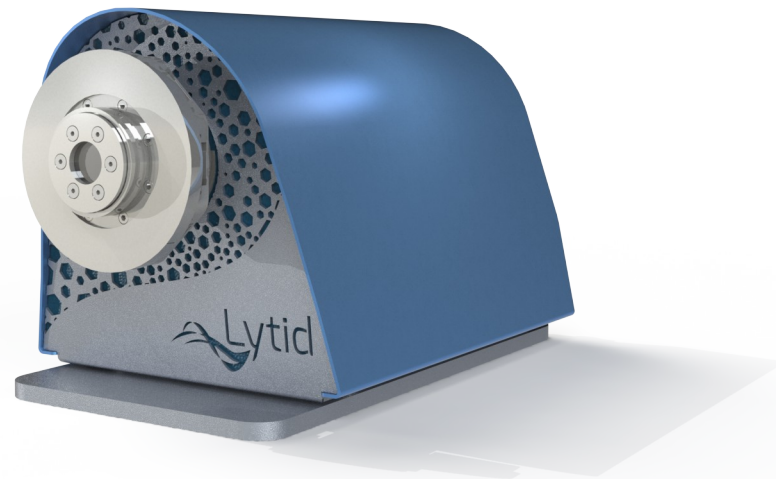


SIRIS – An ultra low-noise and ultra high dynamics SWIR camera



SIRIS

- Technology
- Acquisition modes
- Image processings
- Future developments

SIRIS - Technology

- NIT InGaAs sensor technology
- Dual-mode sensor : linear & lin/log
- 640x512 pixels
- 0,9 to 1,6 micron
- Vibration & cryogenic-free cooler (77K)
- 200 fps full-frame

SIRIS - technology

Fast and high-resolution images (200 fps)



Mars

Linear mode, 10 ms exposure time,
J-band filter (2019)

