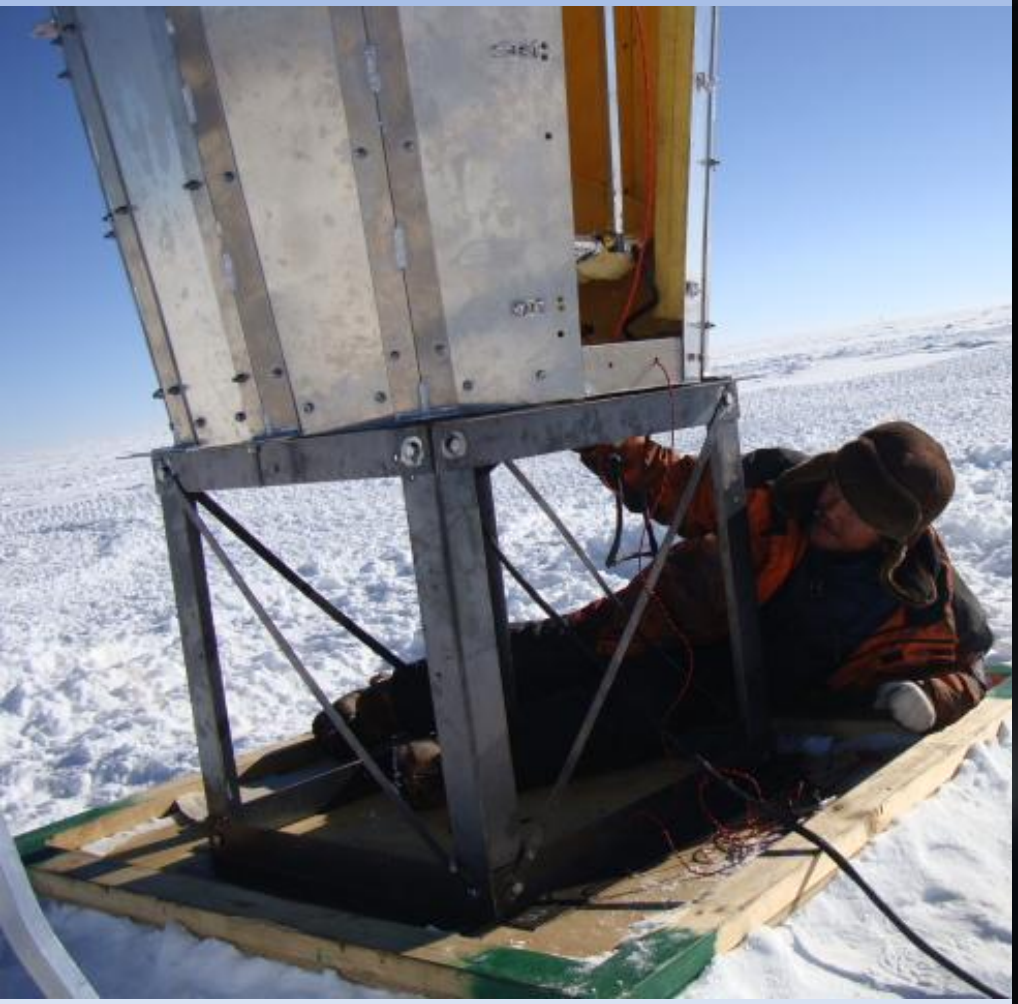


GONG Xuefei

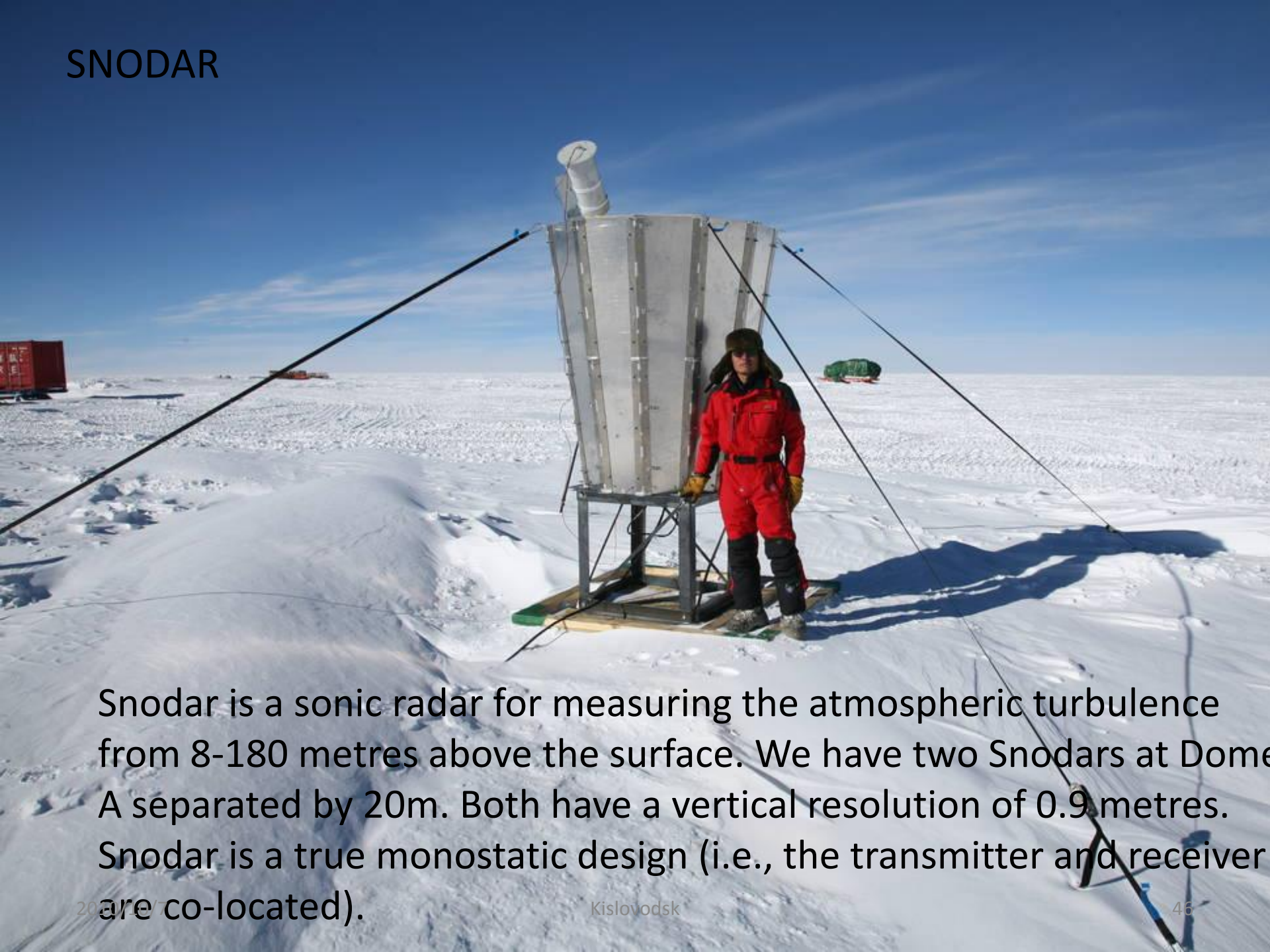
Engine Module of PLATO



SNODAR



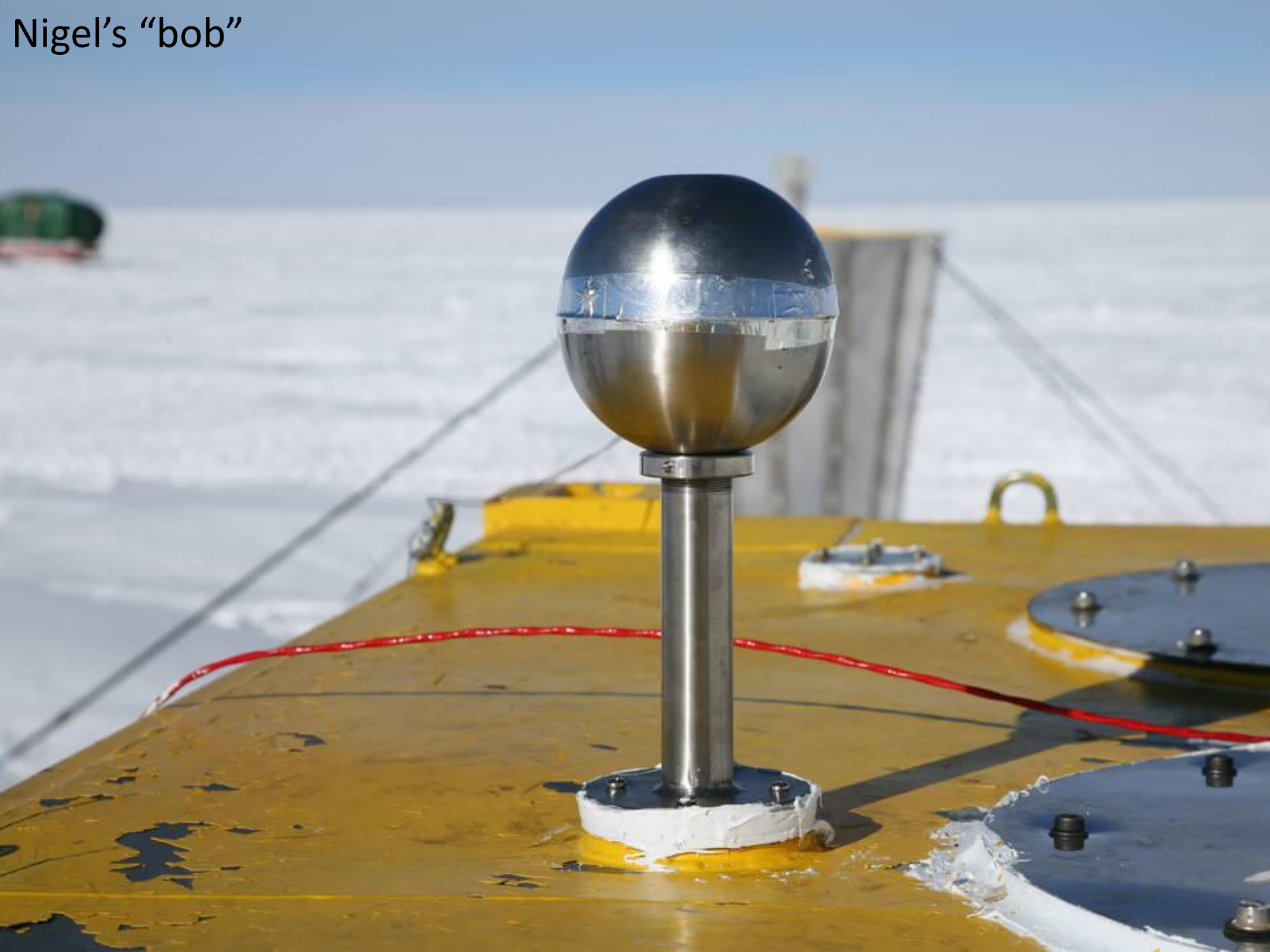
SNODAR



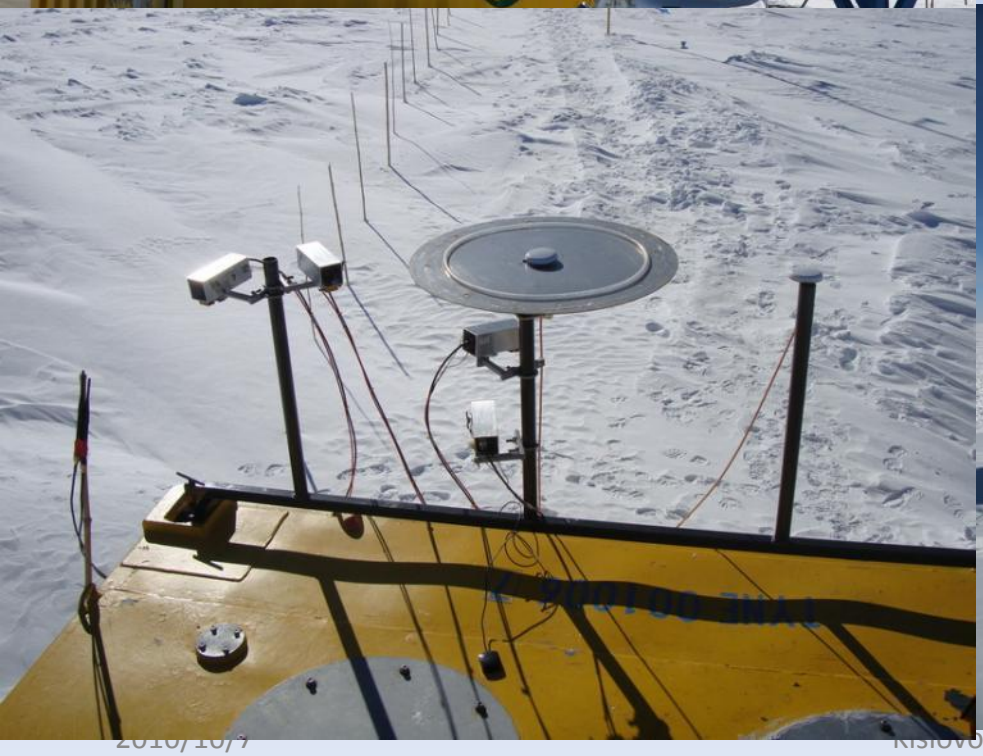
Snodar is a sonic radar for measuring the atmospheric turbulence from 8-180 metres above the surface. We have two Snodars at Dome A separated by 20m. Both have a vertical resolution of 0.9 metres. Snodar is a true monostatic design (i.e., the transmitter and receiver are co-located).

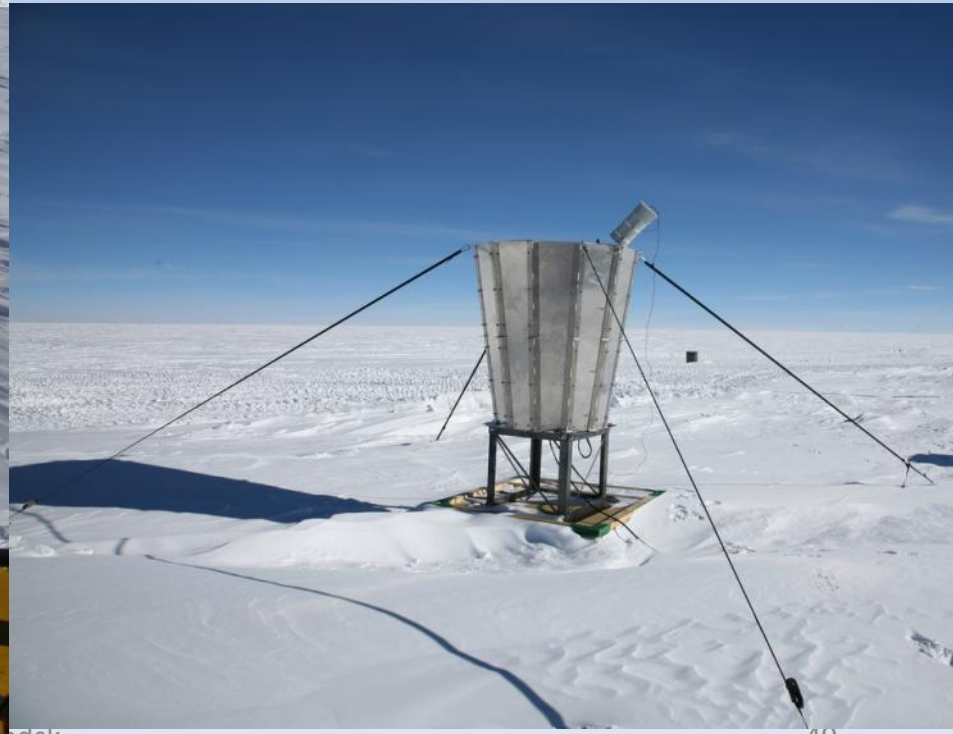
GATTINI and NIGEL

Nigel’s “bob”



Wireless net and WEBCAM






Building I finished at Jan. 27, 2009
Inauguration at Feb.2, 2009
Building II is constructed in January, 2010
中国南极昆仑站开站仪式


中国南极昆仑站开站仪式
中国第二十五次
南极内陆考察队
25
CHINARE
中国第二十五次
南极科学考察队
25
CHINARE

2009/2010 Dome A Traverse

Chinese 26th Antarctic Research Expedition Inland Team

Systematic Measurements of Site Conditions over winters at Dome A

New Instruemtns for 2009-2010 :

