



Solaris



**a smart Solar imaging system at high radio frequency for
continuous Solar monitoring and Space Weather applications**

Alberto Pellizzoni - INAF-Osservatorio Astronomico di Cagliari

**approved by PNRA (Piano Nazionale di Ricerche in Antartide)
as a permanent observatory in Antarctica**

<https://sites.google.com/inaf.it/solaris>

The Solaris Team

UNIMI: E. Boria, F. Cavaliere, W. Merli, B. Paroli, F. Pezzotta, M. Potenza (co-PI), L. Teruzzi, E. Vignati;

UNIMIB: M. Gervasi (co-PI), A. Limonta, A. Passerini, L. Scalcinati, M. Zannoni; **INFN-MIB:** S. Della Torre;

UNIROMA3: G. Pizzo; **UNIROMA1:** M. De Petris, A. Miriametro; **INAF-OAC:** M. Buttu, E. Egron, M.

Marongiu, S. Mulas, A. Navarrini, P. Ortu, A. Pellizzoni (Principal Investigator), T. Pisanu, C. Tiburzi; **INAF-**

OAS: I. Bruni, F. Cuttaia, S. Ricciardi, M. Sandri, D. Vergani, F. Villa (co-PI); **ASI:** M.N. Iacolina, A. Saba, G.

Serra, G. Valente; **INAF-IRA:** S. Righini; **INAF-TS:** M. Messerotti; **SKA Obs./INAF-IASF:** L. Stringhetti

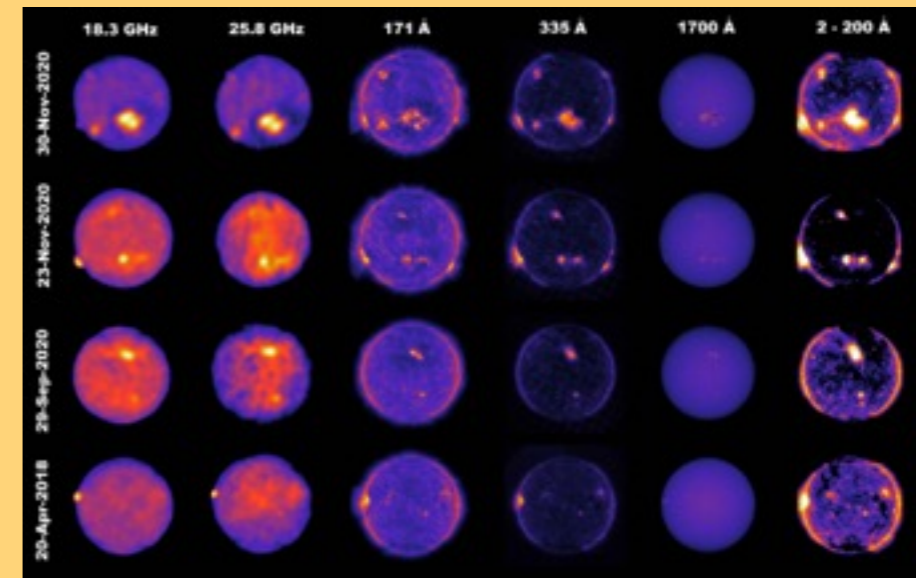
Italian Radio-Band Assets for Solar Observations & Space Weather

TSRWC (Trieste Solar Radio Weather Centre):
spectropolarimetry, 1-18 GHz, 3.7m antenna



RSRWC (Rende Solar Radio Weather Centre):
spectropolarimetry, 1-18 GHz, 7m antenna

SunDish (Single-Dish Solar Imaging with INAF Radio Telescopes):
Solar imaging & spectropolarimetry, 18-26 GHz (up to 100 GHz), 32m/64m antenna

