



AN INSTITUTIONAL OVERVIEW OF FRENCH ASTRONOMY

KICK-OFF MEETING LIA ERIDANUS

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ON BEHALF OF :

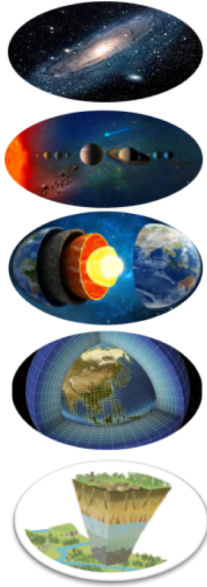
GUY PERRIN
DIRECTEUR ADJOINT SCIENTIFIQUE CNRS-INSU

TOULOUSE
3 JUNE 2019

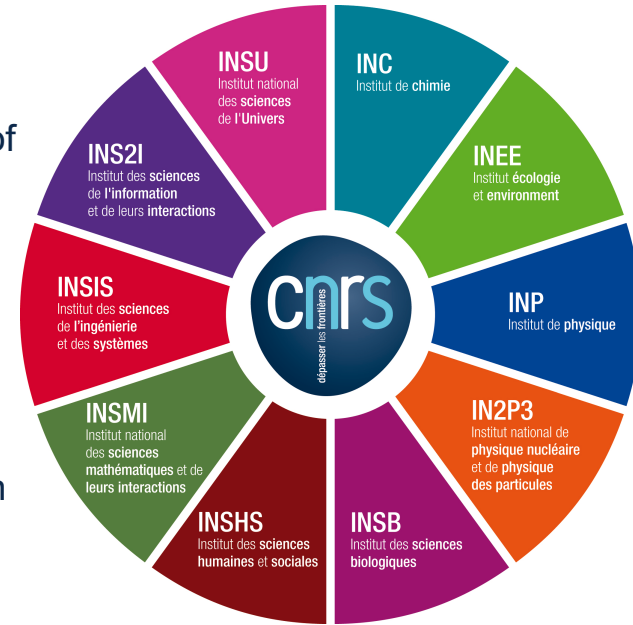


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INSU: 1 OF THE 10 INSTITUTES OF CNRS



- **Astronomy and Astrophysics:** formation and evolution of the Universe and its components
- **Solid Earth:** formation, history and structure of the Earth and planets, dynamics of earth inner envelopes, natural resources, terrestrial hazards earthquakes and volcanic eruptions
- **Ocean and Atmosphere:** climate change and variability, biogeochemical cycles, ocean dynamics, atmosphere-cryosphere-ocean interaction, and atmospheric composition
- **Continental surfaces:** structure and functioning of the Critical Zone, interaction with the atmosphere and oceans, cryosphere, soil and water resources, ecotoxicology and quality of environment



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FRENCH ASTRONOMY IN A NUTSHELL

Science goals defined in a European context (Astronet):

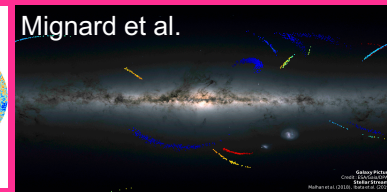
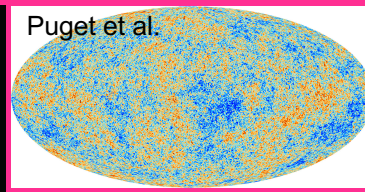
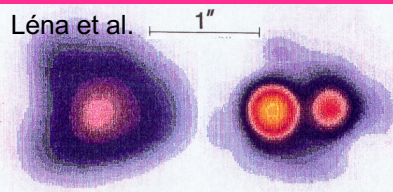
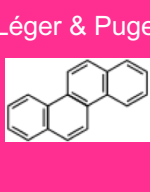
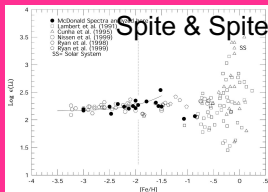
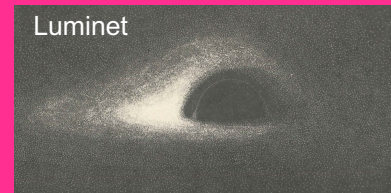
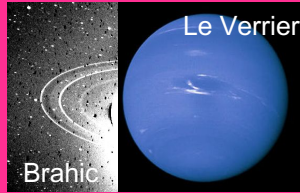
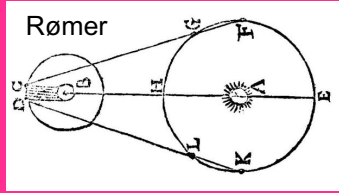
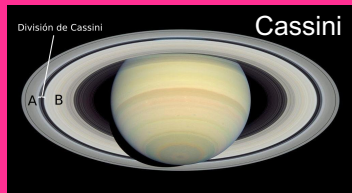
- Do we understand the extremes of the universe?
- How do galaxies form and evolve?
- What is the origin and fate of stars and planetary systems?
- How do we fit in?