SHANG Zhaohui ,HU Zhongwen

THz-FIR FTS、SHABAR

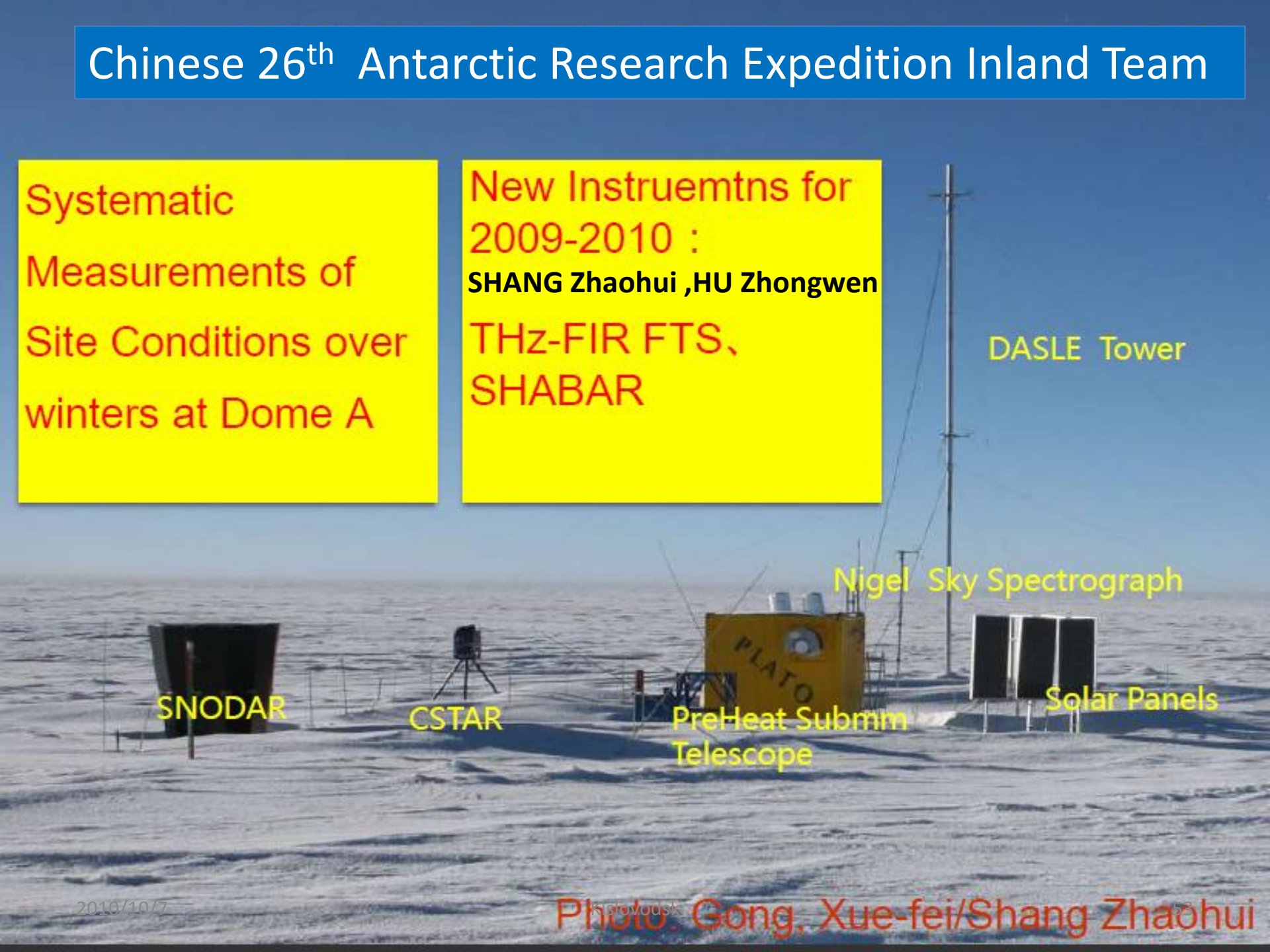
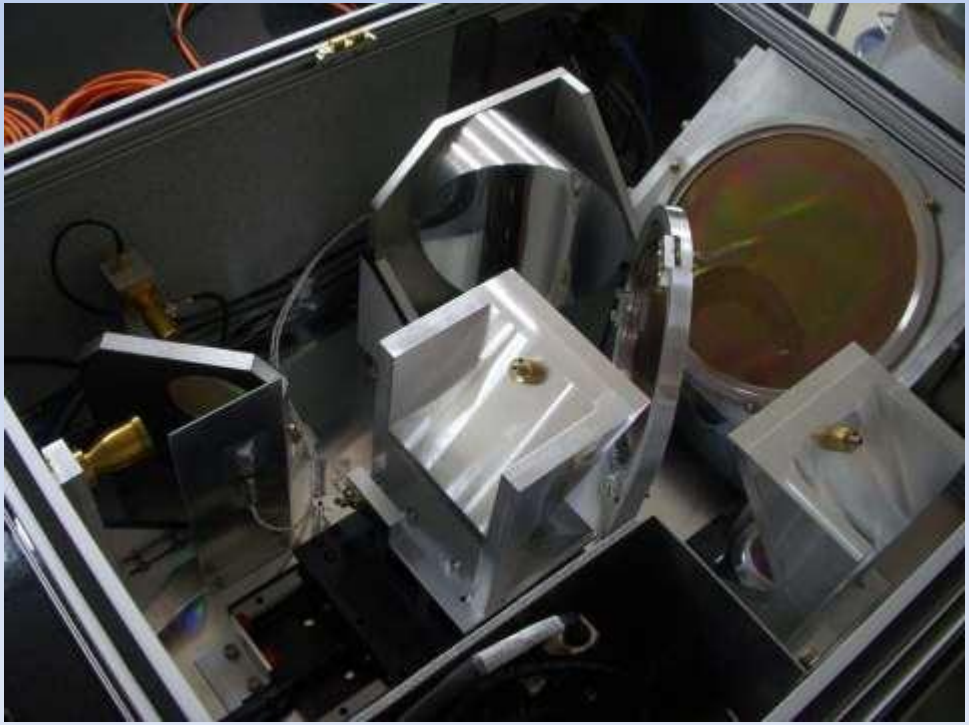
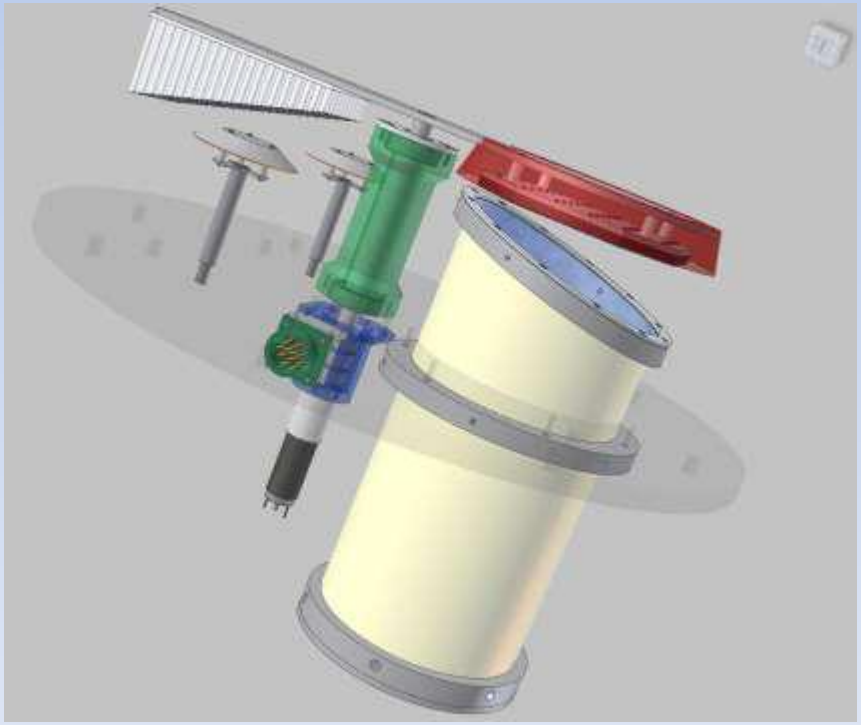


Photo: Gong, Xue-fei/Shang Zhaohui

FTS (Fourier Transform Spectrometer)

Measures the atmospheric transmission from 0.75 to 15 THz, i.e., from 20 microns to 400 microns. Uses ambient temperature DLATGS (deuterated L-anine doped triglycene suplhate) pyroelectric detectors. Sheng-Cai Shi, Q. J. Yao, X. X. Li, X. G., Zhang, Z. H. Lin, K. M. Zhou, Q. G. Huang,J. Yang (PMO); Scott Paine, Q. Z. Zhang (SAO); H. Matsuo (NAOJ)





Status of the instruments

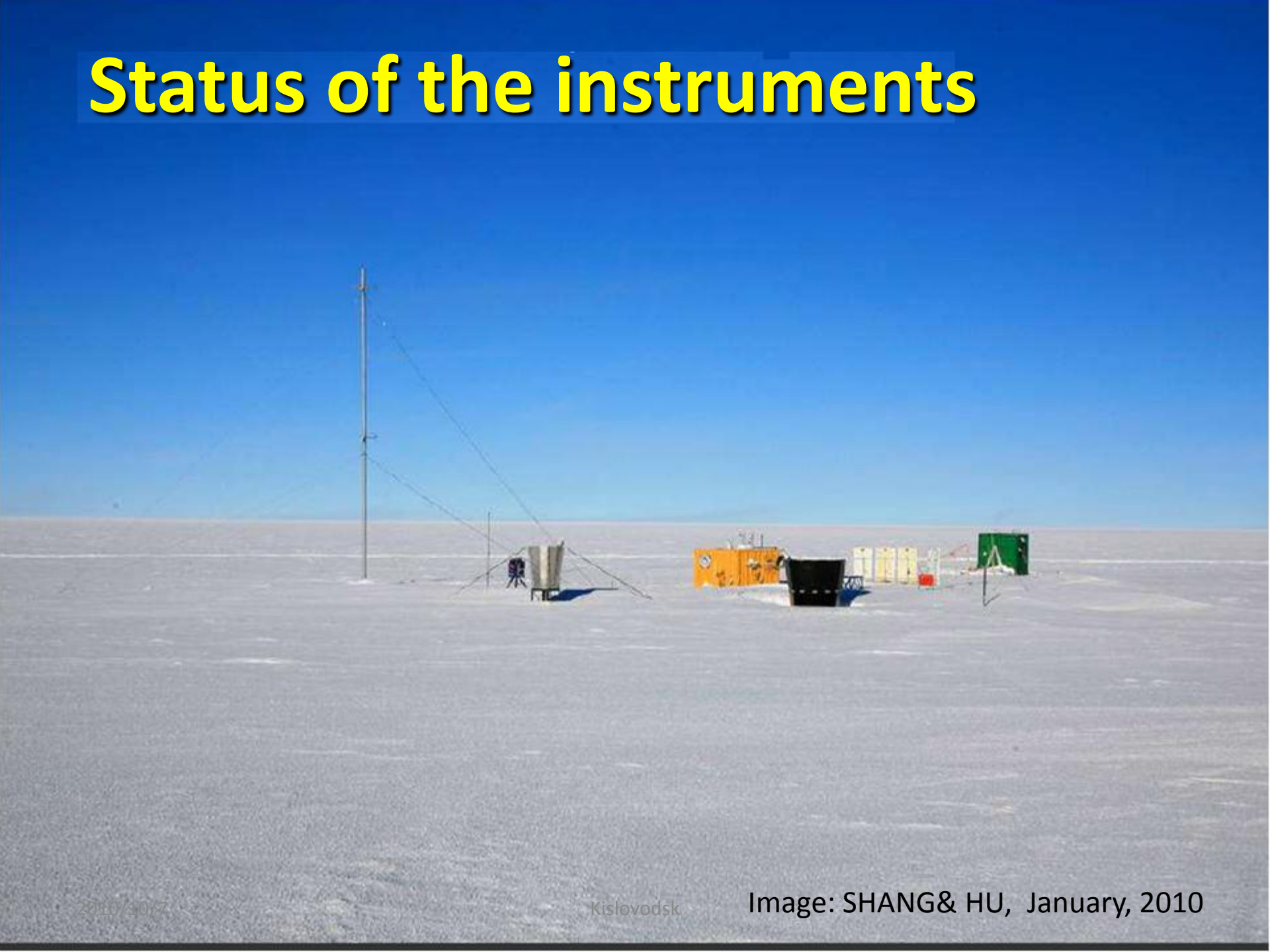


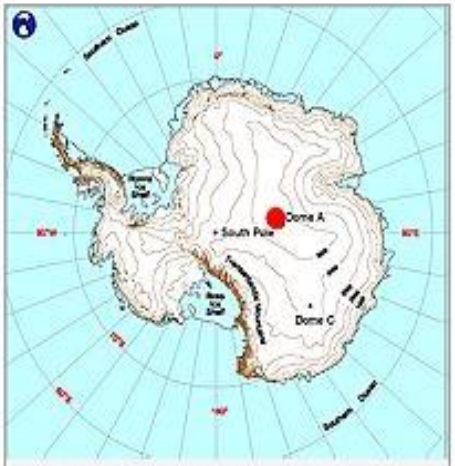
Image: SHANG& HU, January, 2010

PLATO Dome A Robotic Observatory

冰穹A

在过去10年中，研究发现南极点和冰穹C对于天文观测是极优良的站址，远远优于中纬度的站点。南极高原的最高点冰穹A，预计那里的大气温度更低、风速更小、湍流边界层也更接近地面。

作为国际极地年(IPY)的一部分的PANDA和Astropoles计划，中国科学院国家天文台(NAOC)、中国极地研究所(PRIC)、新南威尔士大学(UNSW)合作进行研制和放置自动天文观测站PLATO于冰穹A的计划。PANDA科考队于2008年1月成功地将PLATO运送到冰穹A。一个大国际团队参与其中，铱星通讯由美国南极项目(USAP)提供。



冰穹 A (点击放大)

PLATO Dome A Robotic Observatory

Mission Time: 184 Days 06 Hours 37 Mins 42 Sec

Navigation
- Home
- Science
- Contacts

Live updates
- Week
- Month
- Year
- Webcams

PLATO Module
- Instrument
- Engine

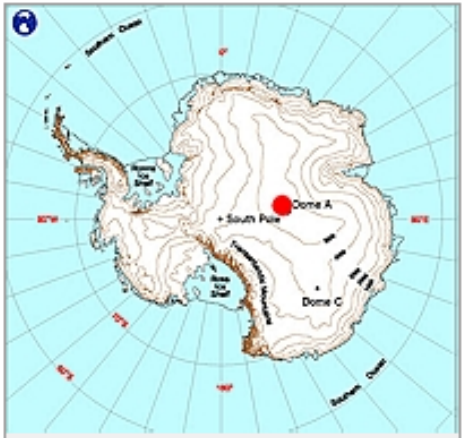
Instruments
- CSTAR
- DASLE
- Gattini
- Nigel
- PreHEAT
- Snodar

Publications
- Papers

Links
- Images
- Weather (AAD)
- Chinese Translation

Dome A, Antarctica

Over a decade of site testing in Antarctica has shown that both South Pole and Dome C are exceptional sites for astronomy, with certain atmospheric conditions greatly superior to those at existing mid-latitude sites. The highest point on the Antarctic plateau, Dome A, is expected to experience even colder atmospheric temperatures, lower wind speeds, and a turbulent boundary layer that is confined even closer to the ground.



Dome A (click to enlarge)

As part of the PANDA and Astropoles programs of the International Polar Year (IPY), an agreement was signed between the the National Astronomical Observatories of the Chinese Academy of Sciences (NAOC), the Polar Research Institute of China (PRIC), and the University of New South Wales (UNSW) to develop and deploy an autonomous observatory called PLATO to Dome A. The PANDA traverse successfully delivered PLATO to Dome A in January 2008. A large international team has contributed to PLATO and its instruments, with Iridium satellite communication being provided by the U.S. Antarctic Program (USAP).

Publications

One refereed publication so far from PLATO. Another has just been accepted (Bonner et al, Snodar: An acoustic radar for atmospheric turbulence profiling with 1m resolution, Acoustics Australia). In addition we have 10 SPIE papers, 4 other conference proceedings, and one submission to Nature.

PUBLICATIONS OF THE ASTRONOMICAL SOCIETY OF THE PACIFIC, 121:174–184, 2009 February
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The PLATO Dome A Site-Testing Observatory: Instrumentation and First Results

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ABSTRACT. The PLATeau Observatory (PLATO) is an automated self-powered astrophysical observatory that was deployed to Dome A, the highest point on the Antarctic plateau, in 2008 January. PLATO consists of a suite of site-testing instruments designed to quantify the benefits of the Dome A site for astronomy, and science instruments designed to take advantage of the unique observing conditions. Instruments include CSTAR, an array of optical telescopes for transient astronomy; Gattini, an instrument to measure the optical sky brightness and cloud cover statistics; DASLE, an experiment to measure the statistics of the meteorological conditions within the near-surface layer; Pre-HEAT, a submillimeter tipping radiometer measuring the atmospheric transmission and water vapor content and performing spectral line imaging of the Galactic plane; and Snodar, an acoustic radar designed to measure turbulence within the near-surface layer. PLATO has run completely unattended and collected data throughout the winter 2008 season. Here we present a detailed description of the PLATO instrument suite and preliminary results obtained from the first season of operation.

The Publications on Dome A Astronomy

“Testing and data reduction of the Chinese Small Telescope Array (CSTAR) for Dome A, Antarctica”, **ZHOU,Xu** et al. 2010,RAA,10,279

“The First Release of the CSTAR Point Source Catalog from Dome A, Antarctica”,**ZHOU,Xu**, et al. 2010, PASP.

“The sky brightness and transparency in i-band at Dome A, Antarctica”,**ZOU,Hu**,**ZHOU,Xu**, et al.2010, AJ.