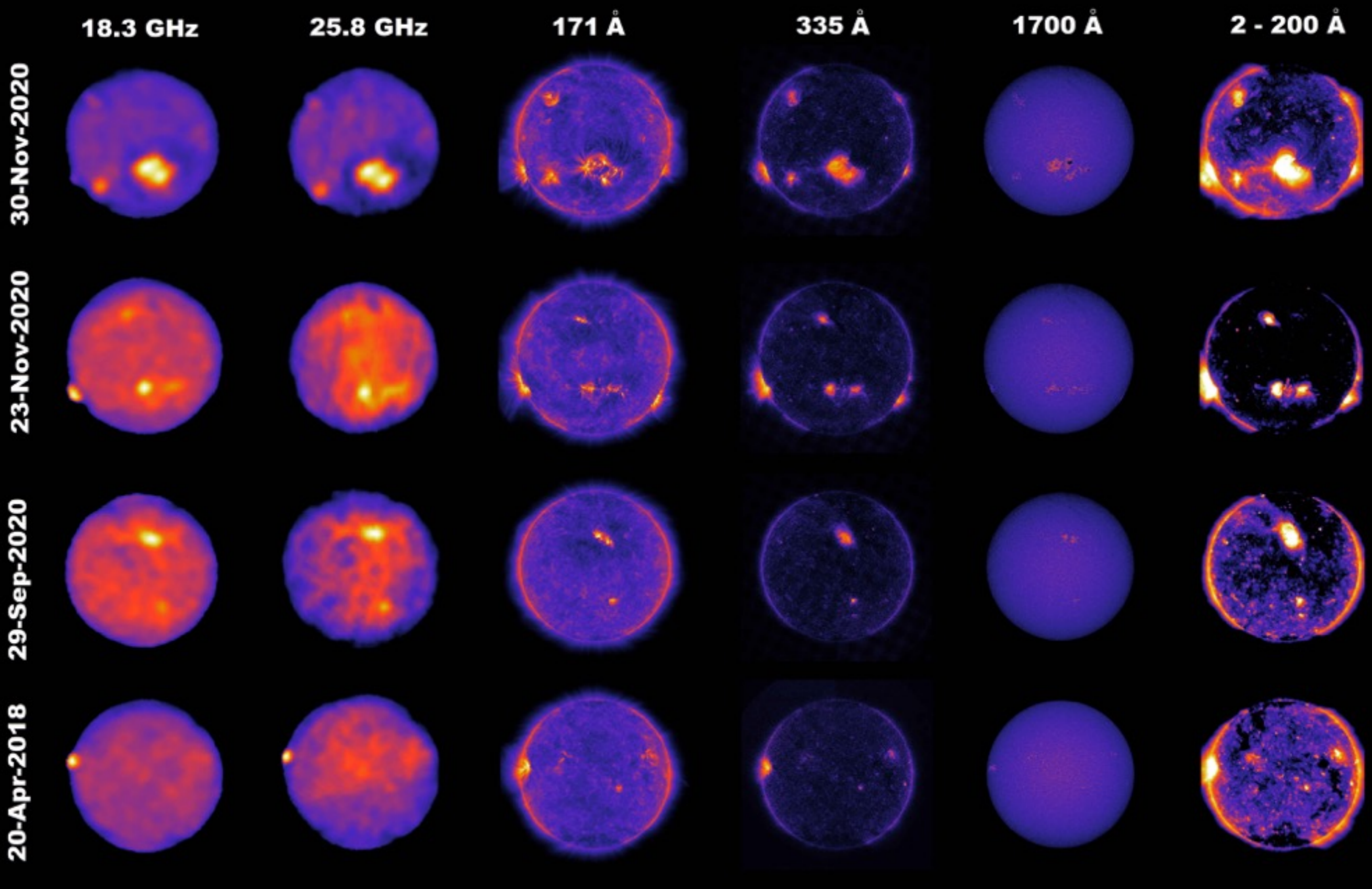


Solaris Observatory (a smart Solar imaging system at high radio frequency for continuous Solar monitoring and Space Weather applications):

Solar imaging, 100 GHz, 1.5/2.5m antenna (for Antarctic/Arctic sites)

