

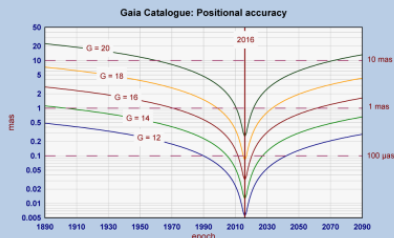
# New Astronomical Reduction of Old Observations with the GAIA reference catalogue (NAROO project)

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## Interest for old observations

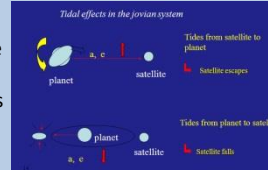
Old observations are interesting for modelling transient events or periodic behavior (observable through astrometry for dynamics or through photometry for variable objects).



## Planetology: natural planetary satellites

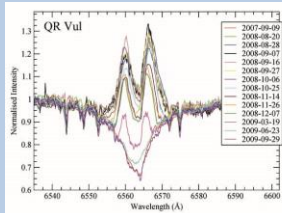


The interest of enlarging the time interval of the observation sets is to allow the quantification of tidal effects in their motion.



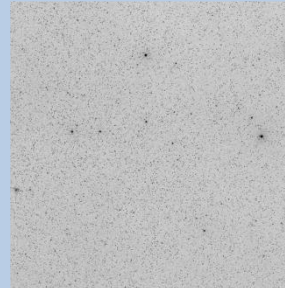
## Spectrometry

It will be possible to digitize the large collection of variable stars spectra (Be stars). The data baseBeSS, available at LESIA, provides a catalogue of all known (~2000) Be stars and owns (~130 000) available spectra of these objects. The study of the long-term spectroscopic variability of Be stars is very important to understand their sporadic ejection of matter. At the present time, the data start only in 1990 and the analysis of plates from 1950 to 1980 will enlarge the time series of data and will allow to detect a period in the ejections.



## Astrometry: asteroids and comets

- Schmidt plates contain lots of unknown objects detectable thanks to Gaia catalogue
- Old plates will allow pre-discoveries of TNO, comets and NEA/NEO
- A long time interval of observation of such objects will allow to quantify non-gravitational effects

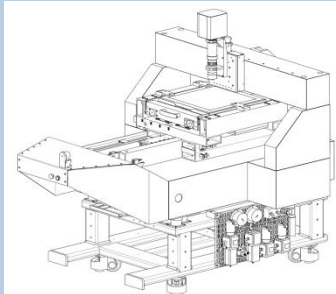


## Partnerships

- IMCCE, LESIA, GEPI (Paris observatory): for planetology and astrophysics
- IPSA (engineering school) for high precision metrology
- Observatory of Bordeaux owning astrometric plates
- OCA owning astrographic and Schmidt plates
- U.S. Naval Observatory (Washington DC, USA): a strong collaboration is still engaged and photographic plates have been scanned and reduced
- Royal Observatory of Belgium (Brussels, Belgium): the high accurate scanner "Damian" has been used for the first tests
- Queen Mary University of London owning Greenwich plates archive
- Bucarest Astronomical Institute (Bucharest, Romania): astrometric plates
- Shanghai Observatory (China): a series of photographic plates including natural planetary satellites are available

## The project

- A submicrometric scanning Machine is built in Meudon
- Scans of old plates will start in 2018 and will be available for scientific projects
- The web site naroo.imcce.fr will gather plate databases and digitized plates.



## Bibliographic references:

- Robert et al.: 2011, A new astrometric reduction of photographic plates using the DAMIAN digitizer : improving the dynamics of the Jovian system, MNRAS 415, 701
- J.-E. Arlot, J. Desmars, V. Lainey, V. Robert: 2012, The astrometry of the natural planetary satellites applied to their dynamics before and after Gaia, PSS 73, 66
- Robert et al.: 2012, Results from the analysis of Galilean satellites plates 1967-1998, A&A in press
- Robert et al.: 2015, First results on the reduction of old observations of the Martian satellites, A&A 582, A36, 8
- Robert, V.; Pascu, D.; Lainey, V.; Arlot, J.-E.; De Cuyper, J.-P.; Dehant, V.; Thuillot, W.: 2016, New astrometric measurement and reduction of USNO photographic observations of the main Saturnian satellites: 1974-1998, A&A 596, A37, 10
- Neiner, C.; de Batz, B.; Cochard, F.; Floquet, M.; Mekkas, A.; Desnoux, V.: 2011, The Be Star Spectra (BeSS) Database, AJ 142, 149