One of the top nations in astronomy:

- 2nd country at IAU (6% of members)
- 27 research units
- 2700 staff members including 650 scientists with permanent position
- 10 research infrastructures + 3 national observatories
- 41 space missions

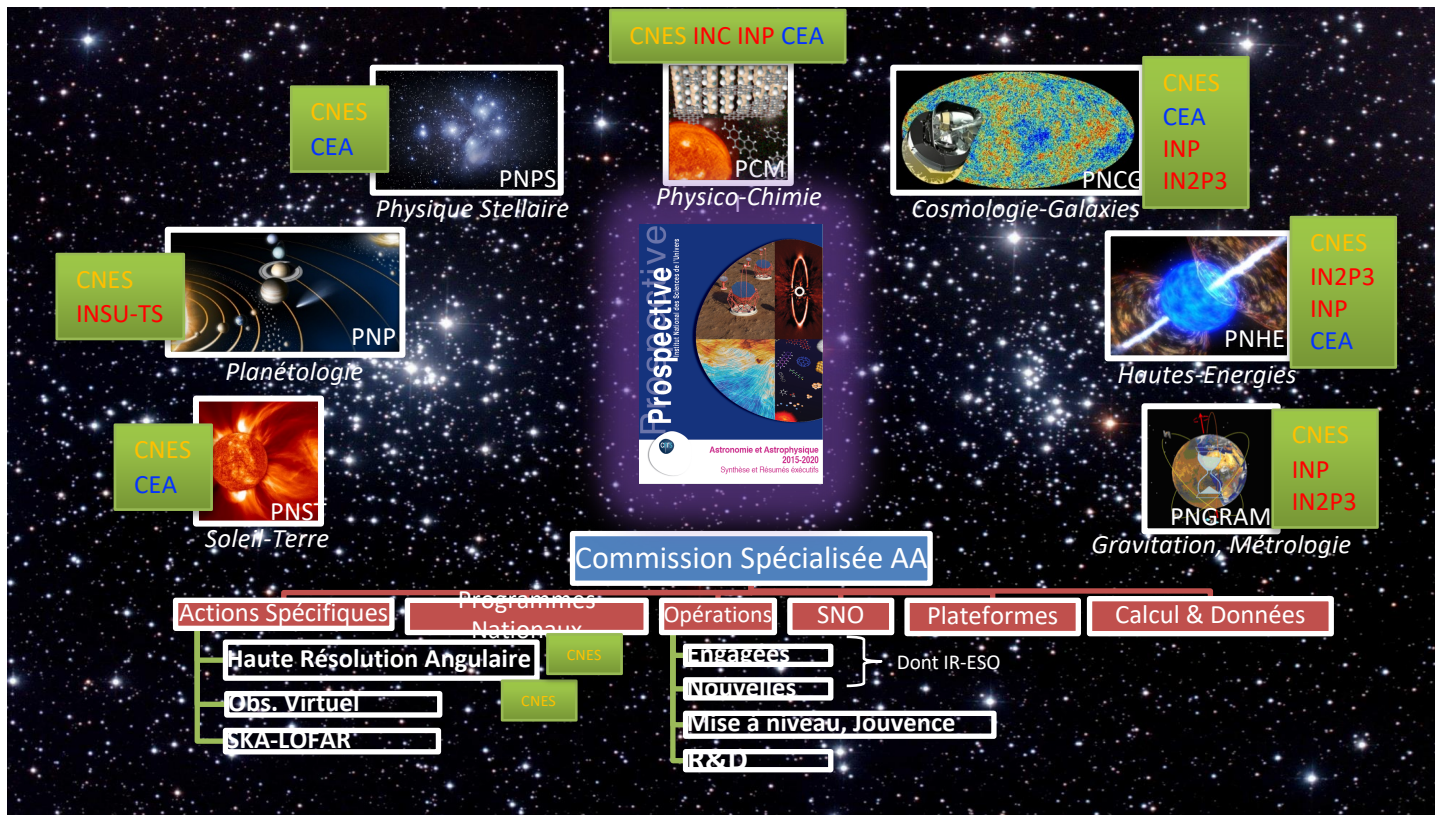
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A SAMPLE OF FRENCH CONTRIBUTIONS TO ASTRONOMY