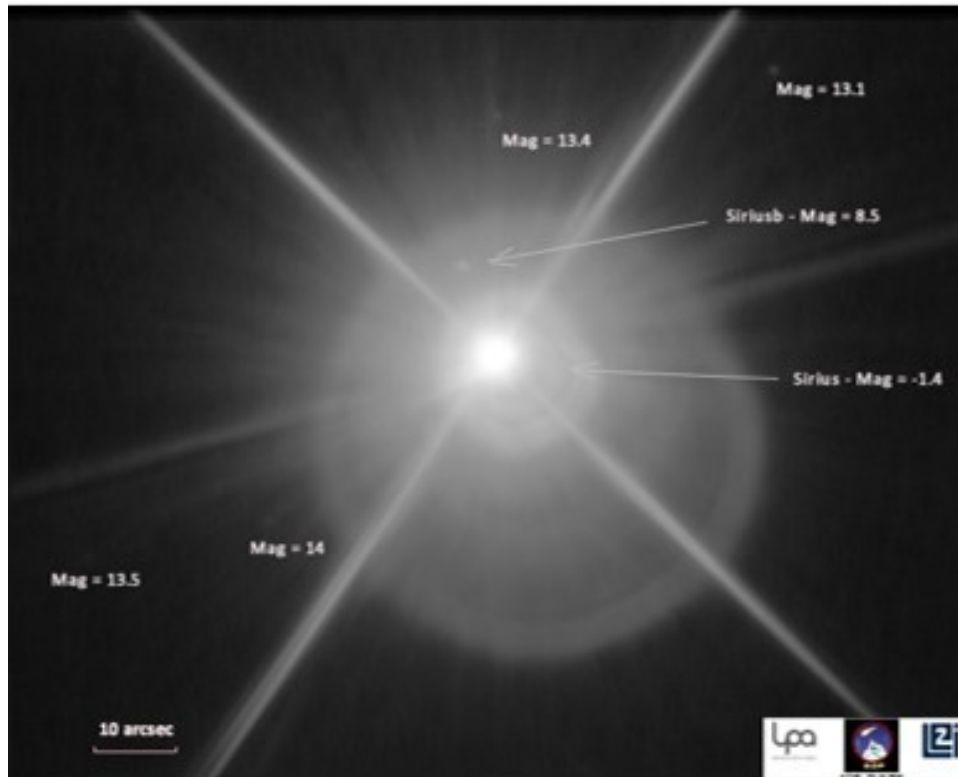


Jupiter and its moon Ganymede

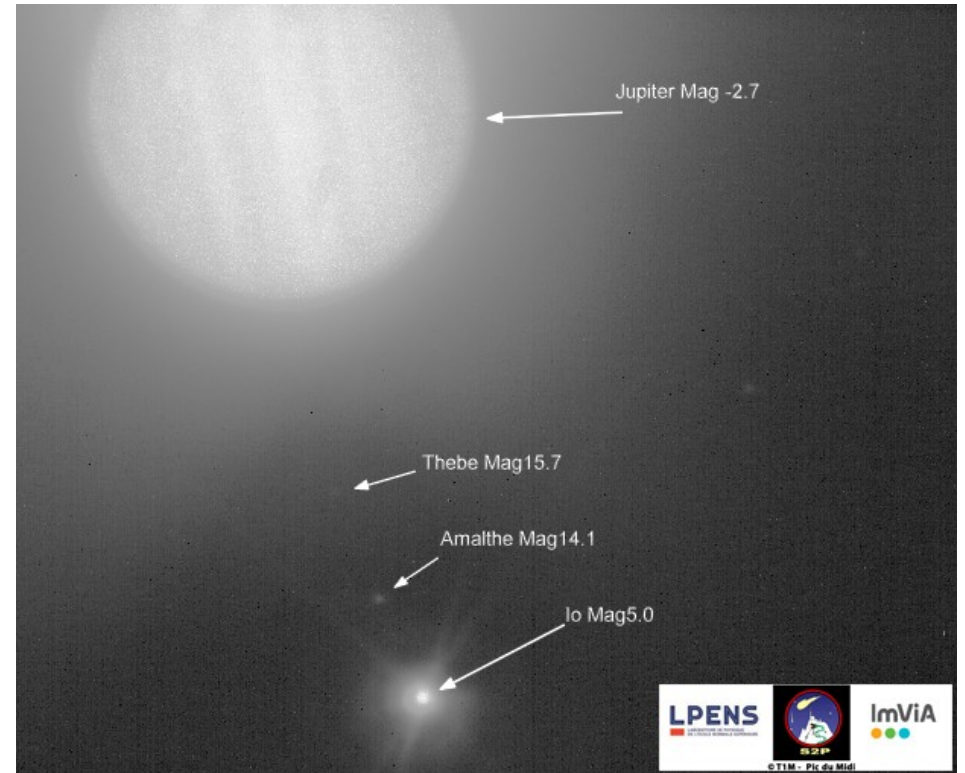
Linear mode, medium pixel gain,
40 ms exposure time, J-band filter (2020)