“PLATO–a robotic observatory for the Antarctic plateau”,Ashley,M.C.B., et al. 2010,EAS,40,79

“Dome A site testing and future plans”, Gong,X., et al. 2010,EAS,40,65;

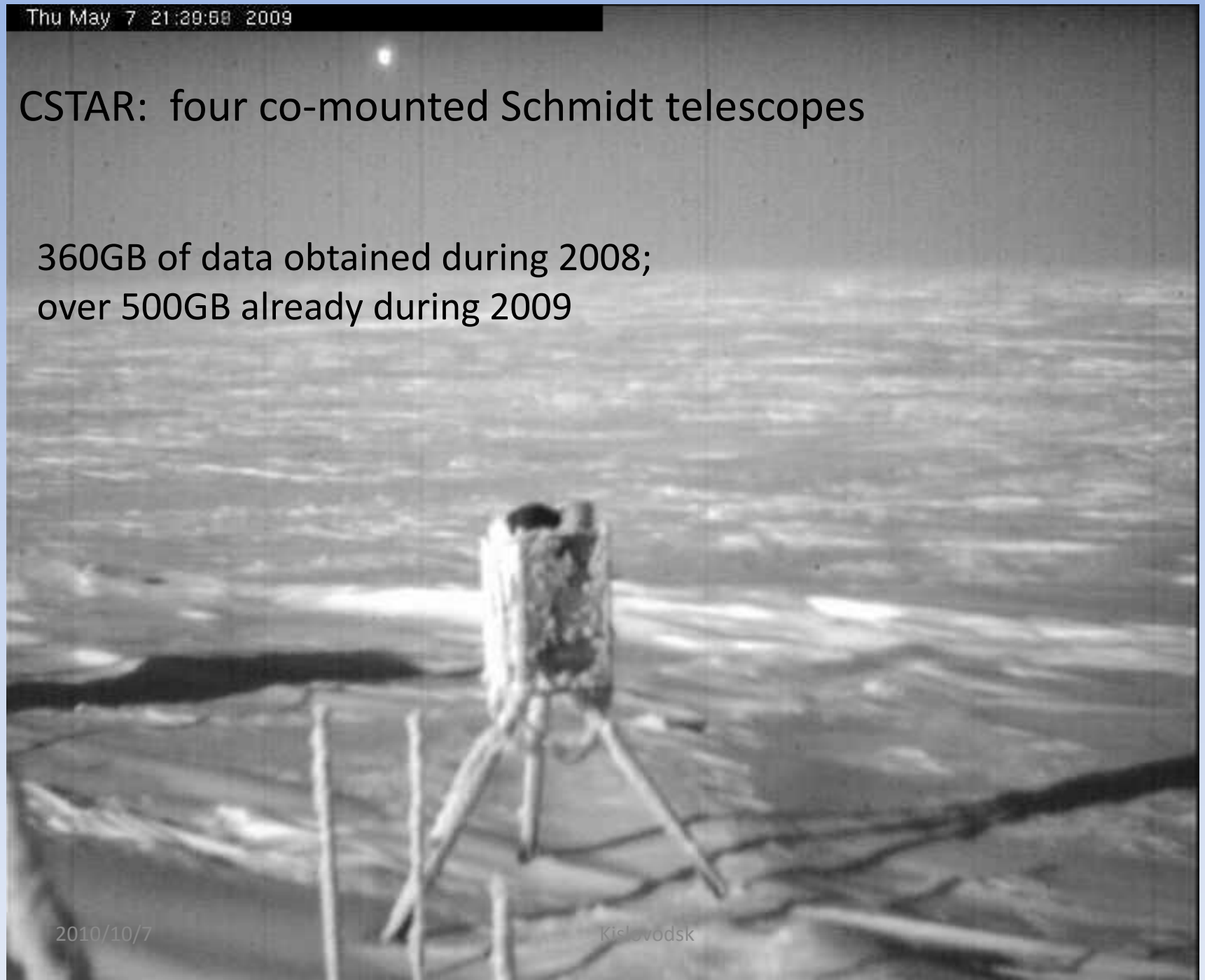
“The PLATO Dome A Site-Testing Observatory: Instrumentation and First Results”, YANG, H., et al. 2009,PASP,121,174

“Chinese Small Telescope ARray (CSTAR) for Antarctic Dome A”, YUAN,Xiangyan, et al. 2008,SPIE,7012E,152

“The PLATO Antarctic site testing observatory”, LAWrence,J.S., et al. 2008, SPIE, 7012,77

“Gattini: a multisite campaign for the measurement of sky brightness in Antarctica”,Moore,Anna, et al. 2008, SPIE,7012,76

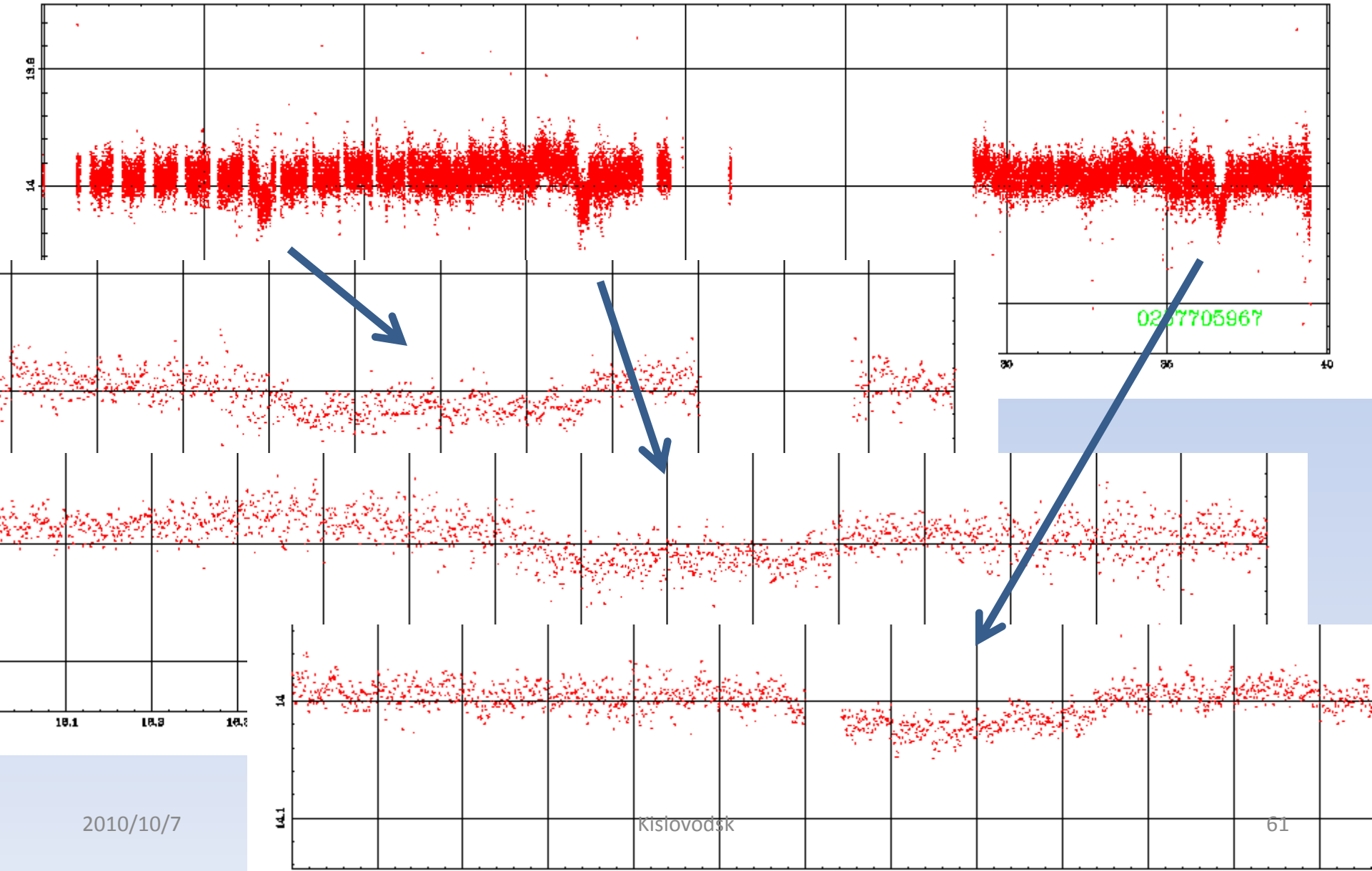
“Exceptional Terahertz Transparency and Stability above Dome A, Antarctica”, YANG,H., KULESA,C.A., et al.,2010,PASP

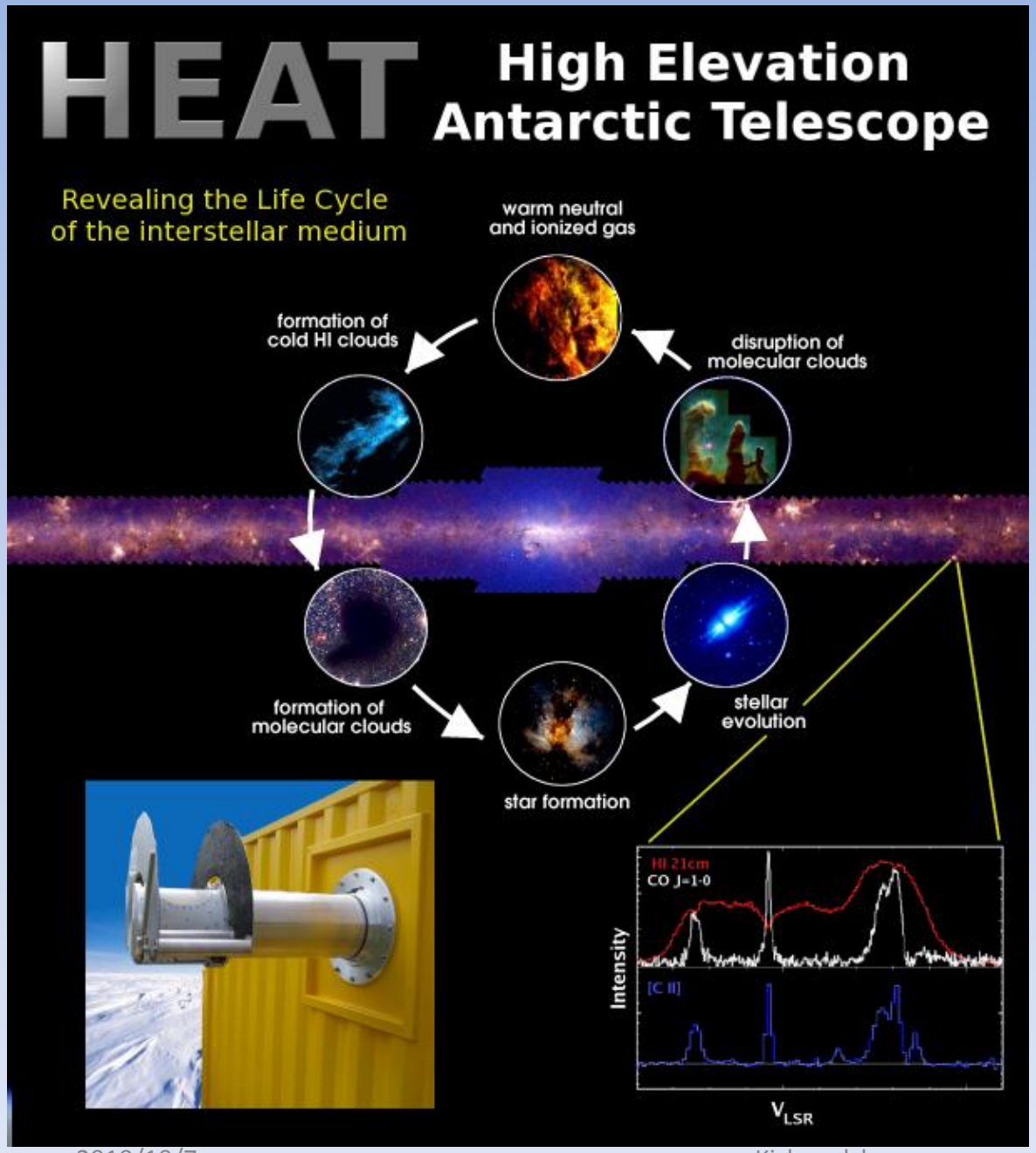


CSTAR: four co-mounted Schmidt telescopes

360GB of data obtained during 2008;
over 500GB already during 2009

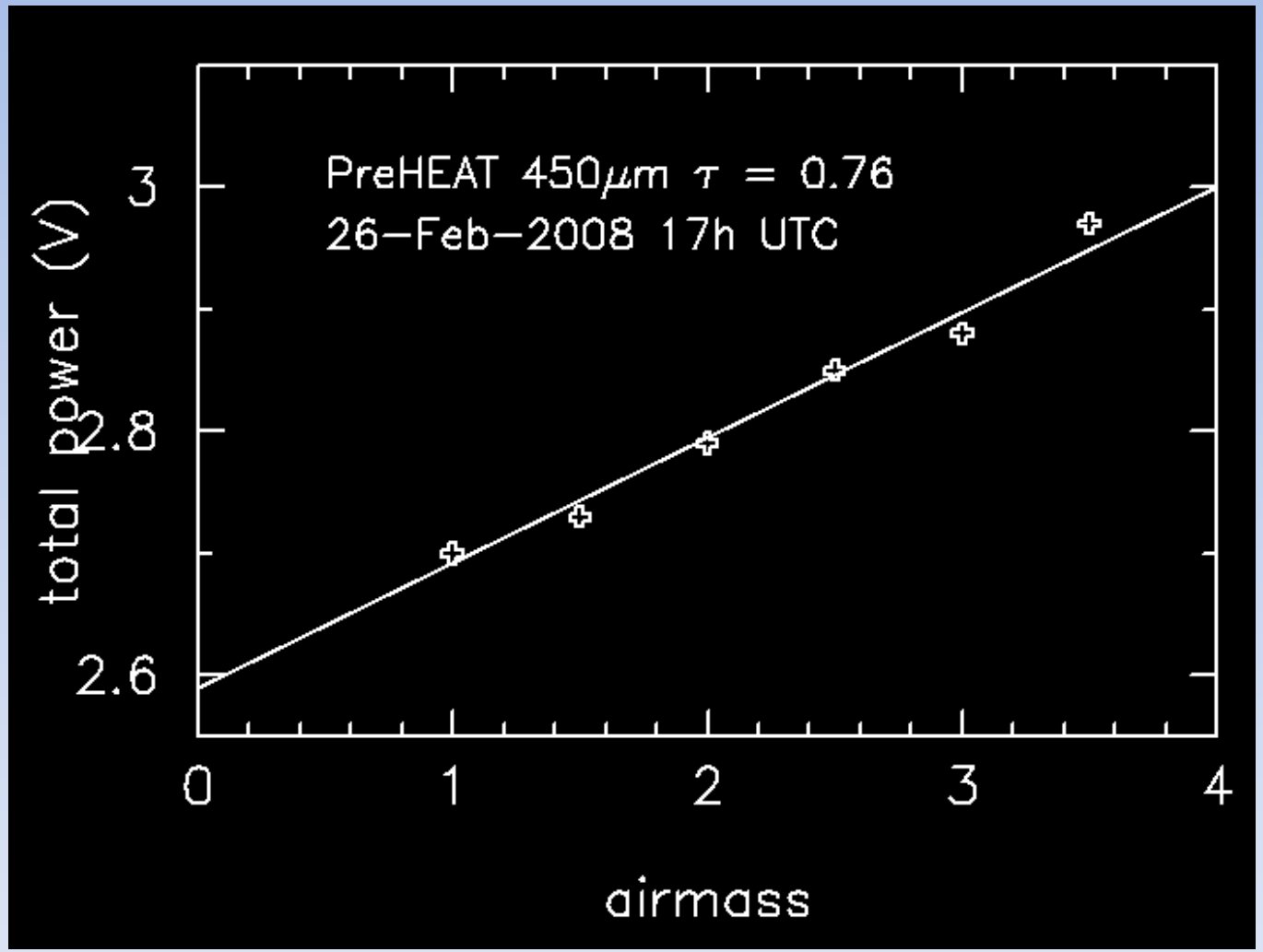
An Extra Solar Planet ?



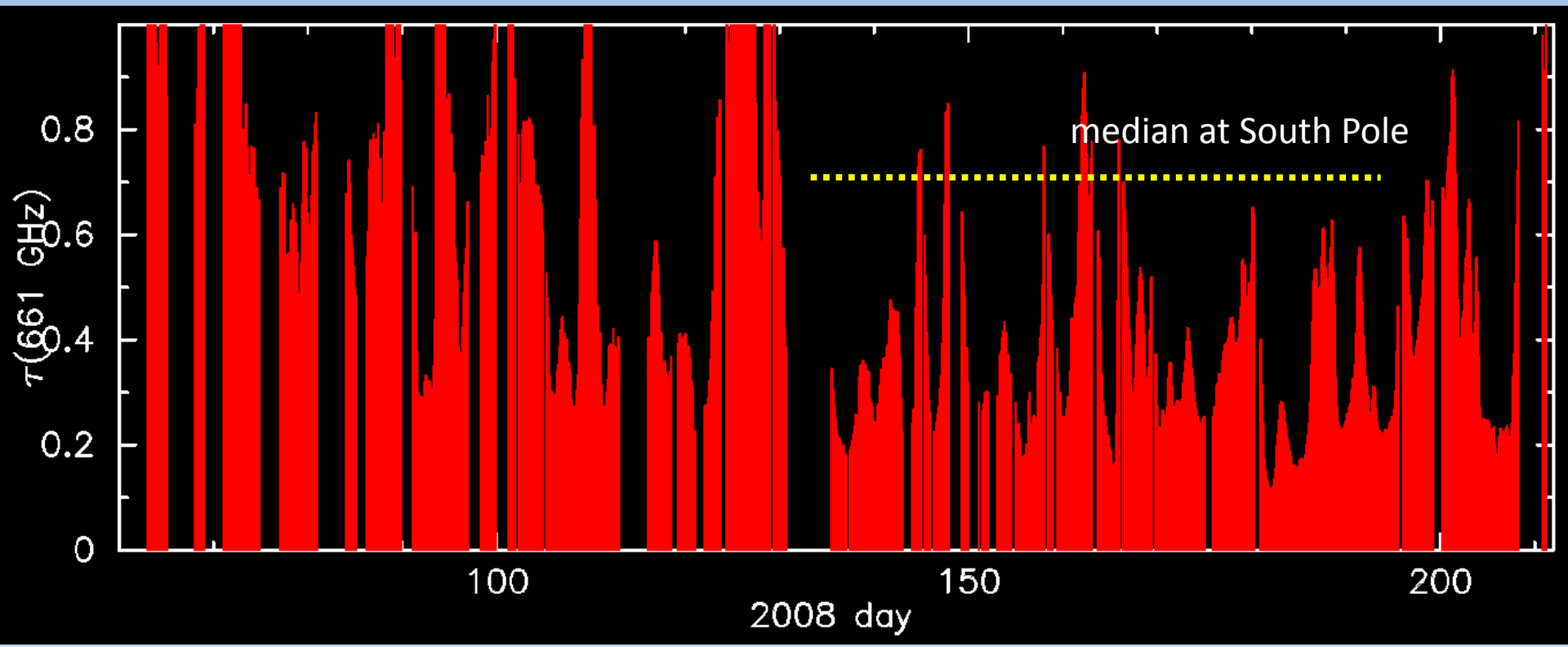


Kulesa, C. A.; Walker, C. K
Steward Observatory, UoA.