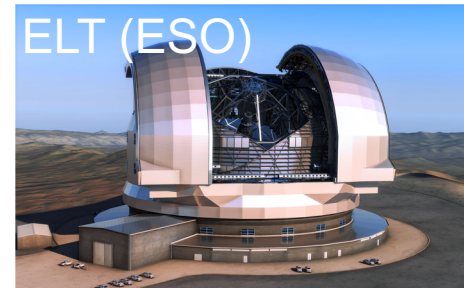
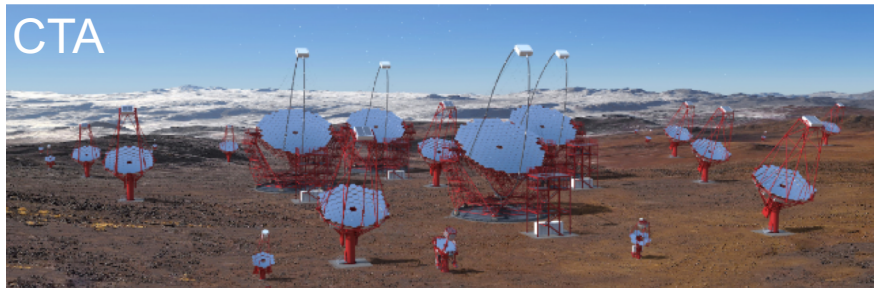
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ORGANIZATION IN NATIONAL PROGRAMS AND SPECIFIC ACTIONS



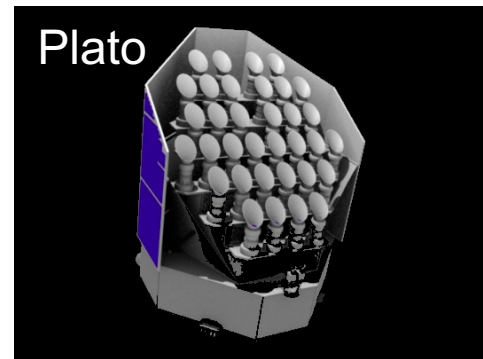
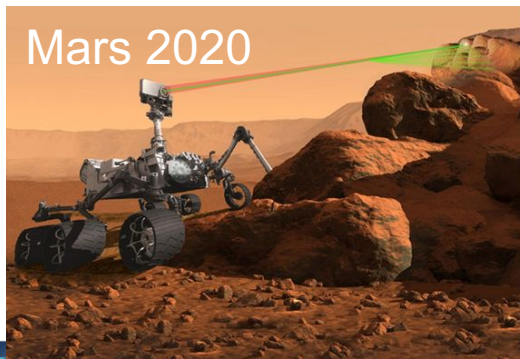
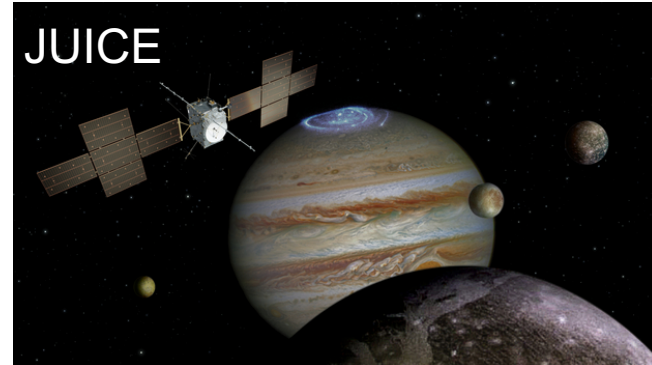
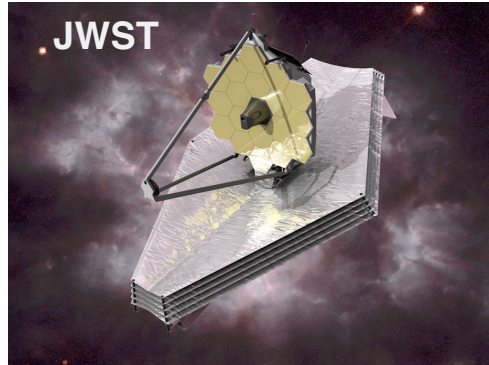
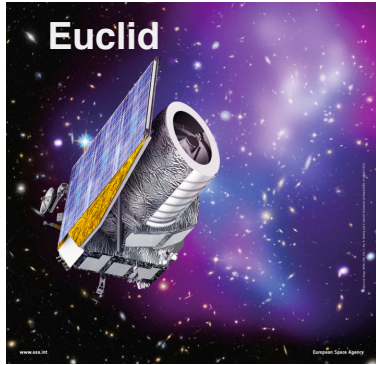
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GROUND-BASED INFRASTRUCTURES (SAMPLE)