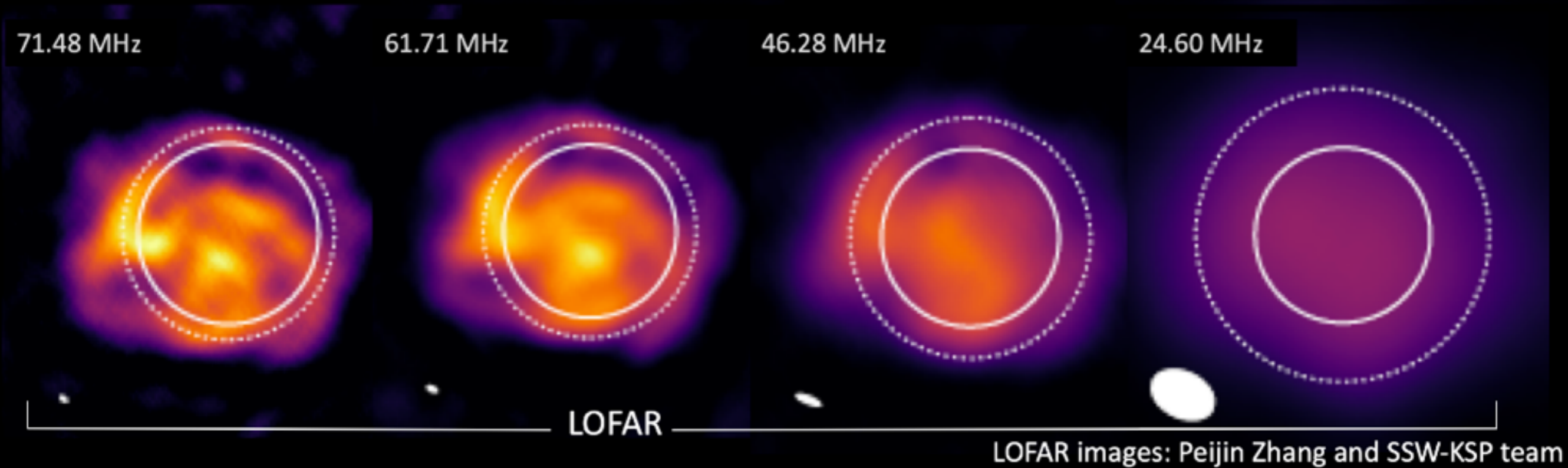
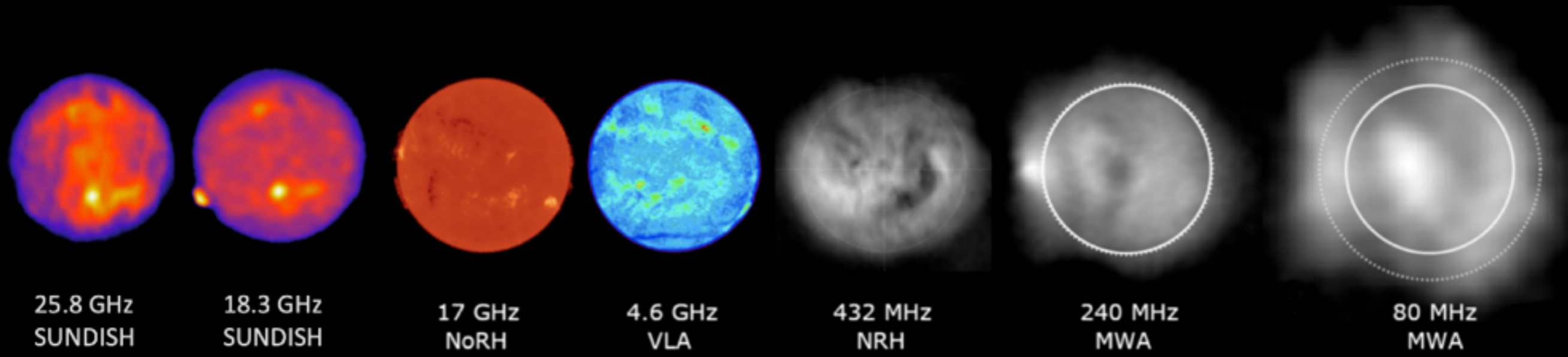
LOFAR-IT (low frequency obs. @ Medicina)