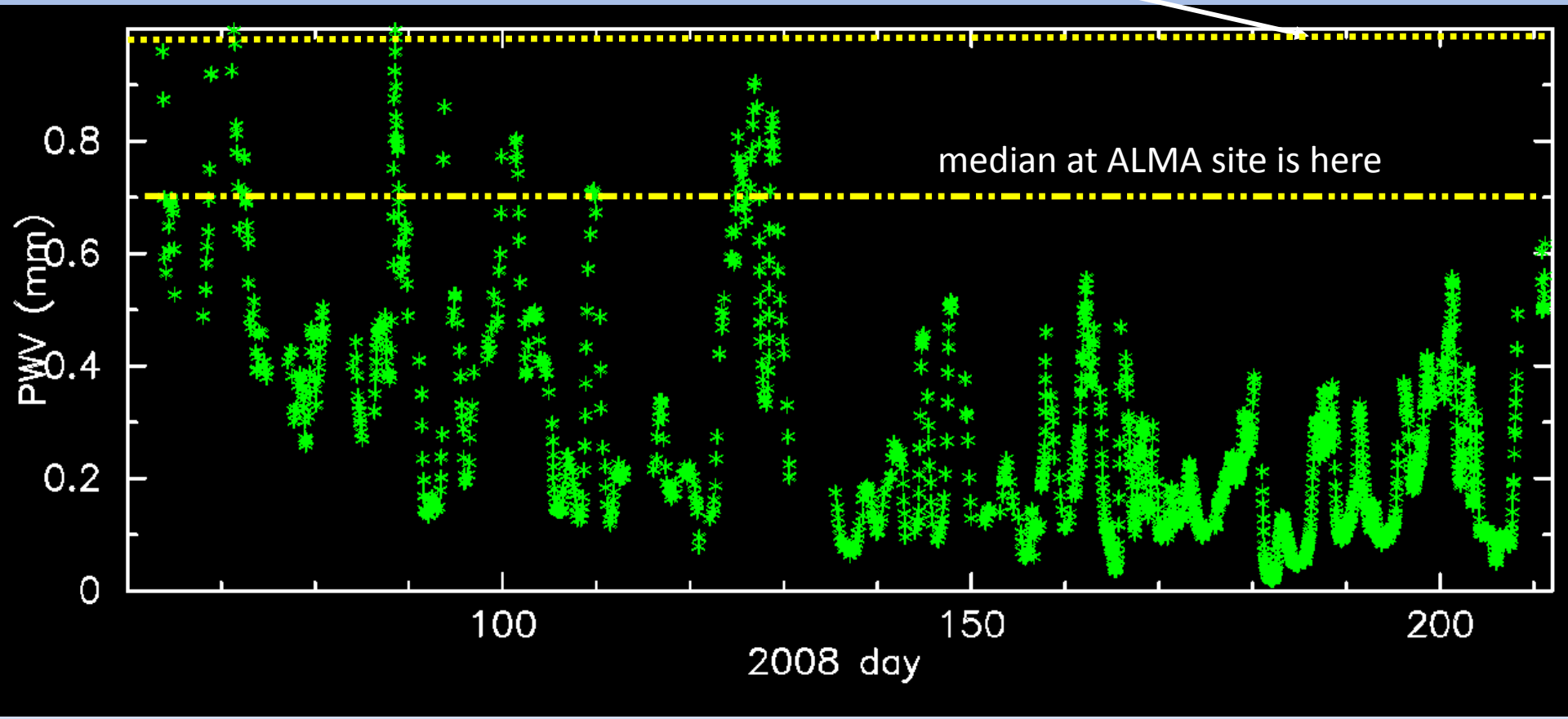
An early example of a skydip measurement from Pre-HEAT



Exceptional 450 micron opacity from Dome A



Derived Precipitable water vapor from Dome A



Current Status, 2009

- The receiver system still works!
- The telescope drive does not.

- A mechanism for taking data at a fixed elevation angle is in place.

Scientific Papers

- SPIE papers for PLATO and Pre-HEAT in 2008
-The first scientific paper summarizing PLATO in PASP (Yang et al. 2009)
- The additional science papers from Pre-HEAT are foreseen.

Snodar

UNSW:M.Ashley et al

Snodar #1

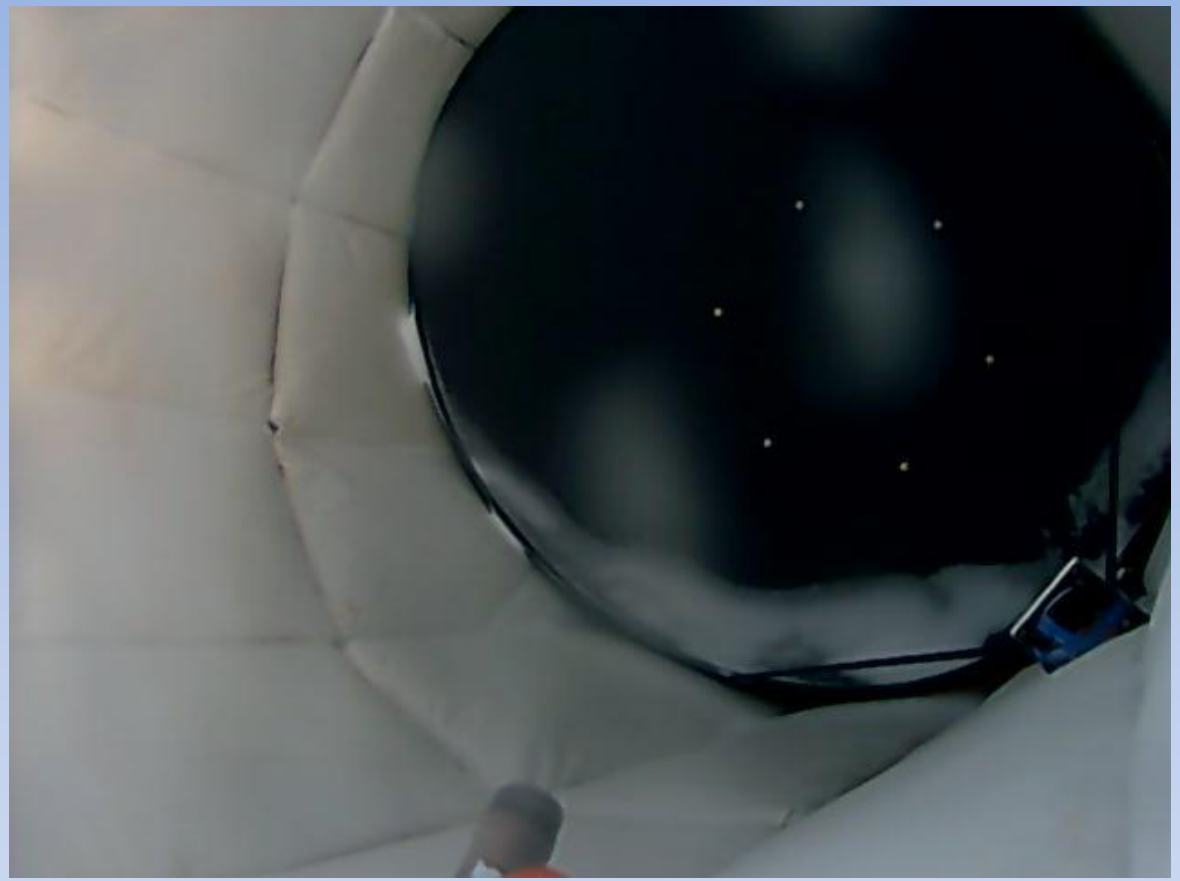
- Samples every 10 seconds at 4,5,6kHz to a height of 180m.
- Uses two transmission power levels for high dynamic range.
- Has an aluminumized and heated 0.9m off-axis parabolic reflector.

Snodar #2

- Samples every 5 seconds at 5kz to a height of 120m.
- Has a heated 1.5m off-axis parabolic reflector.

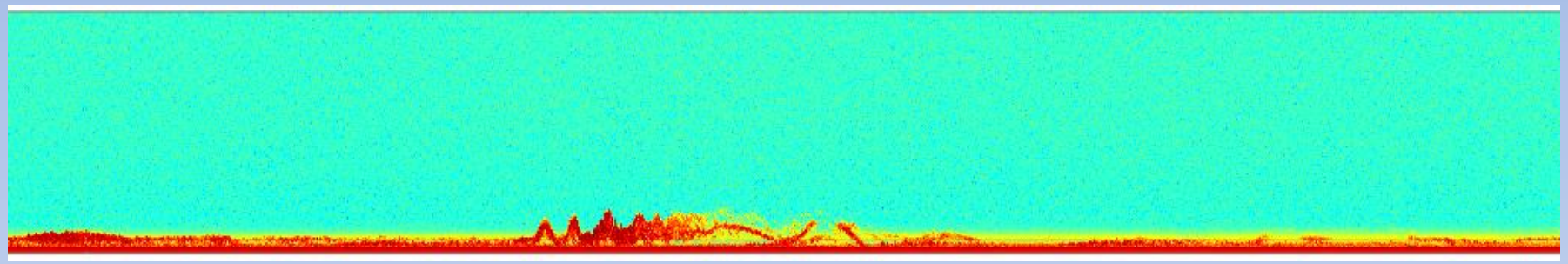
The total number of echoes acquired as of 15 July 2009 was 3.8 million, representing 1.7GB of compressed data. Snodar #2 had a transducer failure in early July 2009.

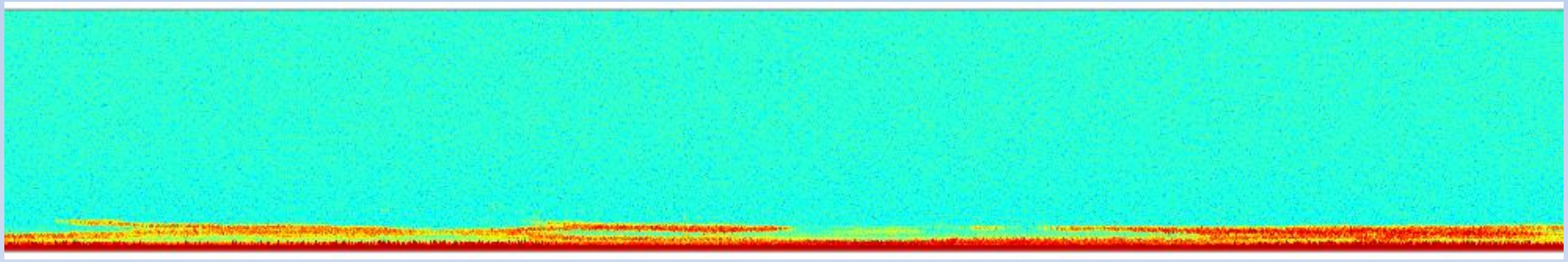
SNODAR webcams allow ice build-up to be monitored

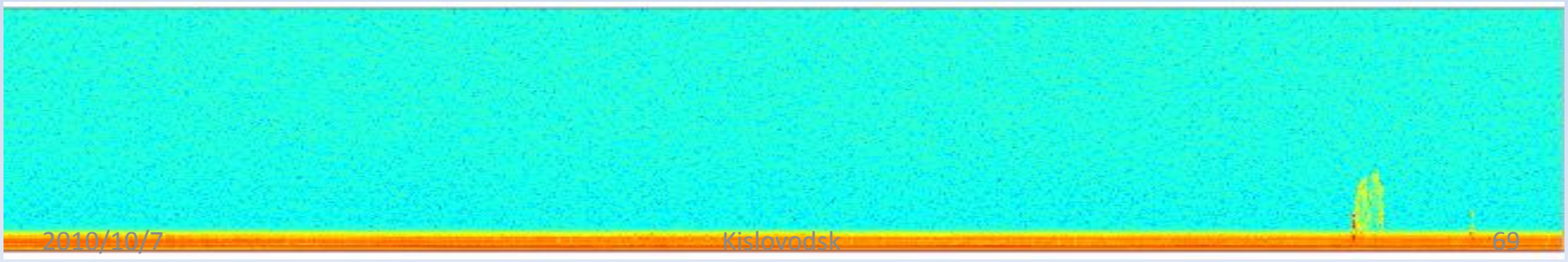


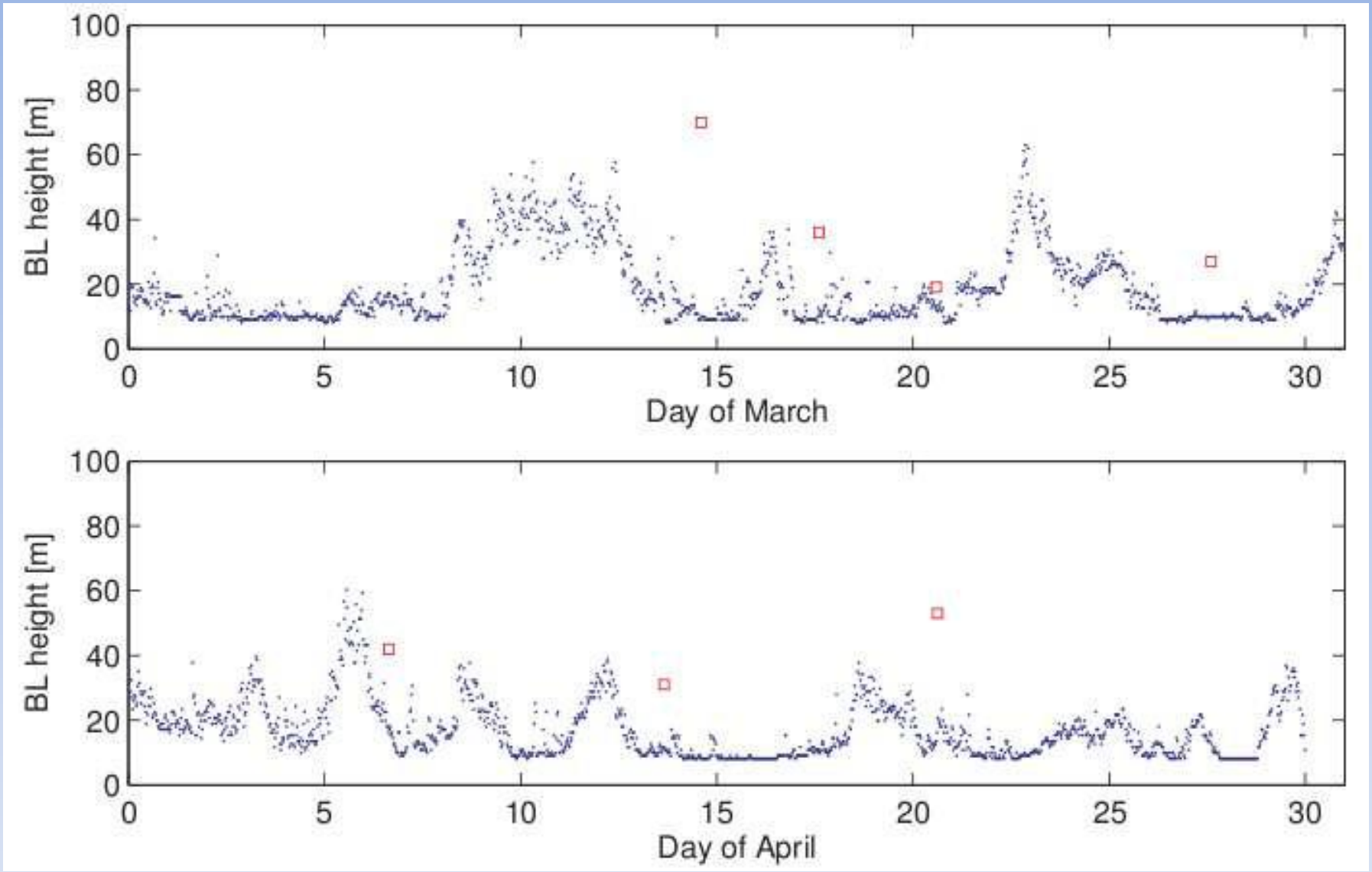
A light can be turned on to illuminate the dish when it is dark

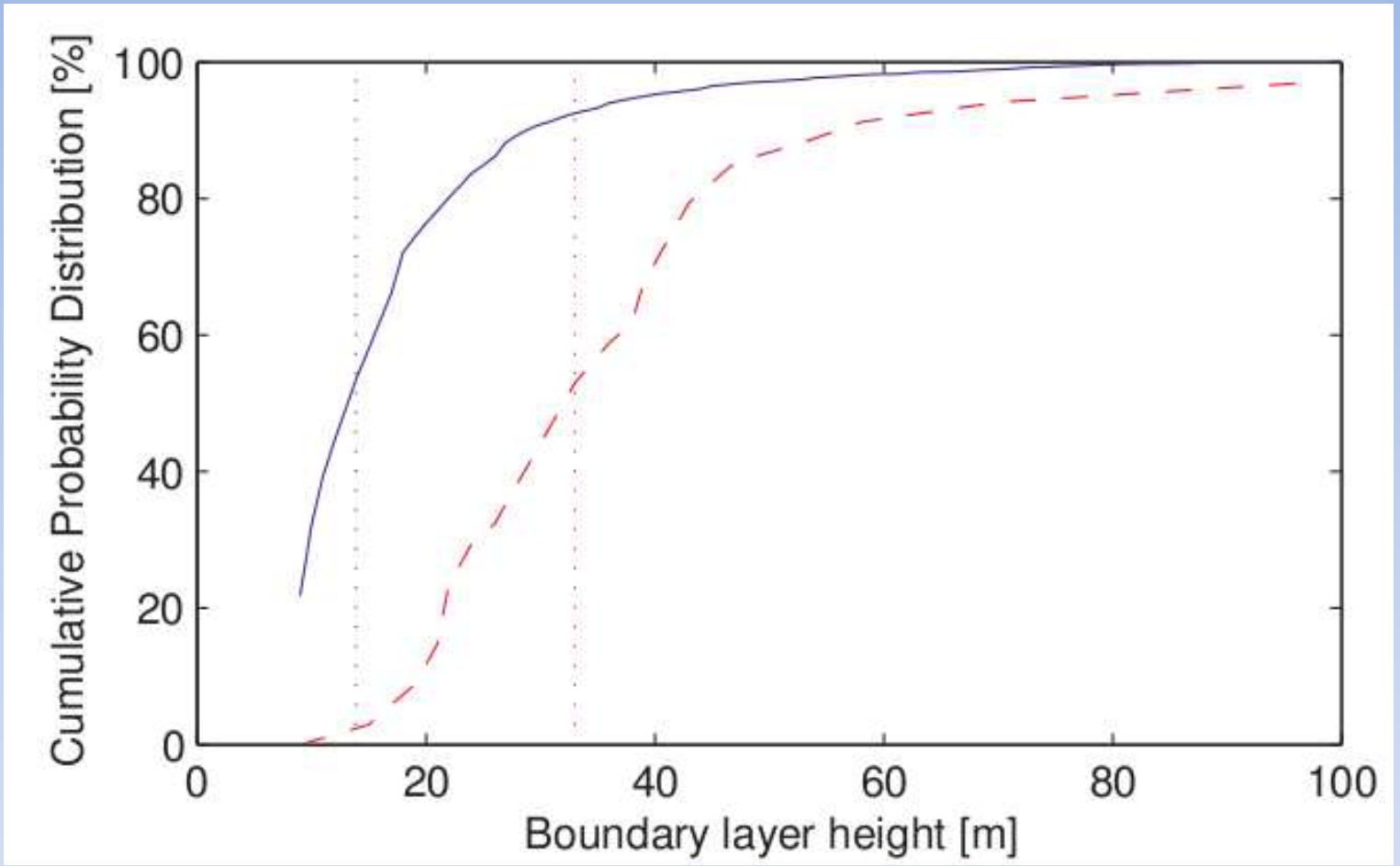
Snodar data; each plot 24 hours; 0-120metres