3

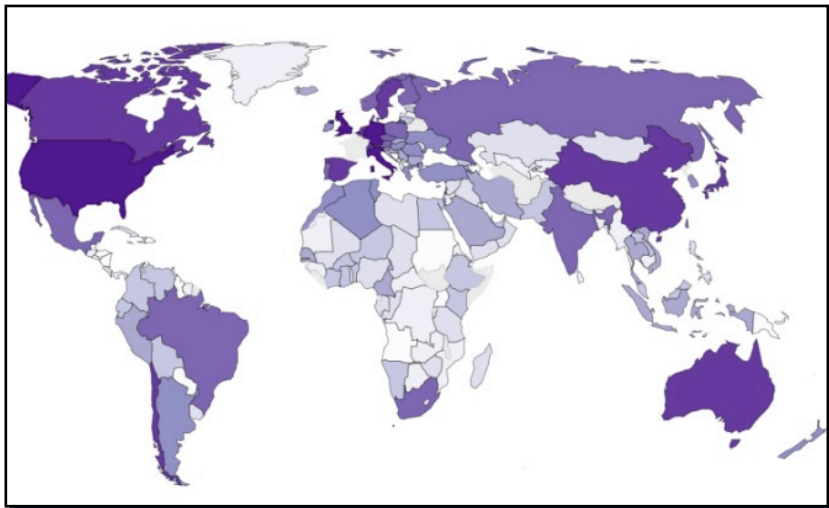
SPACE MISSIONS BEING DEVELOPPED (SAMPLE)



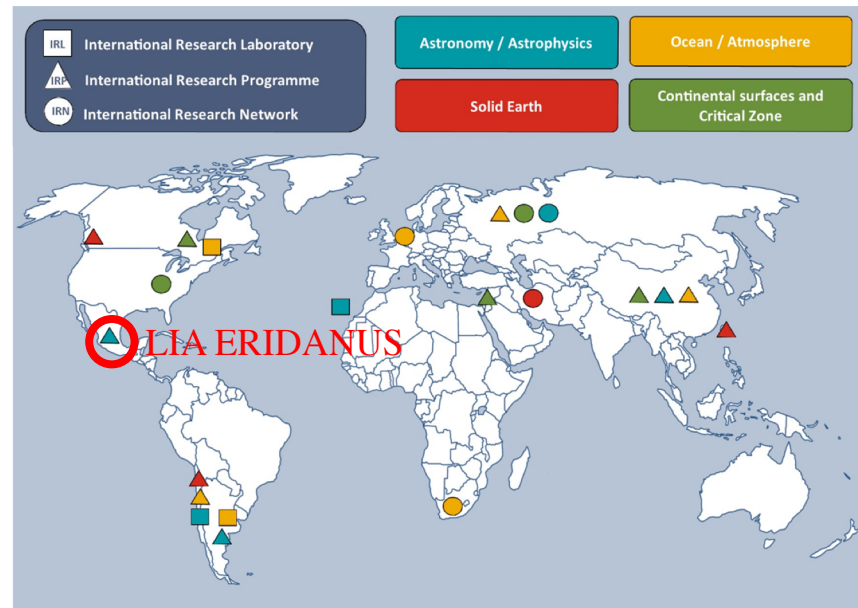
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WORLDWIDE ACTIVITIES