CALLISTO (low frequency obs. @ Trieste)

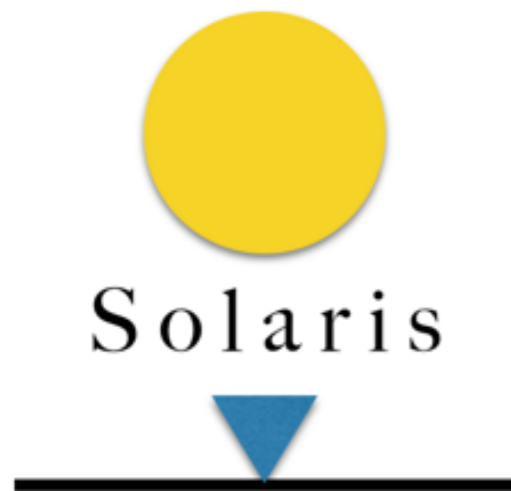


SunDish project: *Single-Dish Solar radio Imaging with INAF Radio Telescopes*
Pellizzoni et al., 2022, Solar Physics (arxiv.org/abs/2205.00197)

 <https://sites.google.com/inaf.it/sundish>



Need for simultaneous multi-frequency solar monitoring



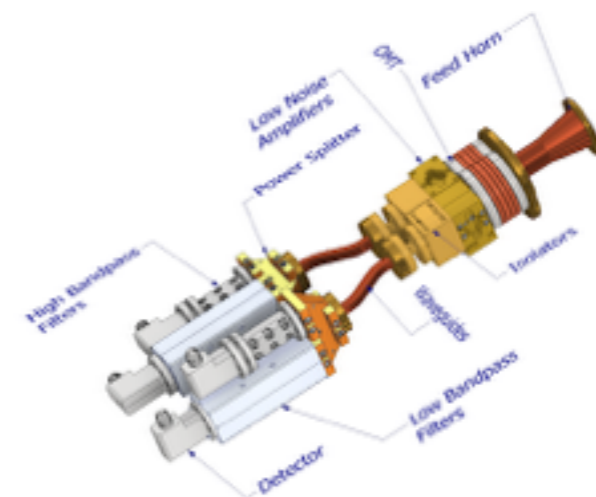
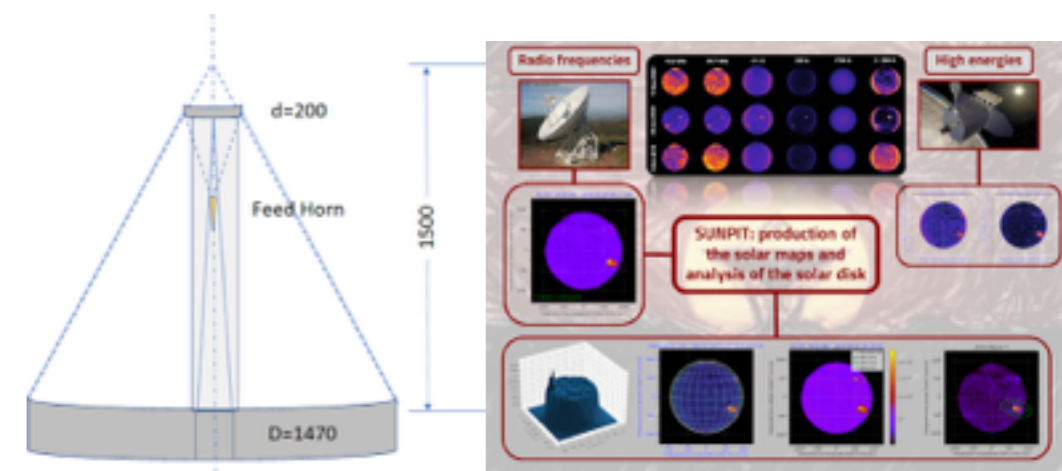
The SOLARIS observatory: a smart Solar imaging system at high radio frequency for continuous Solar monitoring and Space Weather applications