BL height [m]
100
80
60
40
20
0
0
5
10
15
20
25
30
Day of March
BL height [m]
100
80
60
40
20
0
0
5
10
15
20
25
30
Day of April

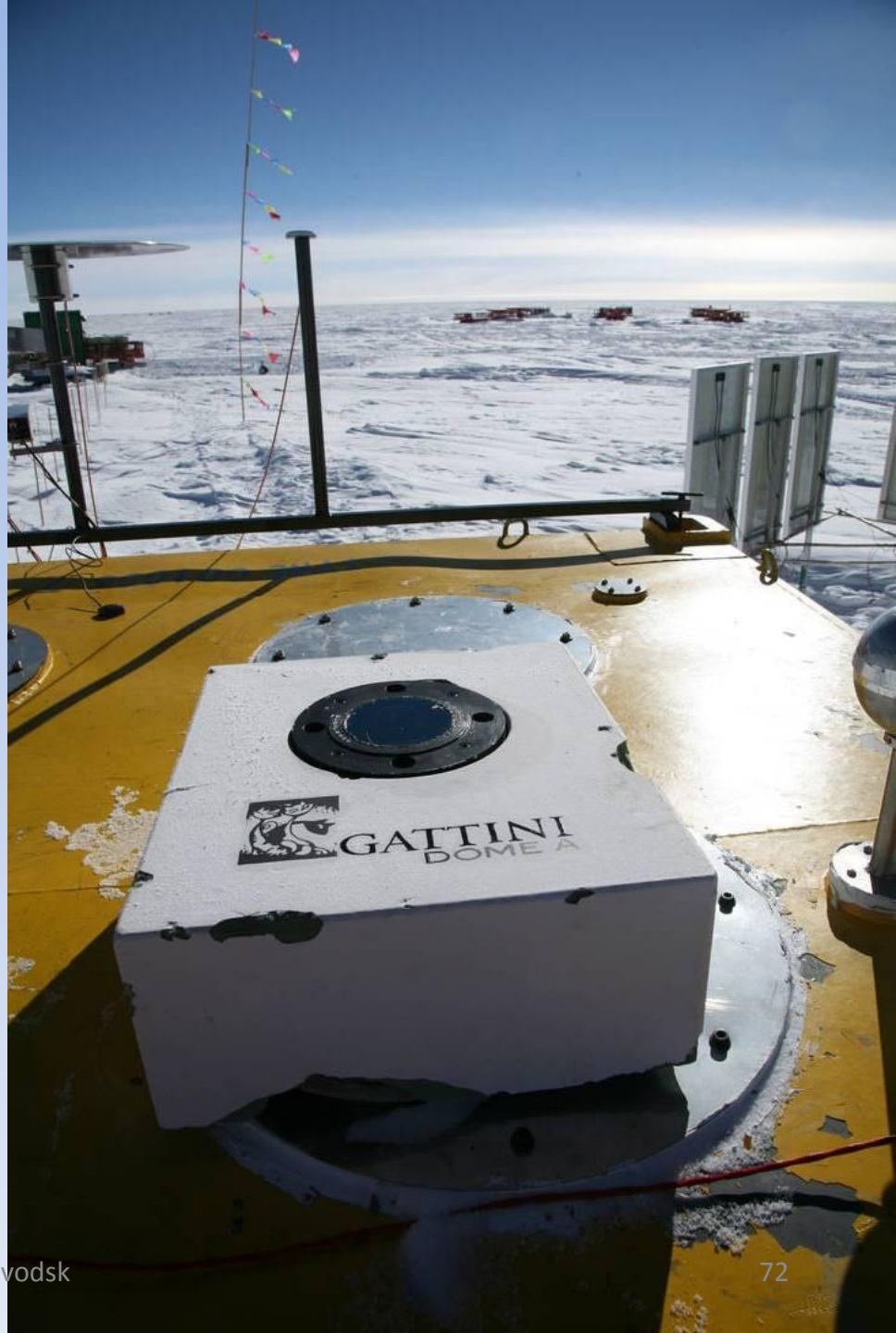

Cumulative Probability Distribution [%]
100
80
60
40
20
0
0
20
40
60
80
100
Boundary layer height [m]

Gattini wide-field multi-filter optical camera

PI: Anna Moore, Caltech

After initial hardware problems (e.g., the external USB disk drive suffers from data corruption issues), Gattini has worked flawlessly since April 2009.

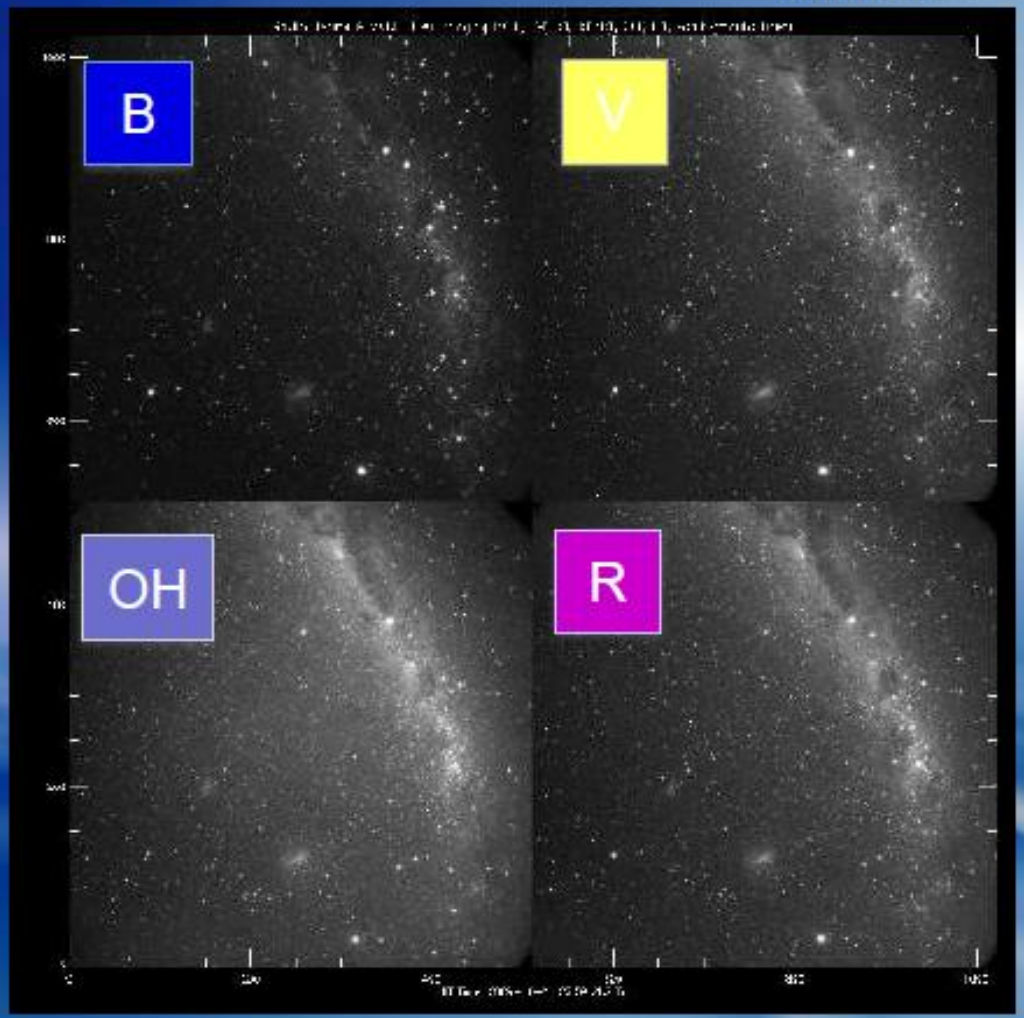
500GB of images have been obtained.



2009 Dataset: 160,000 images

- Full dataset returned to Caltech mid-April 2010
- ~160,000 images to analyze
- ~1000 files per day
- Start date April 18th 2009
- Season finish date October 10th 2009

2009-06-21

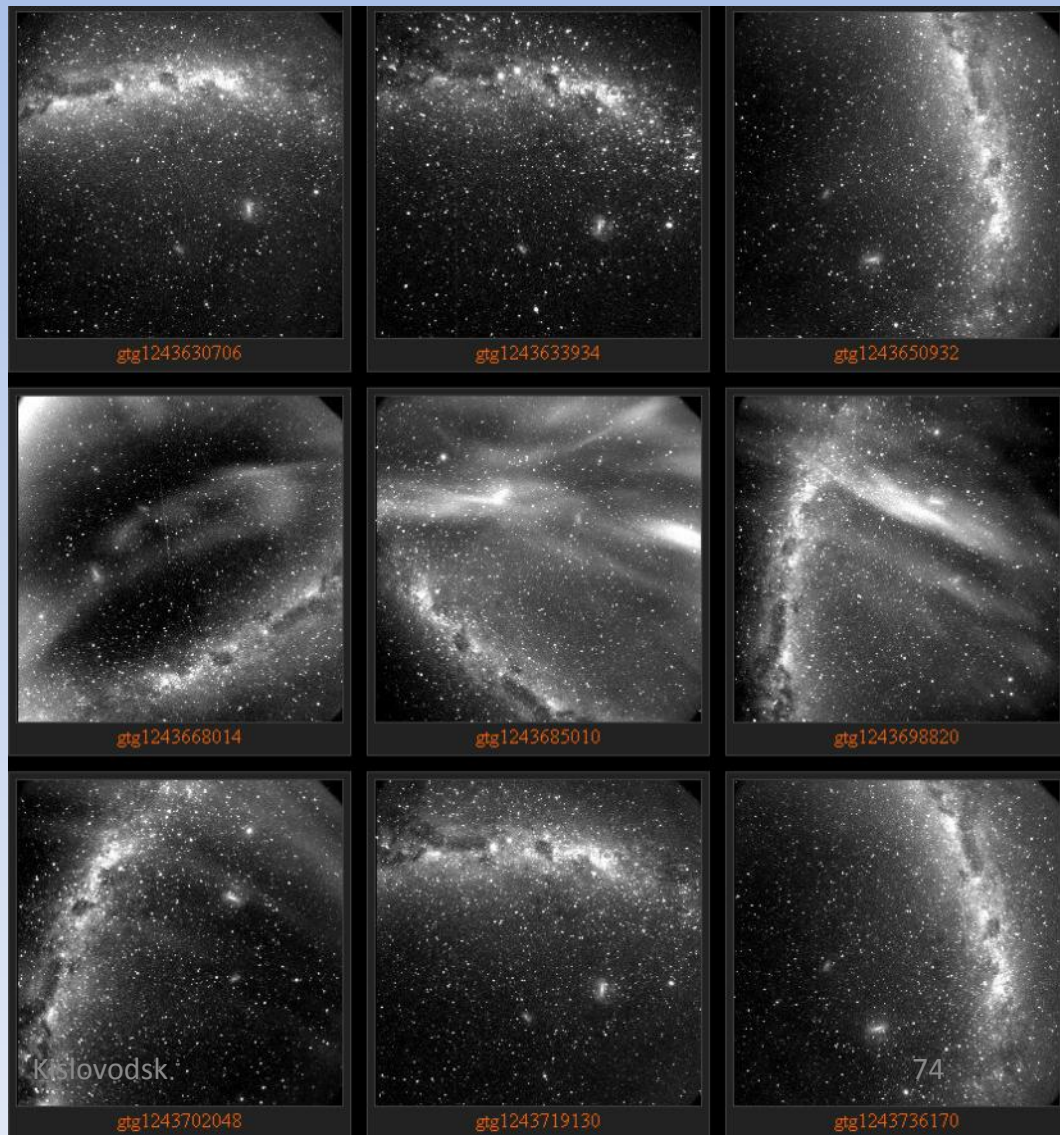


Gattini thumbnails

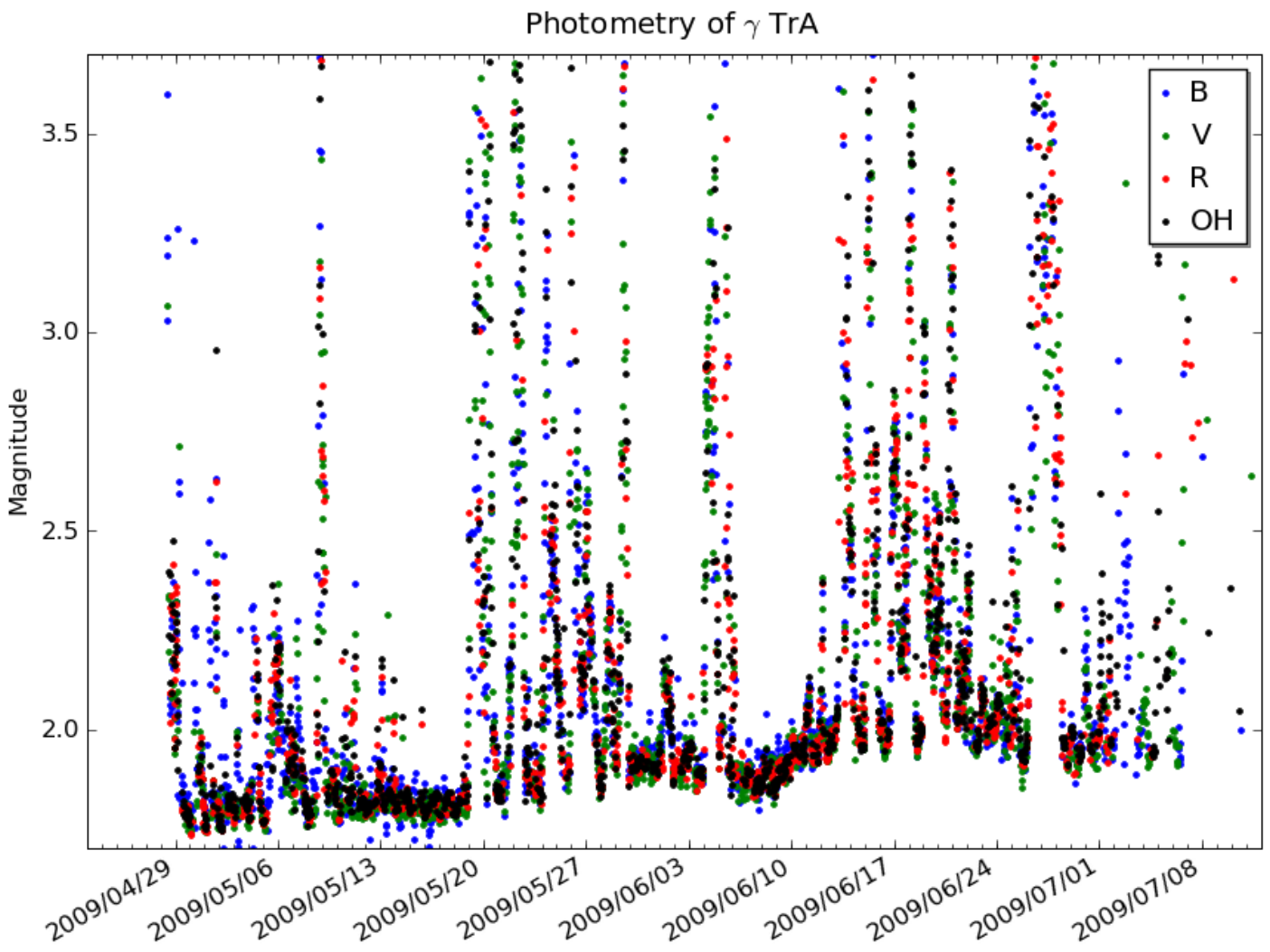
The raw images from the Gattini camera are 2048x2048 pixels (8MB).

We transfer 256x256 thumbnails (50KB) of occasional images.