International bottom-up collaborations



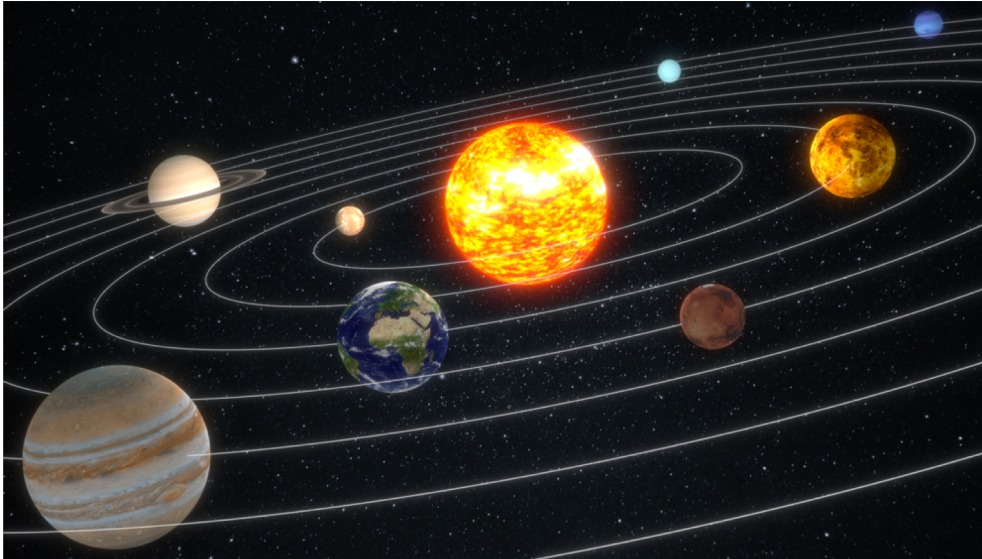
International structures



**SOME RECENT
RESULTS ... WAITING
FOR THE ONES WITH
COLIBRI**

5

THE POWER OF COMBINING CELESTIAL MECHANICS AND GEOLOGY: THE SOLAR SYSTEM 200 MY BACK IN TIME



The parameters of the Earth orbit 200 My ago were constrained by studying climate evolution coded in geological layers.

Parameters for other planets were also consequently constrained.

The horizon was so far limited to 60 My by chaos.

5

AN UNPRECEDENTED SKY MAP AT LOW FREQUENCY WITH LOFAR : THE LOTSS SURVEY



326k objects detected at
120 MHz (≥ 0.35 mJy),
90% are new.

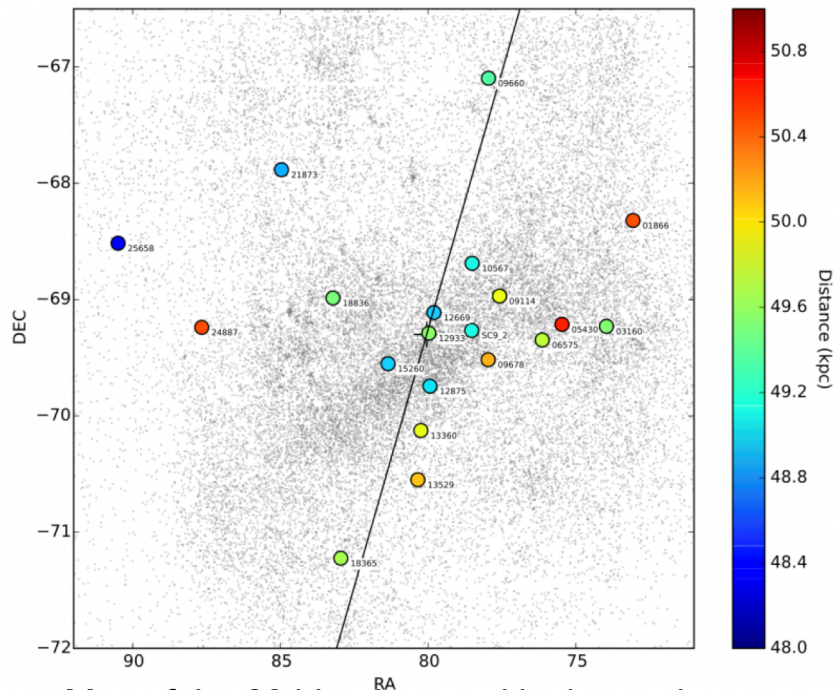
Field of view: $424^\circ 2$
(275% of the Northern
hemisphere)