Team:

UNIMI, UNIMIB, INAF-OAC, INAF-OAS, INAF-IRA, UNIROMA3, UNIROMA1, INFN

- Solaris is a scientific and technological project aimed at the development of a **smart Solar monitoring system at high radio frequencies based on single-dish imaging techniques**.
- It combines the implementation of a dedicated and interchangeable **100 GHz receiver on existing small single-dish radio telescope systems** (1.5/2.6m class) available in our laboratories in Milan and in Antarctica, to be adapted for Solar observations.
- Solaris can perform **continuous Solar imaging observations nearly 20h/day during Antarctic summer**, and it will be the only Solar facility offering continuous monitoring at 100 GHz.

Small radio telescopes
(Milan, OASI/MZS, COCHISE/Concordia)
ALMA receivers technology
(100 GHz, 2 freq. channels)
Single-dish Solar imaging
(INAF "SunDish" network)





Solaris

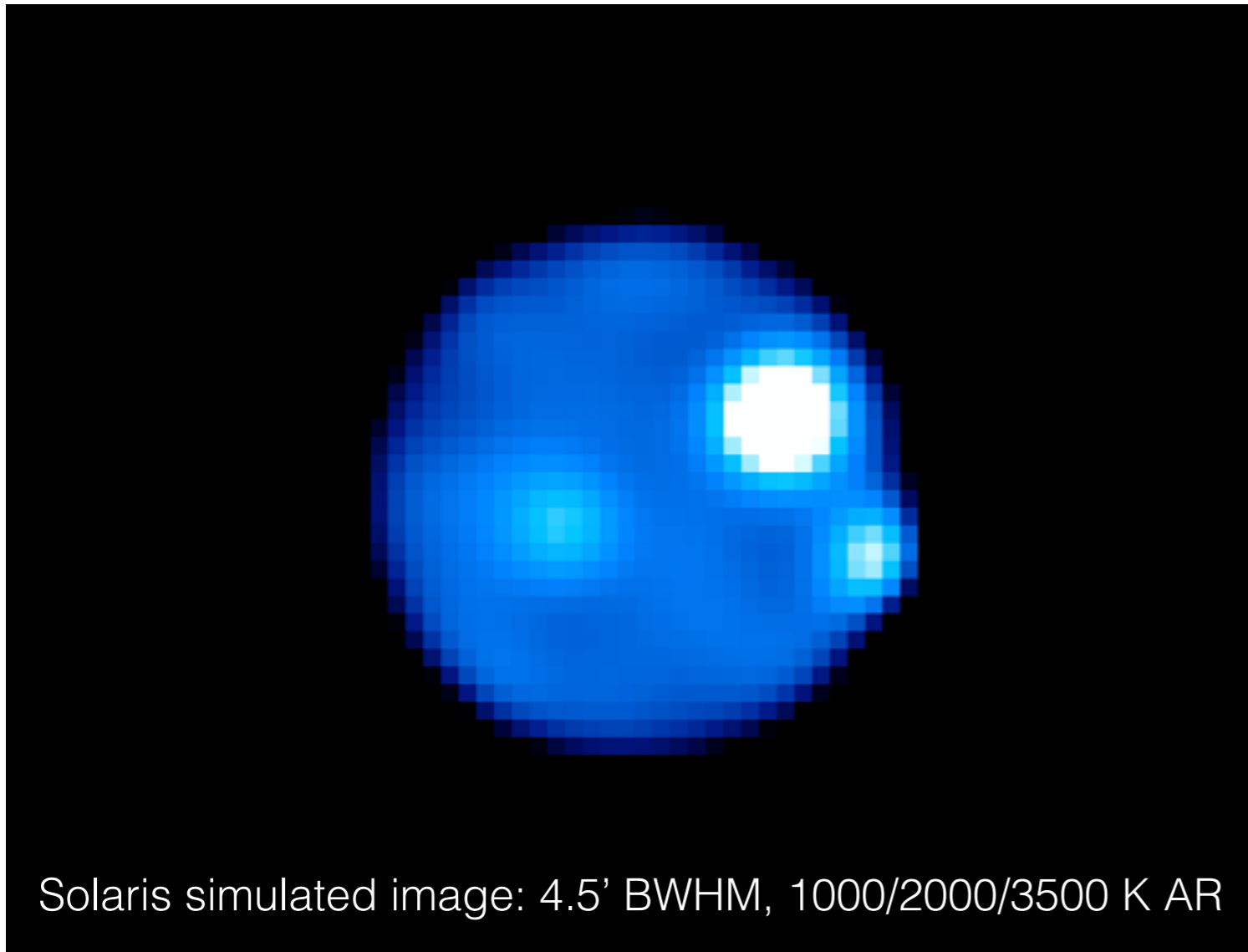


The SOLARIS observatory:

a smart Solar imaging system at high radio frequency for continuous Solar monitoring and Space Weather applications

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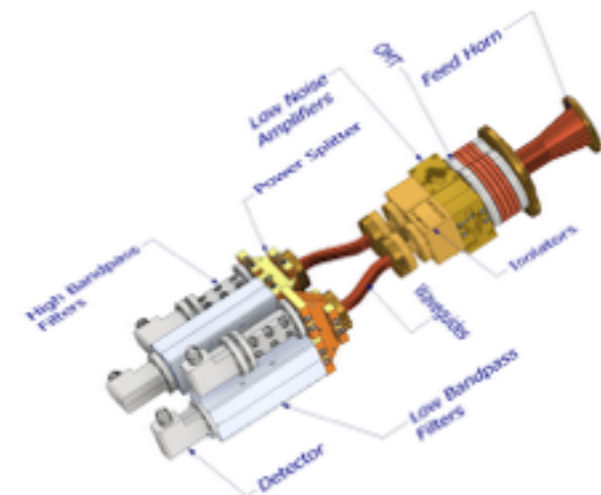
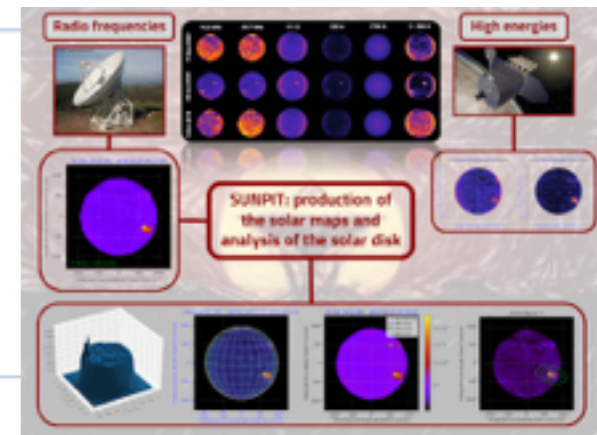
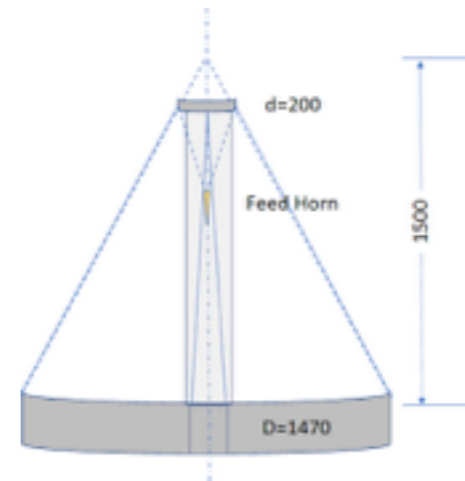


Solaris simulated image: 4.5' BWHM, 1000/2000/3500 K AR

Small radio telescopes
(Milan, OASI/MZS, COCHISE/Concordia)