SIRIS - Technology

Large dynamics with lin/log mode

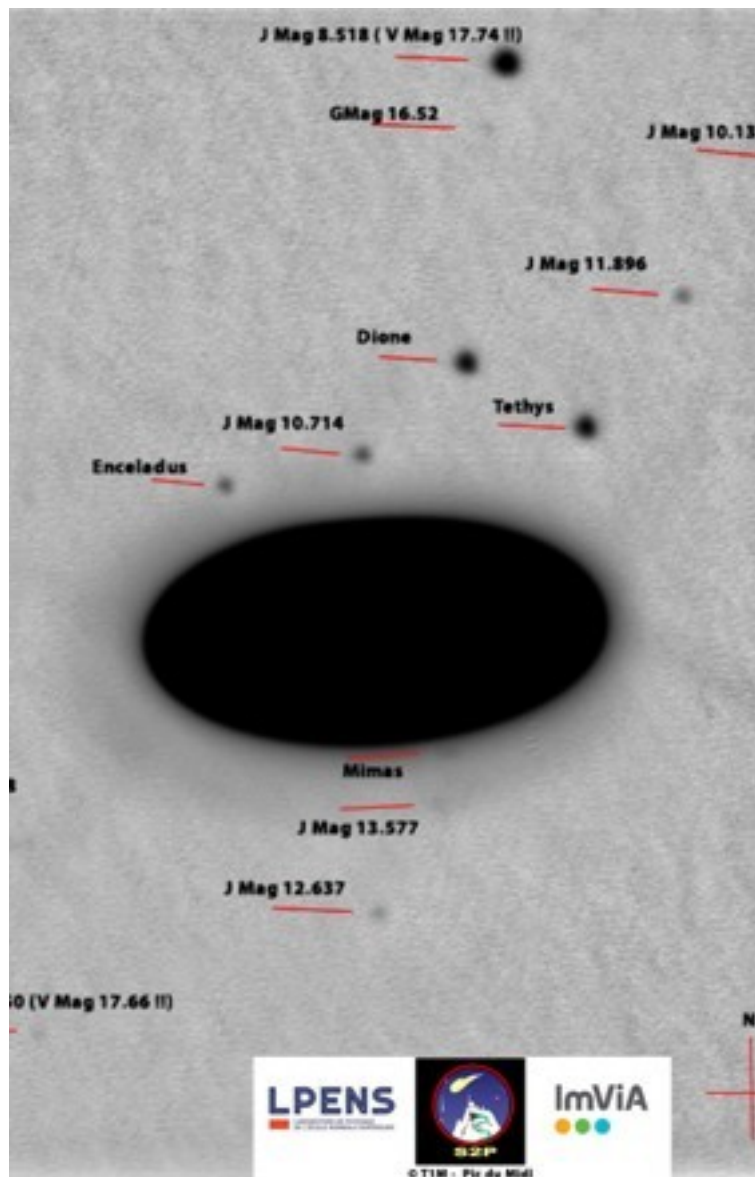


Sirius magnitude is equal to -1.4, Sirius B magnitude to 8.5 and the weakest star magnitude is equal to 13.5.



Jupiter is acquired in logarithmic pixel mode, while its moons in linear pixel mode, with 10 s integration time. Jupiter magnitude is -2.7 while Thebe's is 15,7 (July 2020)

SIRIS – Acquisition modes



LIN/LOG Sensor Mode

Saturn is acquired in logarithmic mode, while the closest stars in linear mode. In