Resolution: 6''

Example : M106 :
LOFAR image (orange)
superimposed to the
SDSS optical image

5

THE DISTANCE TO THE LMC AT 1% ACCURACY: FROM STELLAR PHYSICS TO COSMOLOGY



Map of the 20 binaries used in the study

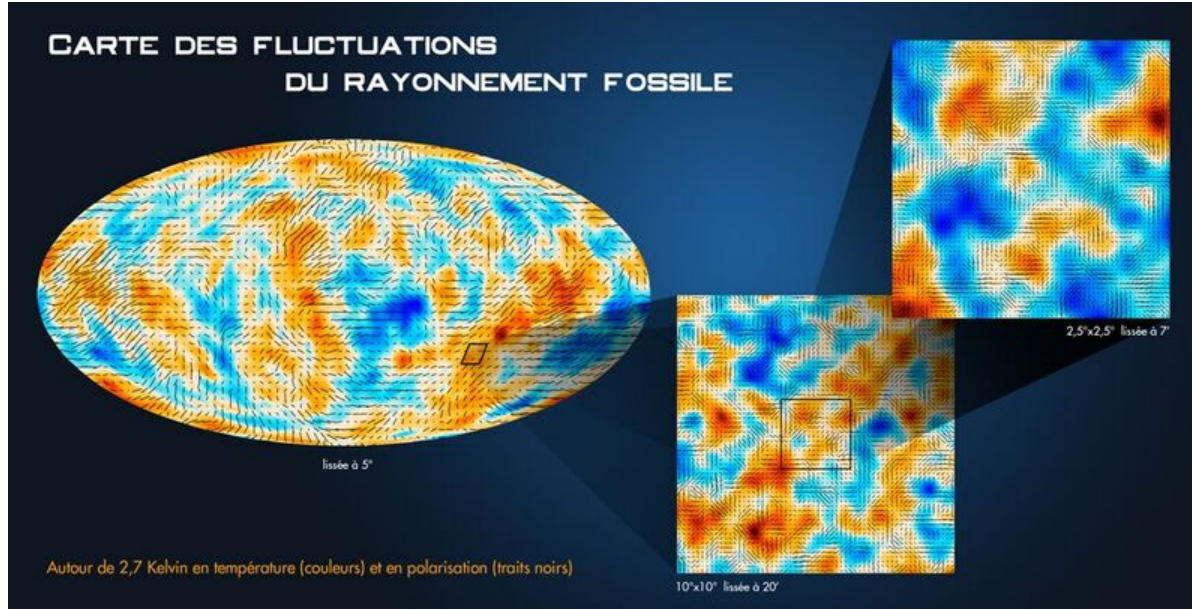
Distance is measured by comparing linear and angular diameters of stars in eclipsing binary systems.

Result : accuracy of 1%

This new distance has allowed to calibrate other distance scales and to better calibrate H_0 .

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THE STANDARD MODEL OF COSMOLOGY CONFIRMED BY PLANCK



Strong international recognition:

Gruber prize 2018

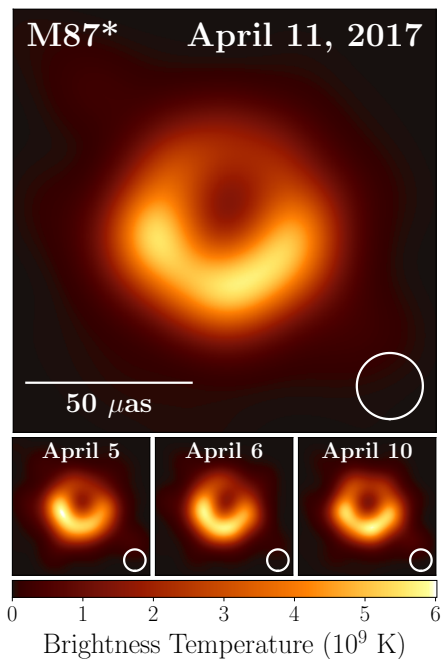
Shaw prize 2018

Giuseppe and Vanna Cocconi Prize 2019 (European Physical Society)