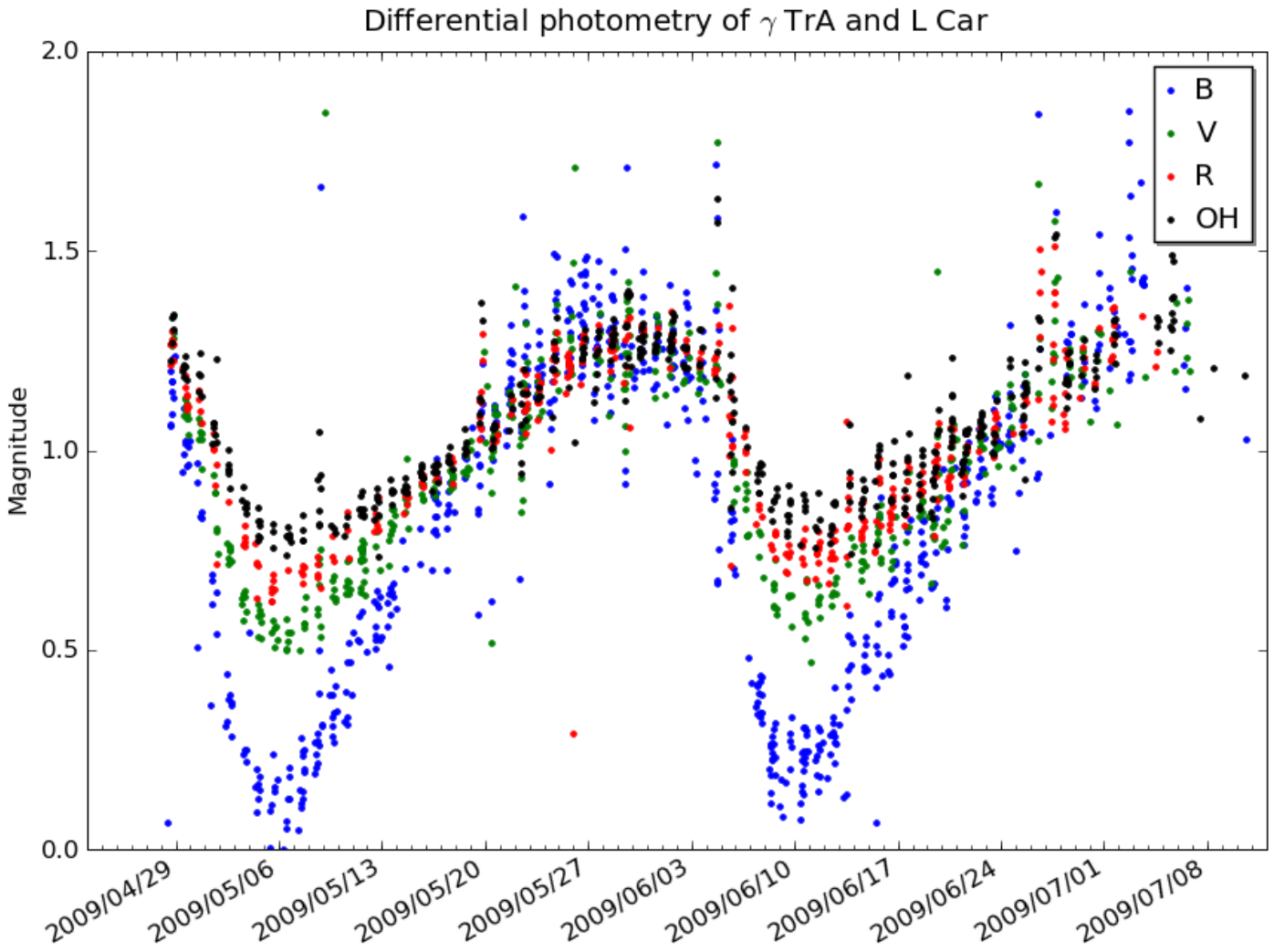
We send back all the pixels within small apertures around 40 stars.



Gattini absolute photometry

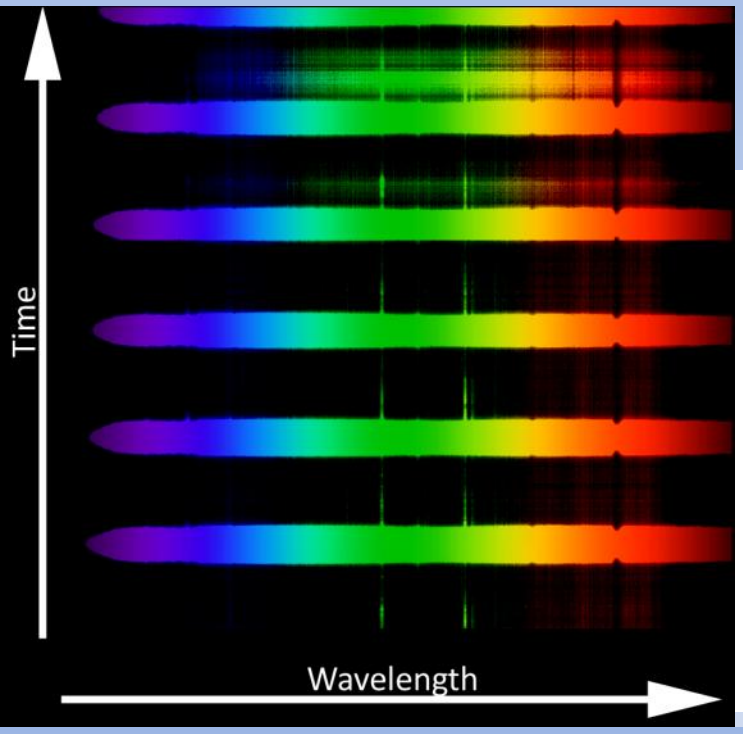


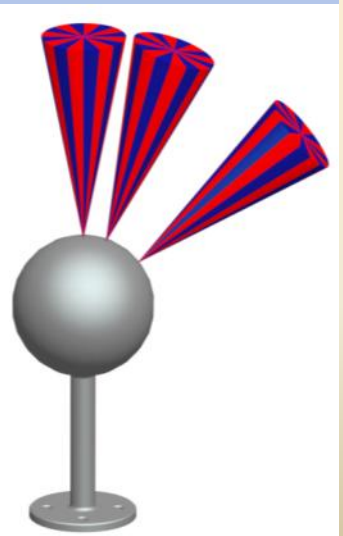
Gattini observations of a bright Cepheid, 35 day period



Nigel: optical spectroscopy of the sky

with Shane Hengst, Jon Everett





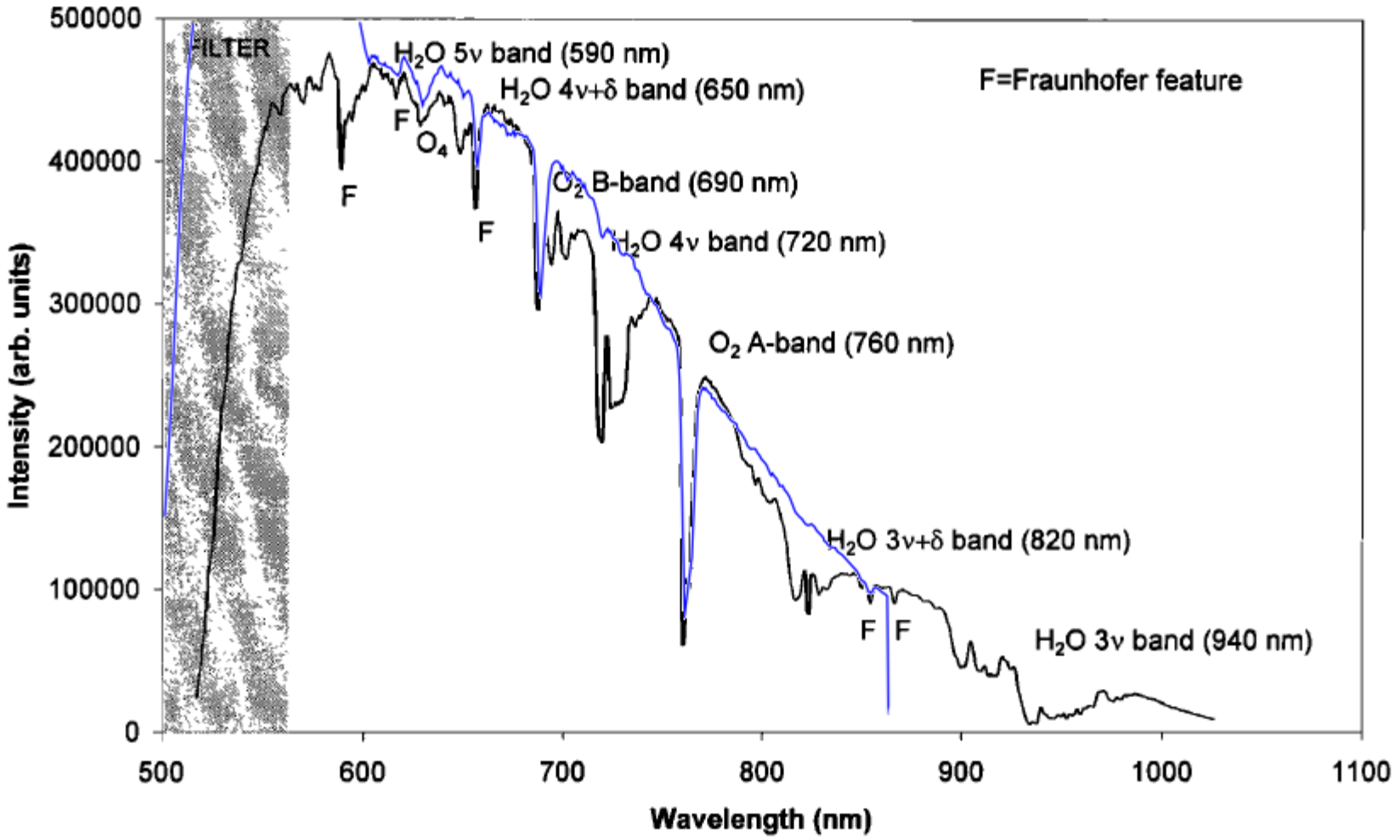
Nigel has three pairs of fibres. One fibre in each pair has a low-pass filter to remove higher spectral orders. The pairs are pointed at 40°, 71.5° and 90° altitude to measure the moon, geo-magnetic pole and Gattini field respectively.

All six fibres are fed into a spectro-meter with a concave holographic diffraction grating of 200 grooves per millimeter. The dispersed image is captured by a 256 x 1024 CCD camera.

A colourised reduced set of Nigel zenith fibre data over a 5 day period during which there was significant auroral activity. The aurora can clearly be seen in the green region.

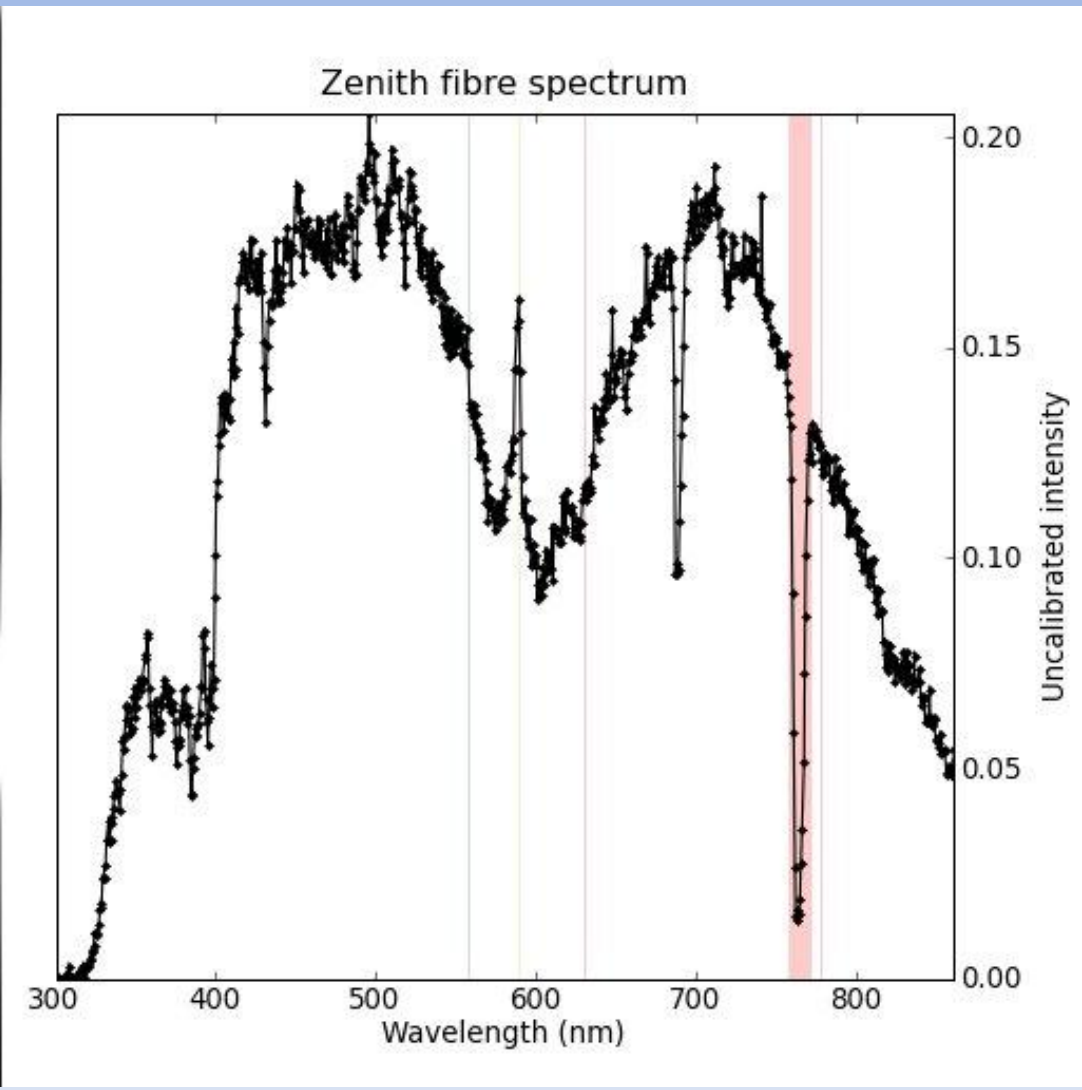
This set of data was taken when there was a still a significant contribution by the Sun. Also of note is the lunar contribution in the last two days which can be seen as a broad spectral brightening during the dark periods.

Nigel at Dome A

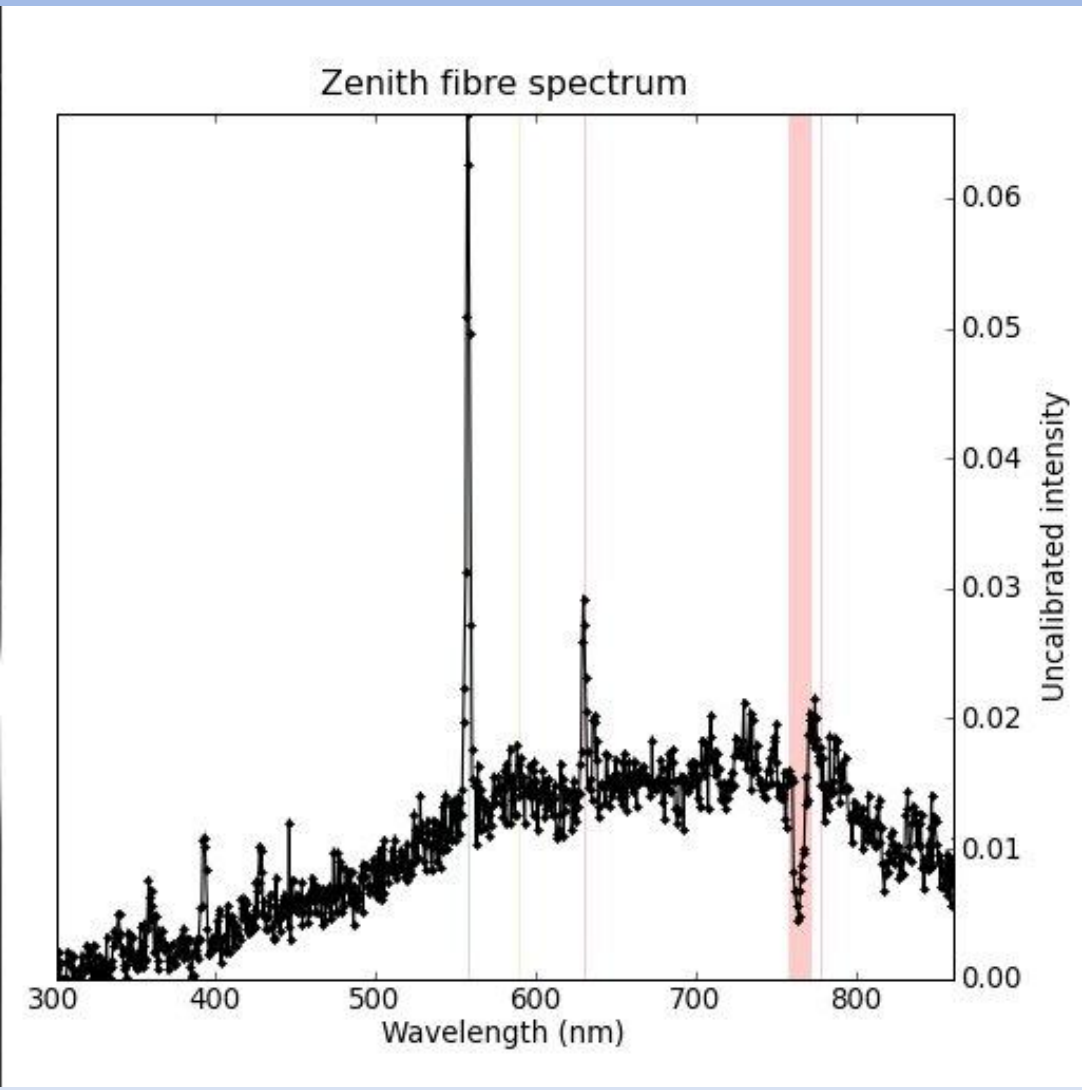


Black spectrum: Hill & Jones JGR **105,** 9421 (2000)