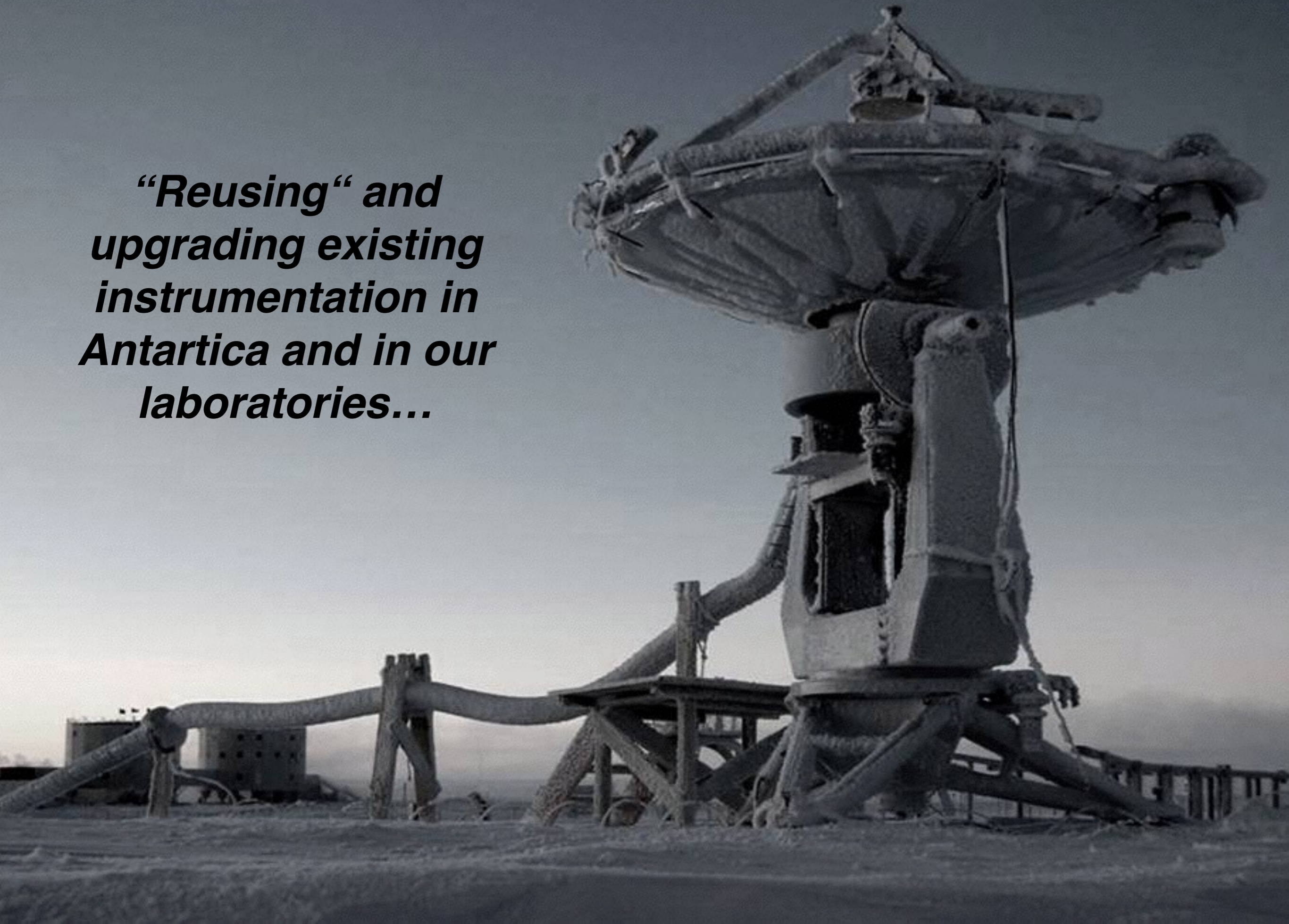
ALMA receivers technology
(100 GHz, 2 freq. channels)

Single-dish Solar imaging
(INAF "SunDish" network)



24h/day monitoring during Antarctic summer!