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BLACK HOLES BECOME CLEARER AND CLEARER

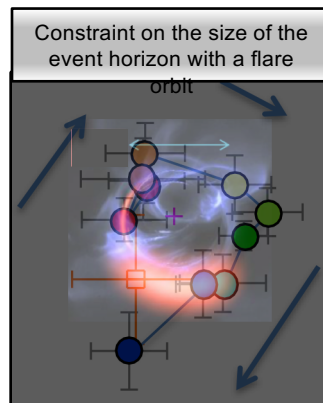
Image of M87* with the EHT



(IRAM and ALMA are part of the EHT)

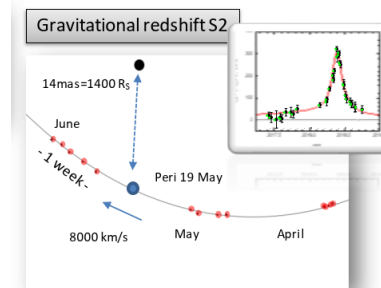
EHT collaboration et al. 2019 (6)

Horizon-scale size of Sgr A* and GR tests with ESO/MLTI/GRAVITY



EHT: 1.3 mm
GRAVITY: 2.2 μm

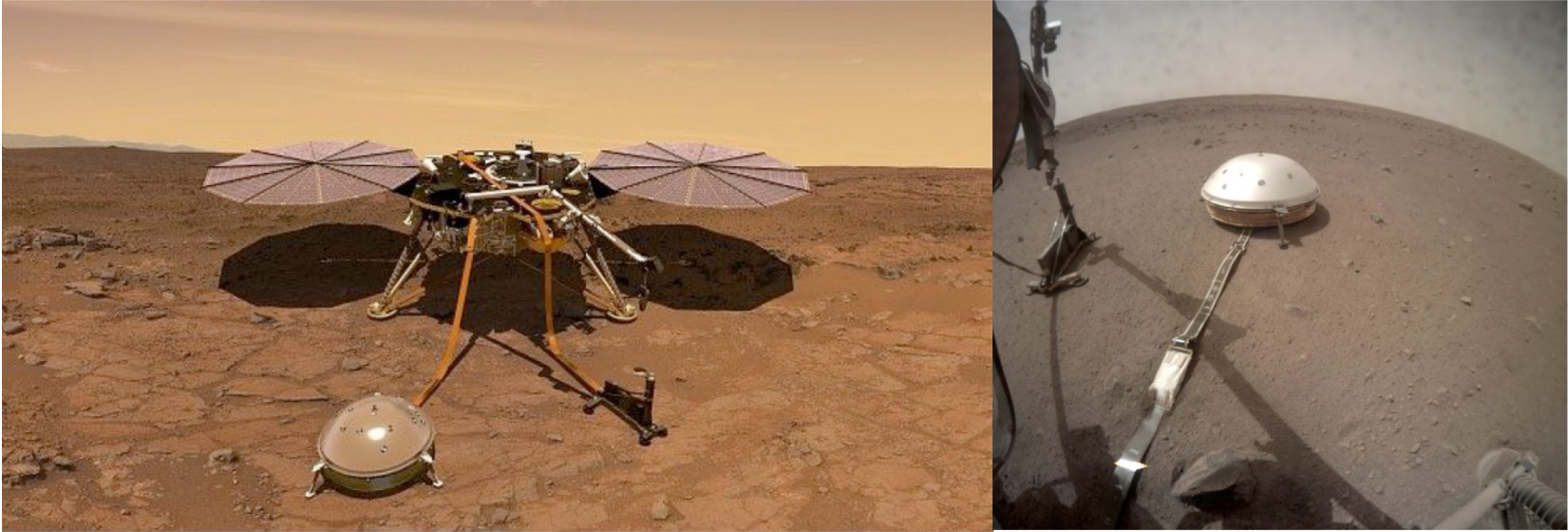
Both black holes are seen ~ pole on



GRAVITY collaboration et al. 2018ab, 2019

5

... WAITING FOR THE FIRST VIBRATION FROM THE MARTIAN INTERIOR WITH THE INSIGHT SEISOMETER ...



© NASA/JPL Caltech, 2018

A USA-France collaboration

Joining expertise from CNRS and Institut de Physique du Globe de Paris,
Together with CNES and SODERN space constructions.