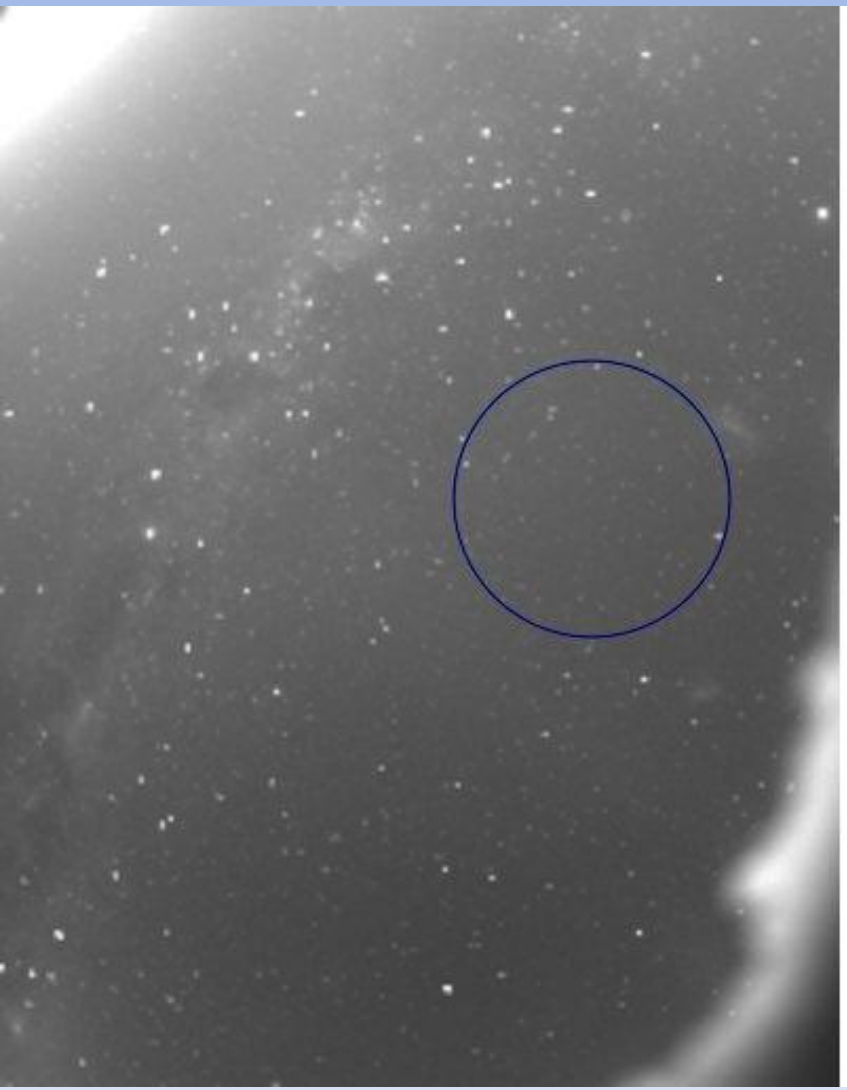
Gattini-Nigel: twilight sky

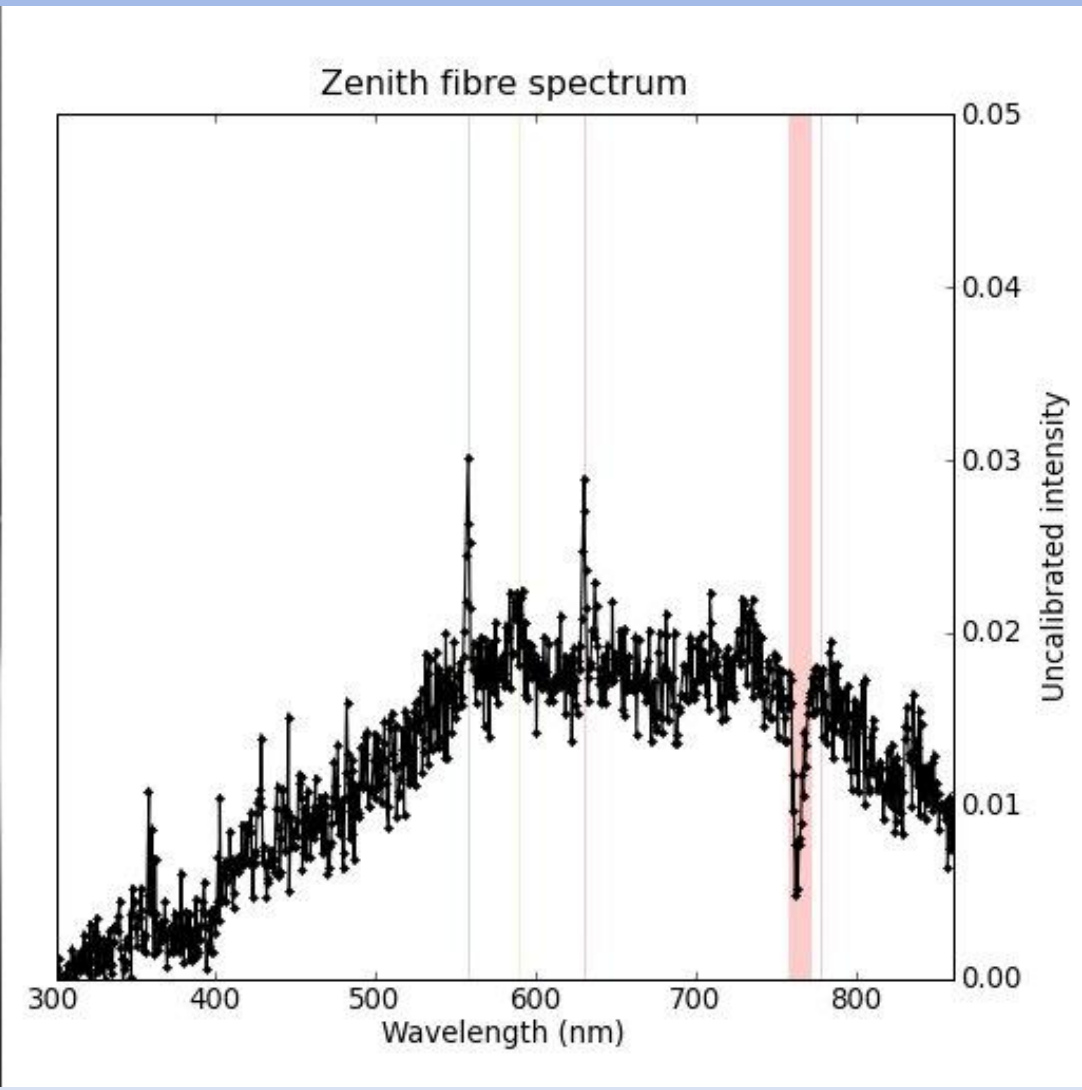


Gattini-Nigel: a bright aurora



Gattini-Nigel: moonlit sky

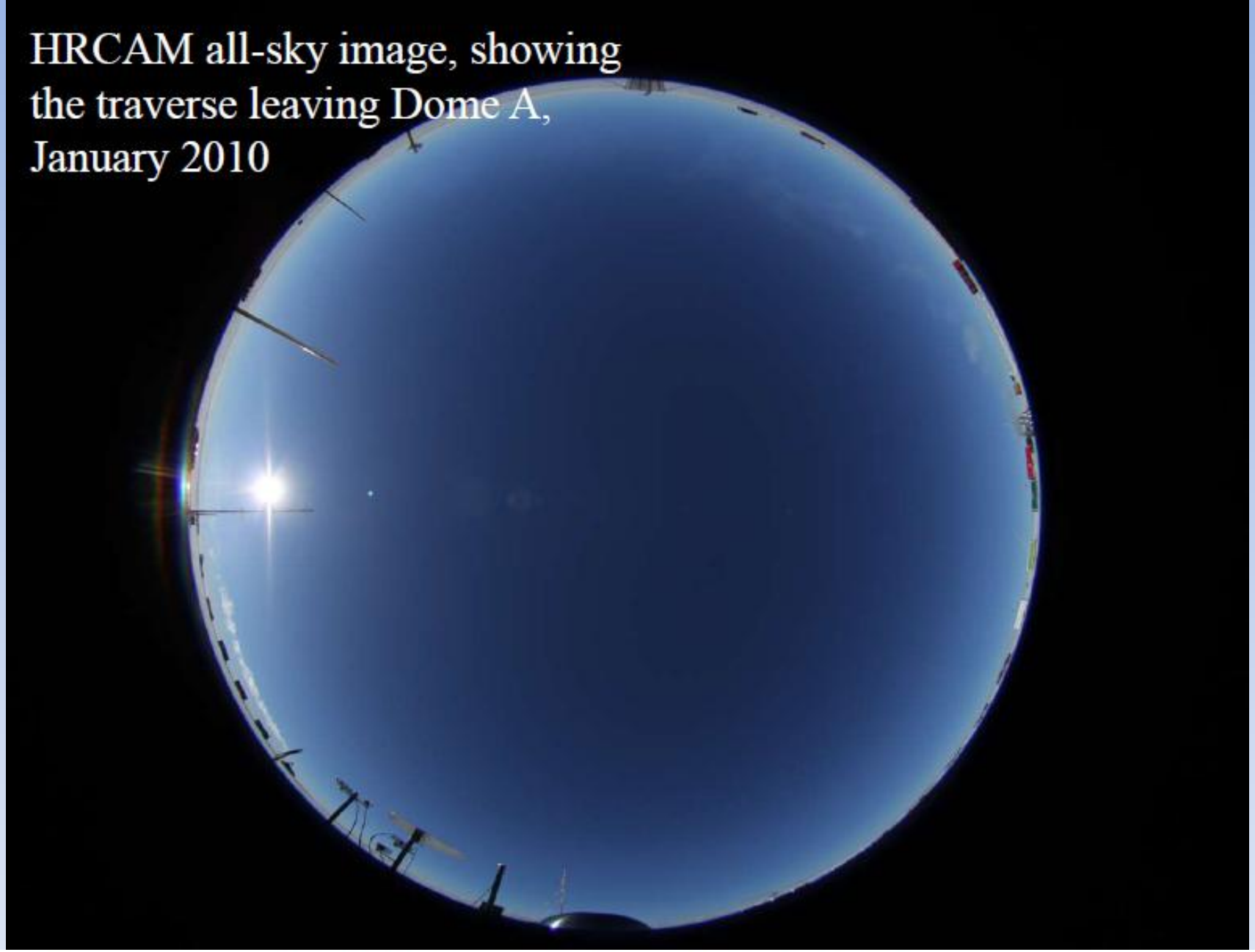





Mon Apr 13 16:59:48 2009


Thu Apr 16 16:59:48 2009

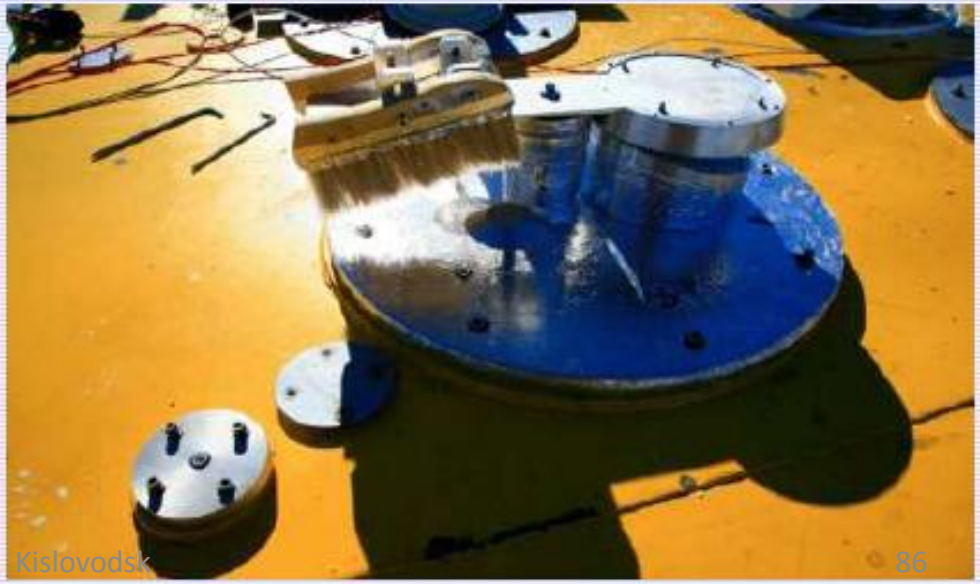

Wed May 6 19:59:48 2009



All-sky camera images. The Iridium satellite antennae are visible at bottom left. Kunlun Station is at the right, just above the centre. The original images, stored at Dome A, are 15Mpixels in size; these thumbnails are 0.02Mpixels. The exposure time in fractions of a second is given in the caption.

Measurement of Atmospheric THz Transmission by FTS (Ref: Shi, S.-c.'s Talk)

- In 2009，a FIR/THz FTS was fabricated to measure the atmospheric transmission over 0.75-15 THz under the collaboration among PMO, CfA, and NAOJ, with remote operation support from NSWU.
- The results，combined with 660GHz radiometer measurement by Pre-HEAT，strongly suggest that Dome A is a unique site for ground-based THz observations.
- THz facilities working at 200-350 mm windows can be planned.



Present work and the future projects

AST3(Three Antarctic Schmidt Telescope)

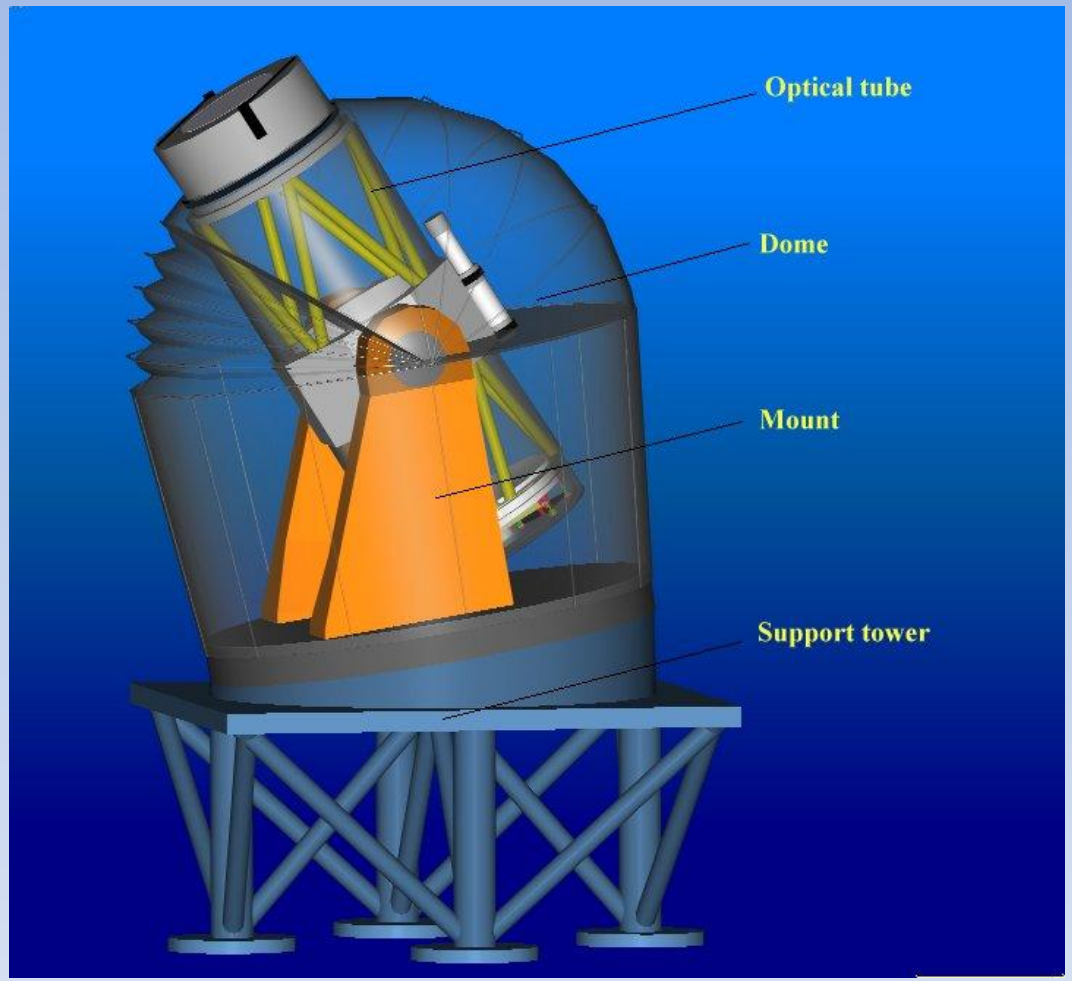
Clear aperture：50cm； FOV：4.2° ；
Wave Band：400nm-900nm (g, r, i filter for 3 telescopes)；
Scale：1 arcsec/pixel；
CCD: STA1600 ,9micron /pixel, 10k× 10k ；

- Studies of Type Ia supernovae and the dark energy of the universe;
- Microlensing and searching for extrasolar planets;
- Searching for variable stars;
- Asteroseismology;
- Site testing such as measurement of atmosphere extinction and sky brightness, like CSTAR.