order to visualize the low-brightness stars, the grayscale has been inverted.

SIRIS – Acquisition Modes

Non destructive Read-Out Mode (NDRO)

- Via the sensor controller
- Allows a fast sampling of a long exposure time acquisition (200 fps full-frame)

ex : For a 1s acquisition, 200 intermediate NDRO frames

- Allows real time processing during a long acquisition.

SIRIS – Non Destructive Readout



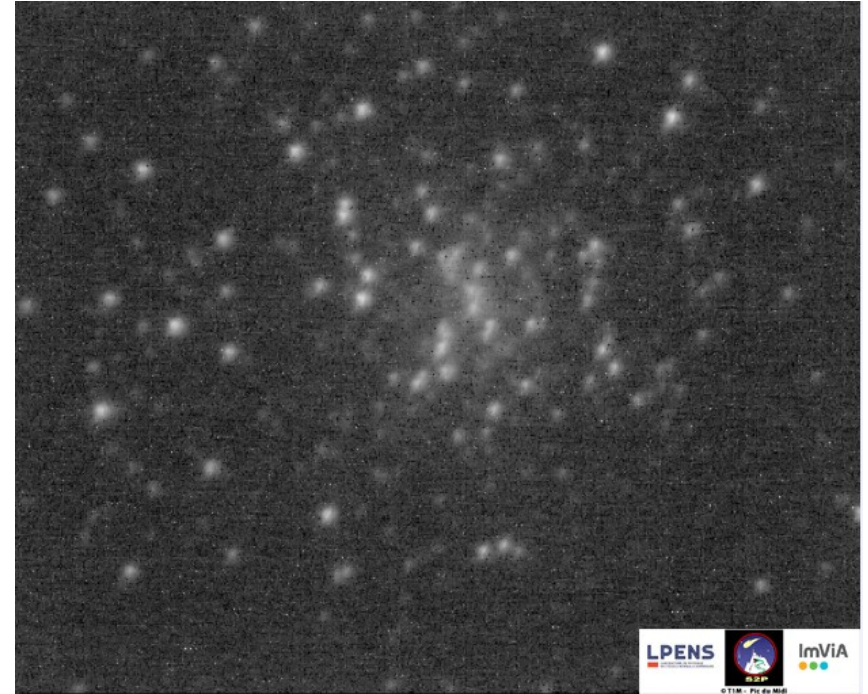
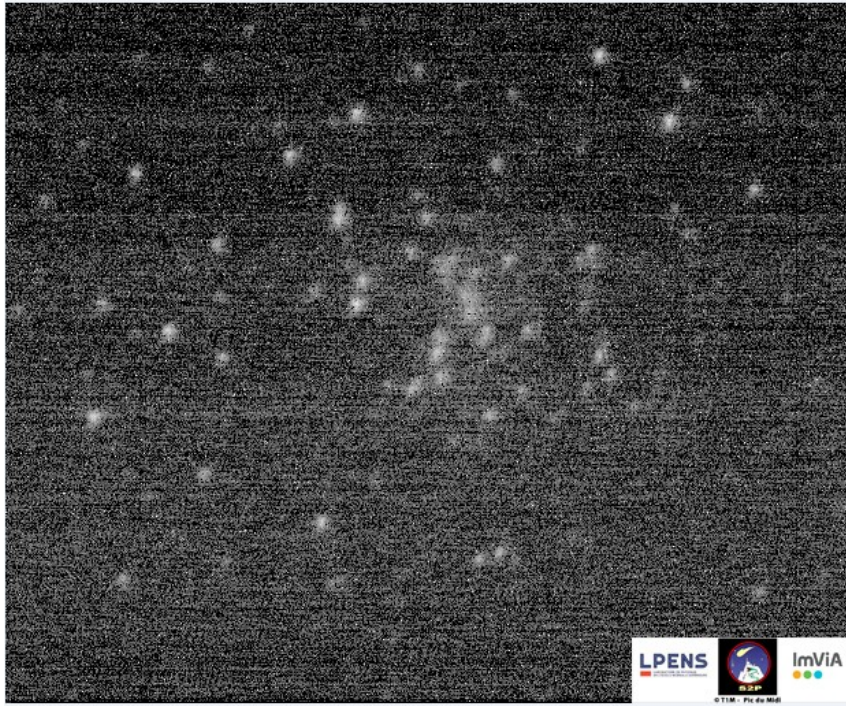
SIRIS – Image Processings