***“Reusing“ and
upgrading existing
instrumentation in
Antartica and in our
laboratories...***





A. Miriametro, F. Cavaliere, L. Pizzo, G. Dall'Oglio, L. Valenziano. presso la Mario Zucchelli Station



Once upon a time (1989).....

2.6m telescope @ OASI (Mario Zucchelli Station)

(Osservatorio Antartico Sub-millimetrico ed Infrarosso)

originally conceived for galactic and extragalactic science
(cold dust, star forming regions...)

<http://officina.fisica.unimi.it/wordpress/missioni/antartide/>



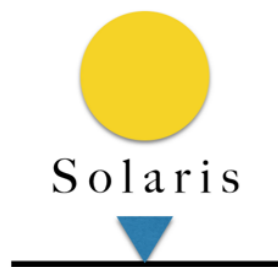
...and more recently (2006).....

**2.6m telescope @ COCHISE (Concordia - Dome C)
(Cosmological Observations at Concordia with High-
sensitivity Instrument for Source Extraction)**

Sabbatini et al., 2010

**[http://officina.fisica.unimi.it/wordpress/missioni/
antartide/](http://officina.fisica.unimi.it/wordpress/missioni/antartide/)**





Main Scientific Goals & Applications:

- Unprecedented continuous solar monitoring at high radio frequency in optimal observing conditions (sky opacity & visibility).
- Constraining purely non-thermal emissions in the Quiet Sun and Active Regions components.
- Active Regions flux and spectral variability monitoring.
- Solar Flares detection and observations.
- Study of Flare precursors (Space Weather Forecast).
- Trigger for high-resolution follow-ups with other facility (including “zoom-in” with SRT 64m)

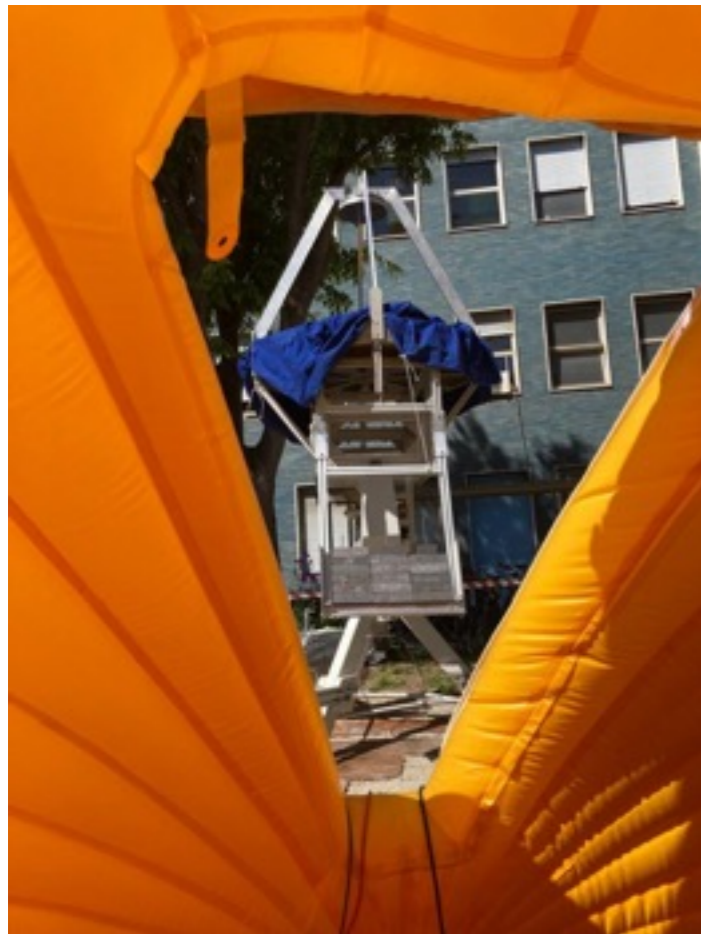


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**Solaris Prototype
(1.5m, UNIMI, Italy)**







Solaris “by night”?
Radio transient monitoring



Solaris



Thank You!