3 Antarctic Schmidt Telescopes(AST3)—

3X 500mm/680mm Schmidt telescopes

Structure



Equatorial mount

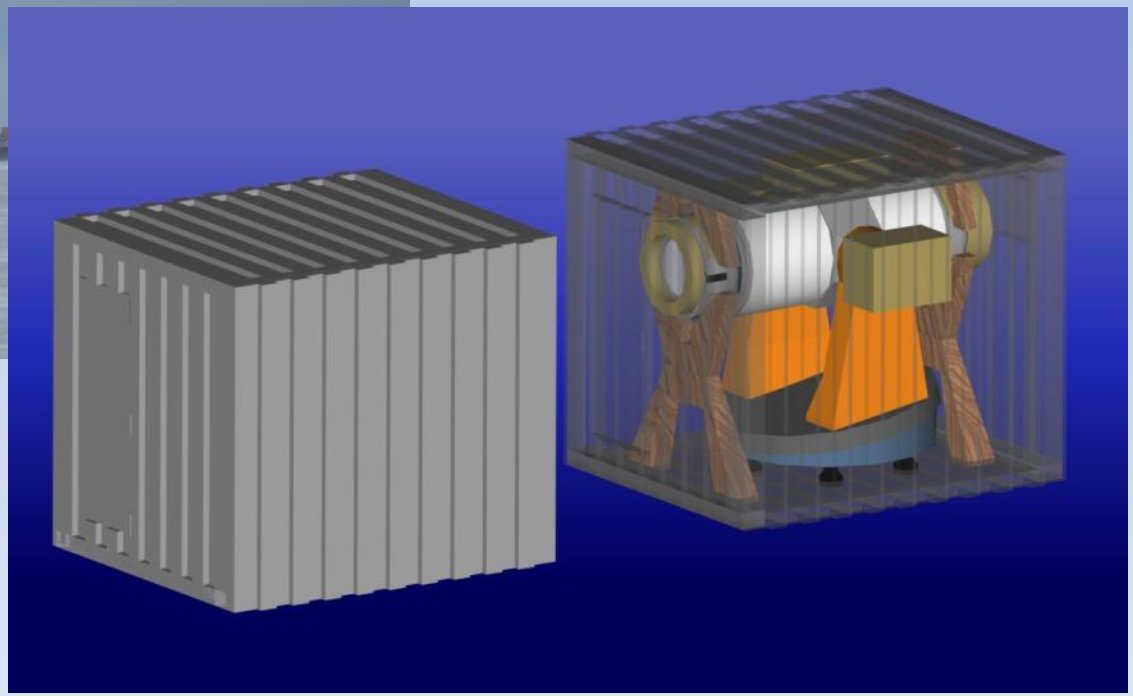
1) Adjustable tower height；

2) Foldable tent-like dome；

3) ITO coating plus active snow removing；

4) Auto-focusing

Transportation and assembly

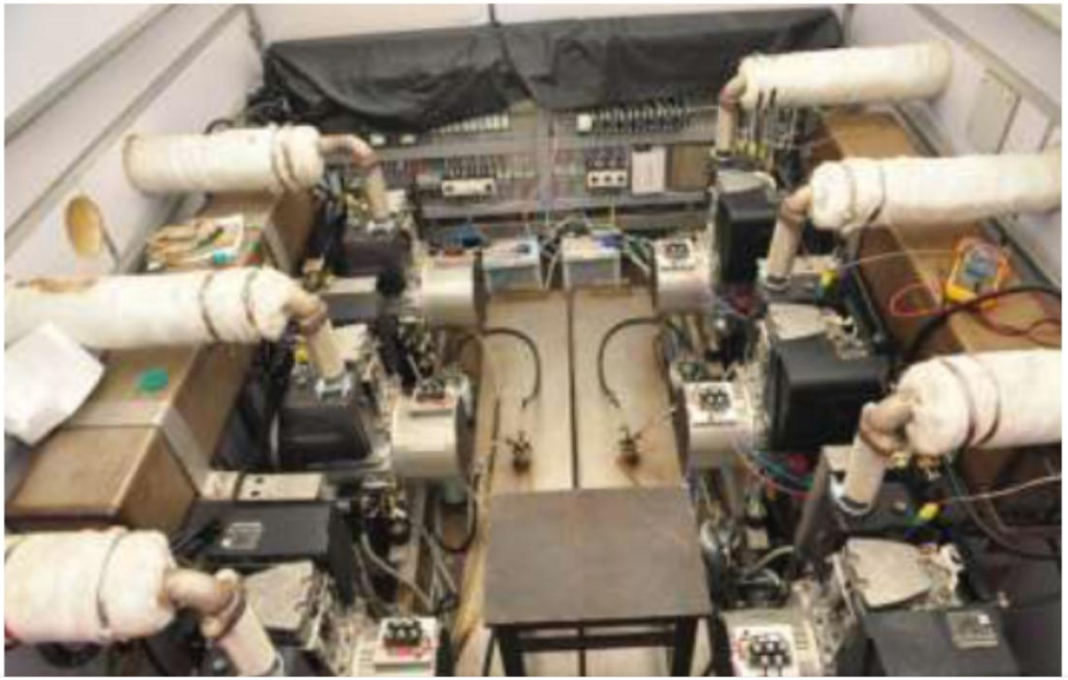


Custom 10’ container

AST3 on Dome A

First one could be deployed at 2012

New design of ASP by CCAA-SEU: higher power output & larger data storage, testing in Tibet in 2010 summer.



Major Construction for Dome A Observatory Proposed for 2011-2015 Construction

- 2.5m Optical/NIR Telescope
- 5m THz Telescope
- Antarctic Support Platform

- On-Site Assembly
- Transportation System
- Remote Operation

Yang Ji's talk in Xi'an China

2.5m KDUST (Cui'X-.q. et al)

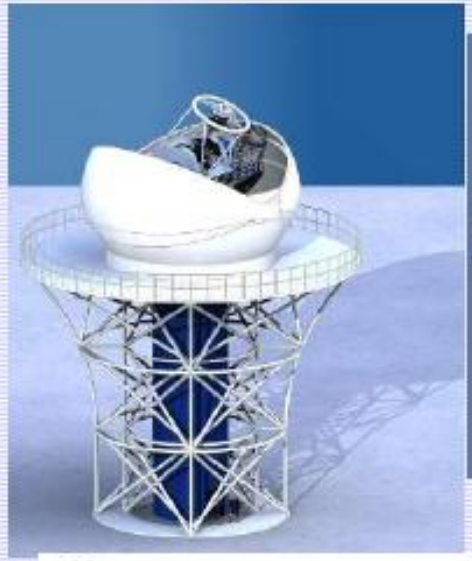
Optics：R-C or SNAP type

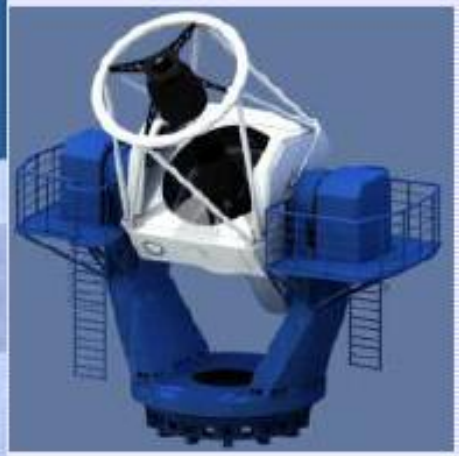
Operation Mode: Large FoV Survey

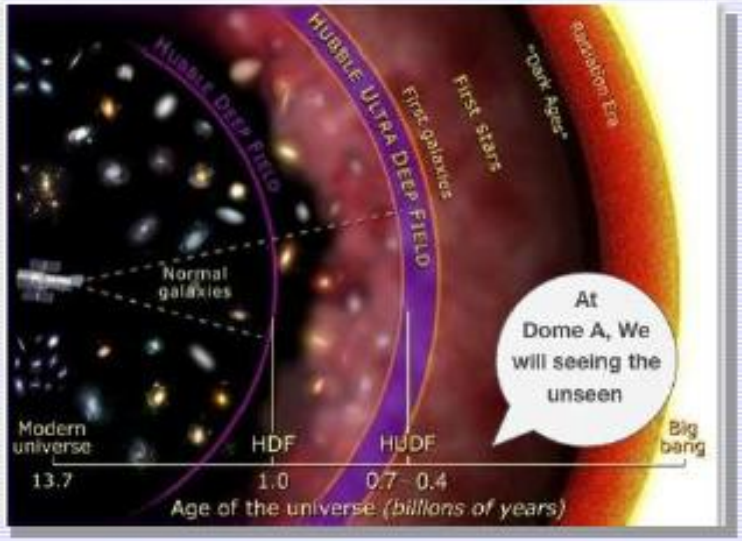
Science：Dark Universe、Exoplantes

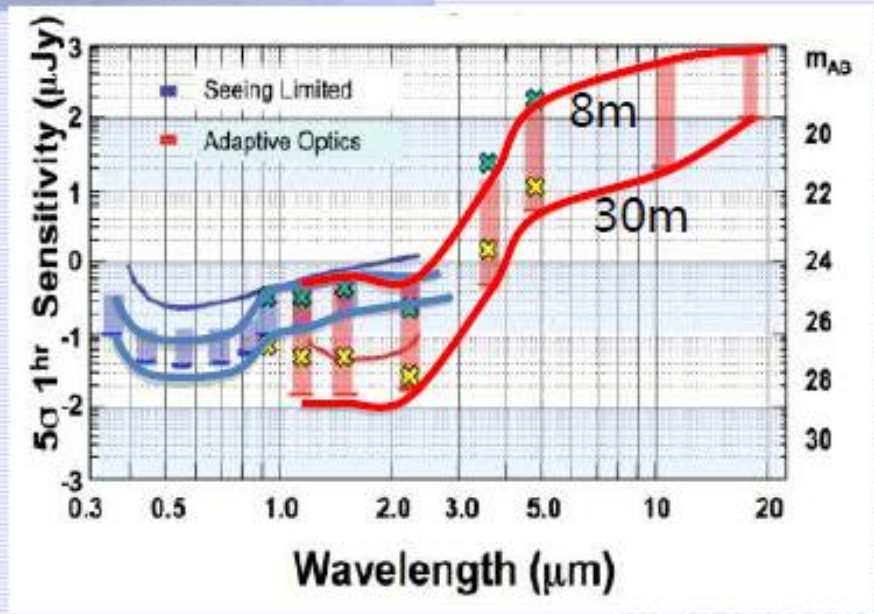
Methods: SNIa，Lensing

Construction：5 Years









Goals:

➔To reach seeing limited image quality of 0.3" in optical

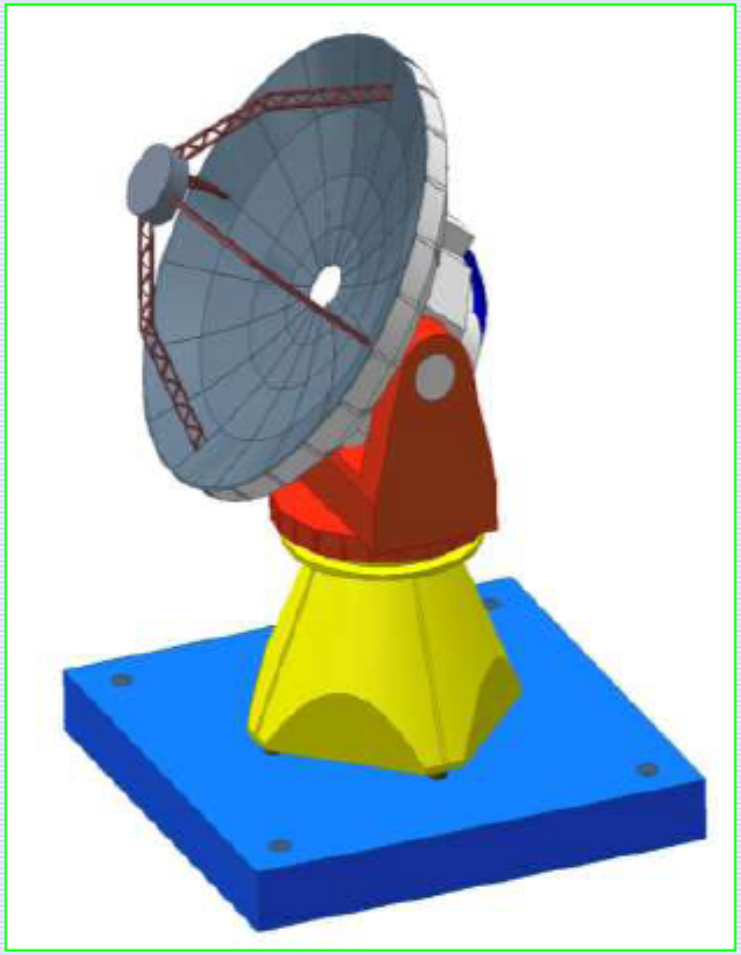
➔To reach diffraction limited image quality in NIR

5m THz Telescope (Shi, S.-c et al)

Working wavelengths: 350 μm, 200 μm, fully tracking

Precedent to Space Program

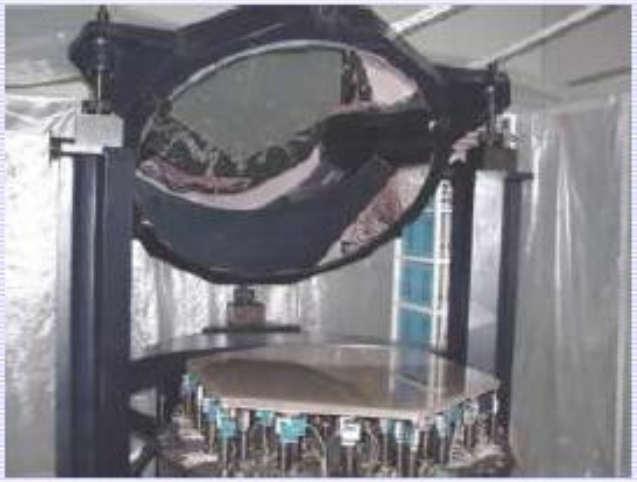
	5m	Herschel
Resolution	Higher	Lower
Duration	Long	Limited
Upgrade	YES	No
Cost	Lower	Higher



Complement to ALMA/CCAT

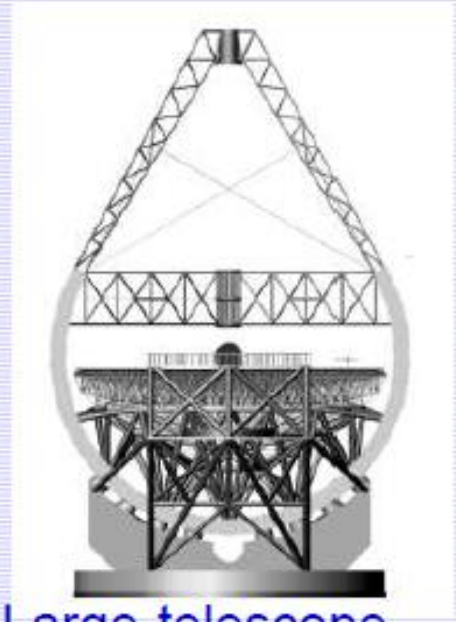
	Dome A 5m	ALMA/CCAT
Frequency (<350 μm)	YES	NO
FoV	Wide	Narrow/Wide

Technological Supports: NIAOT, NAOC



LAMOST segmented mirror & thin mirror active optics

Mirror Fabrication Facility



Large-telescope Technology

Experience derived from LAMOST

2.5m 13.7m

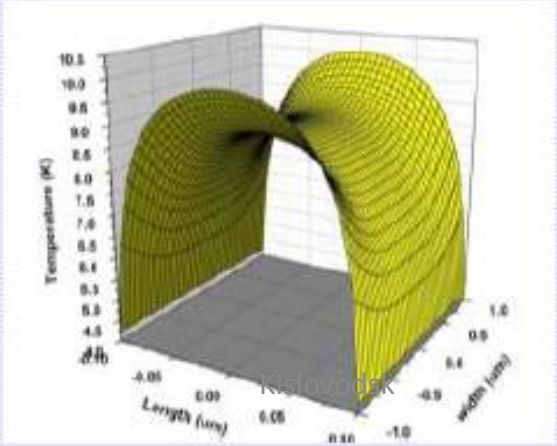
Technological Support: PMO

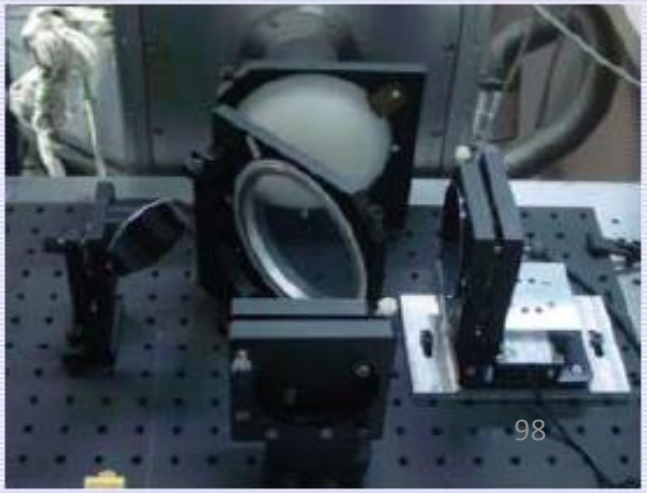
Development in mm, submm, THz receivers. Construction and Operation of millimeter telescope, joint development of SMA & ALMA

Superconducting Array Receiver

Joint R&D of HEB Mixers

THz FTS for Dome A





Infrastructure at Dome A

Fully Supported by Polar Research Institute, China

Xuelong Ice breaker

Dome A Expedition Team

Finishing Kunlun Station

Enhanced Infrastructure in Future

Polar Research Planning: New Ice Breaker & Airplane

9.048 厘米

CCAA Partner Institutes

- Purple Mountain Observatory （Host Institute）
- National Astronomical Observatories, Chinese Academy of Sciences (NAOC)
- Polar Research Institute
- Nanjing Astronomical Optics and Technology Institute, NAOC
- Tianjing Normal University
- Institute of High-Energy Physics (IHEP)
- Chinese University of Sciences and Technology
- Tsinghua University
- Nanjing University
- Shanghai Astronomical Observatory
- Yunnan Astronomical Observatory, NAOC

International Collaborators

- NSWU（*）
- Texas A&M Univ.
- Caltech（*）
- LBNL
- UC Berkeley（*）
- UoA（*）
- Chicargo Univ（*）

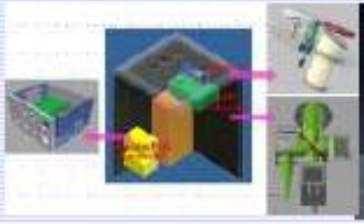
（*）——signed agreement

Dome A Observatory Development: A Roadmap

2006-2008 — Site Survey & Small Telescope



2009-2011 — +Site Testing & Middle-size Telescope



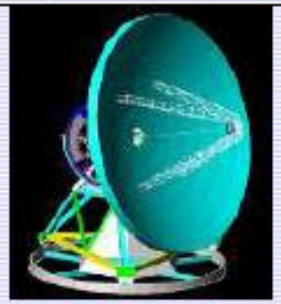

2011-2015 — Dome A Observatory Phase I

2.5m Opt/NIR
KDUST

5m THz
DATE5

2016-2025 — Dome A Observatory Phase II

6-8m
Opt/NIR



15m THz

Summary

• Stimulated by Polar Research activities, the site surveys at Dome A demonstrate its excellent observing conditions for ground-based astronomy;

• Small-scale instruments have been used at Dome A for continuing site survey and astronomical observations;

• Dome A has been selected as one of the major goals of development for Chinese astronomy;
Major Instruments are proposed;

• Dome A astronomy has achieved rapid development through the solid supports from polar society, and infrastructure for future development is promising;

• International collaboration has been successful and will be encouraged in future.

Thank You!