Processings with Non-Destructive Read-Out mode

- High Dynamic Range
- Noise reduction
- In post-processing or Real Time

SIRIS – Image Processings

Messier 15 NDRO mode noise reduction

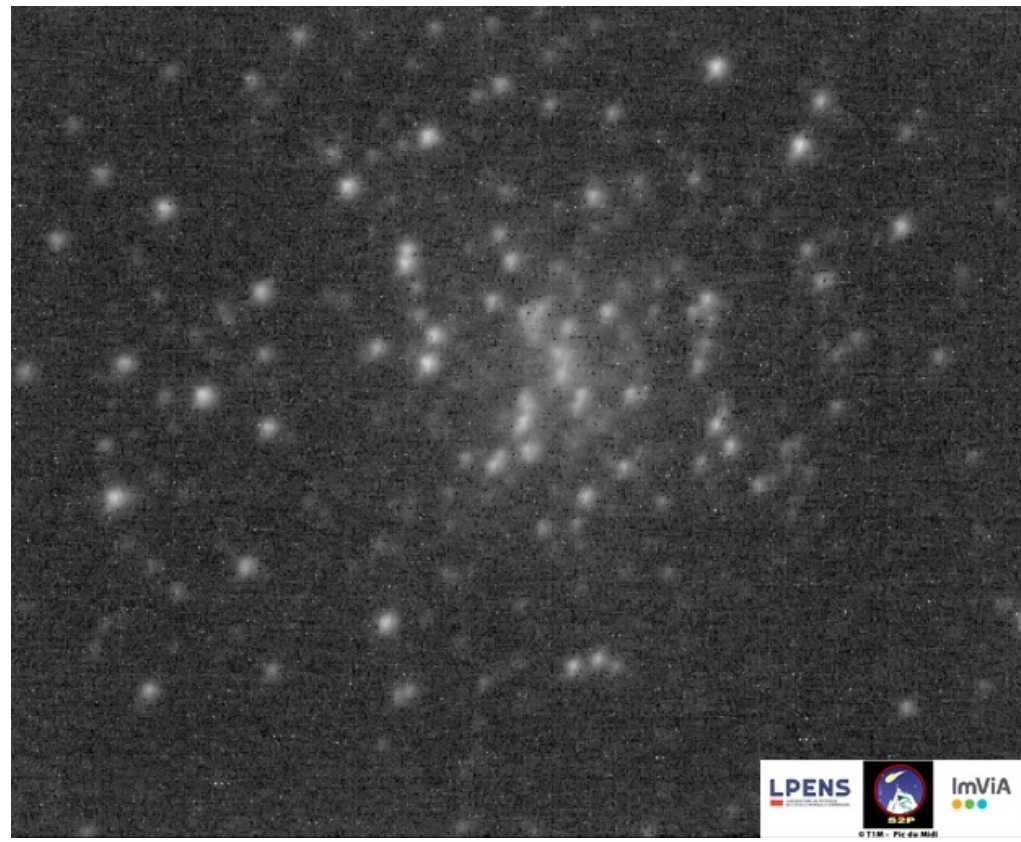
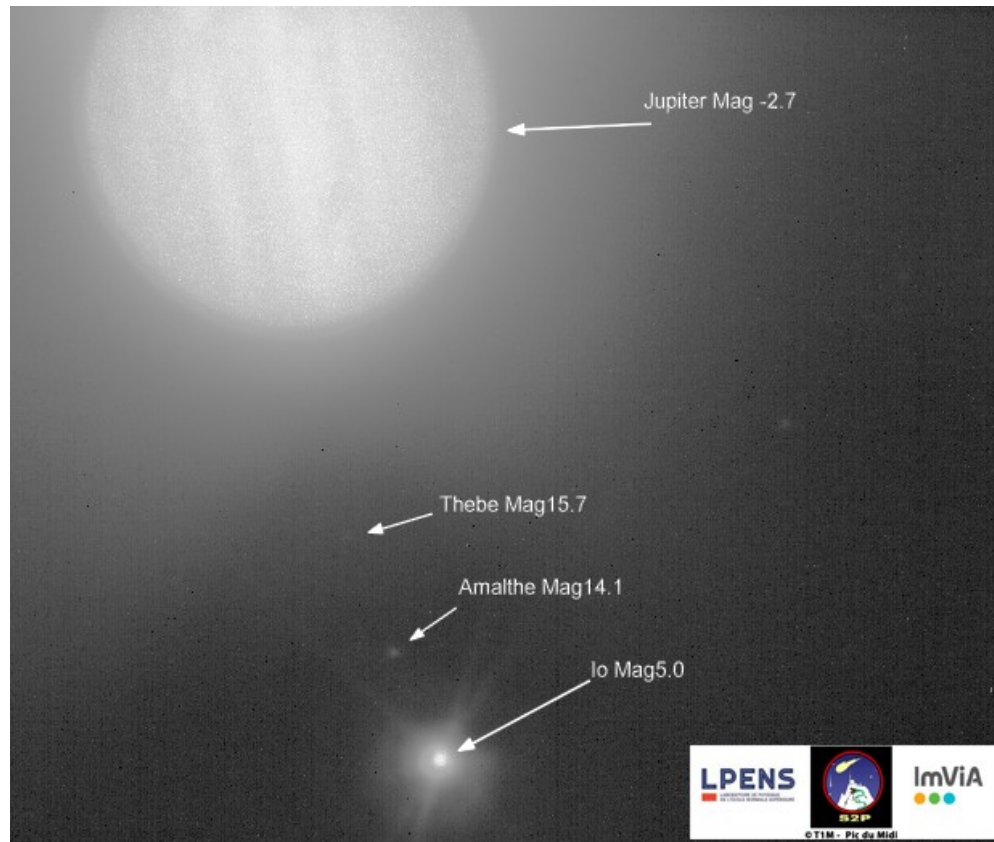


Here the same acquisition (1 s exposure time, J-band filter) of Messier 15 (M15), a globular cluster in the constellation Pegasus. The NDRO mode decreases the noise and allows to detect signals 6 times less bright.

SIRIS – Future Works

- Improve the current image processings (HDR and noise reduction)
- New sensor hybridation for 2,5 μm imaging
- One sensor Adaptive Optics (Analysis of the atmospheric turbulence directly with the image acquisition sensor, in fast acquisitions or with NDRO mode)
- Remove satellites during acquisition ?

SIRIS – Future Works



Depending on the number and the dimensions of bright enough objects that can be seen at 200 fps (full frame), we can consider analysing the local atmospheric turbulence in the entire observed field, for adaptive optics solutions.

SIRIS – Adaptive Optics

