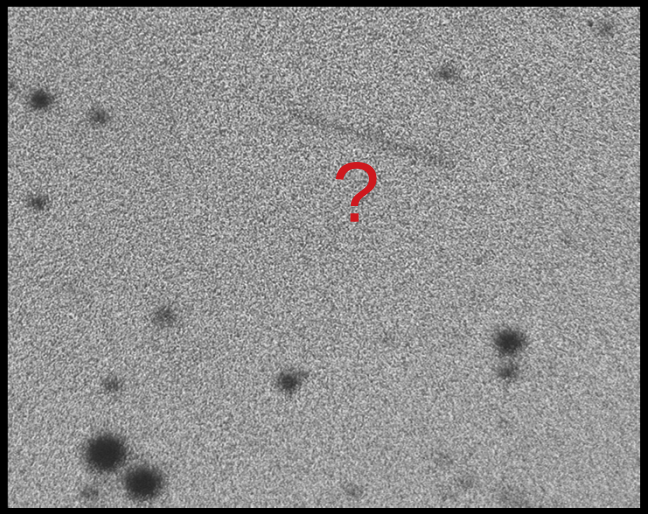
Photographic heritage and astrometric reduction



J. Guérard - SAF
V. Robert - IMCCE

Camille Flammarion

- Camille Flammarion observatory in Juvisy

1842-1925
Amateur / Professional astronomer !
Creator of the french astronomical society : SAF

Juvisy site
SAF property
Observatory code 285

- Zeiss refractor

D=240mm, F=3750mm
First light in 1885
Restored in 2011

Available for public observations

Old photographic plates

- 6000 plates from 1898 to 1947

Star fields, planets & satellites,
Comets, Sun & Moon

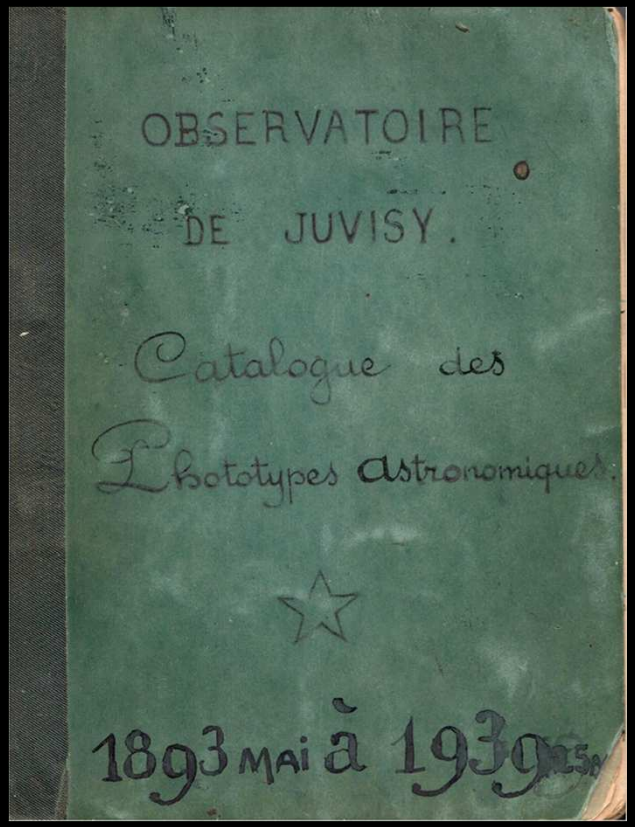
➡ Identify & Save this century-old heritage (mandatory)

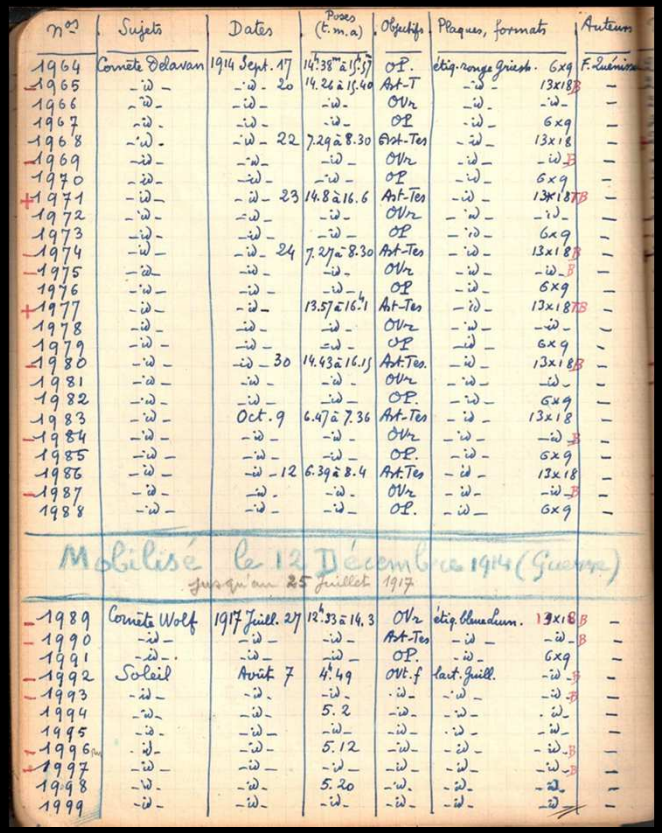
➡ Do science at the same time ?

(the answer is Yes !)

Data / meta-data

- Hand-written logbooks





Main astronomers :

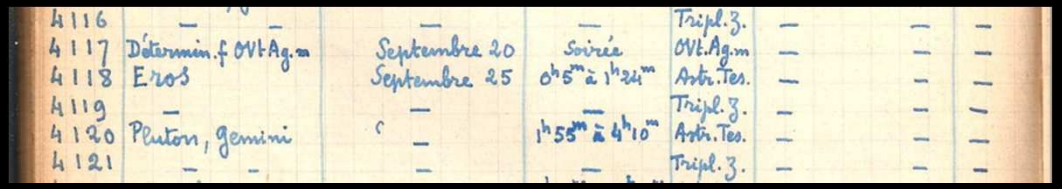
Eugène Antonialdi (from 1897 to 1901)

Ferdinand Quénisset (from 1893 to 1947)

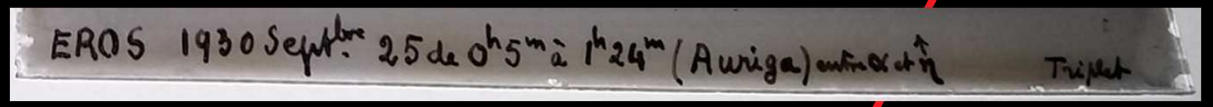
Modern use of big data → digital transcription

First step : logbook

logbook



Inscription on plates



check

Find the plate

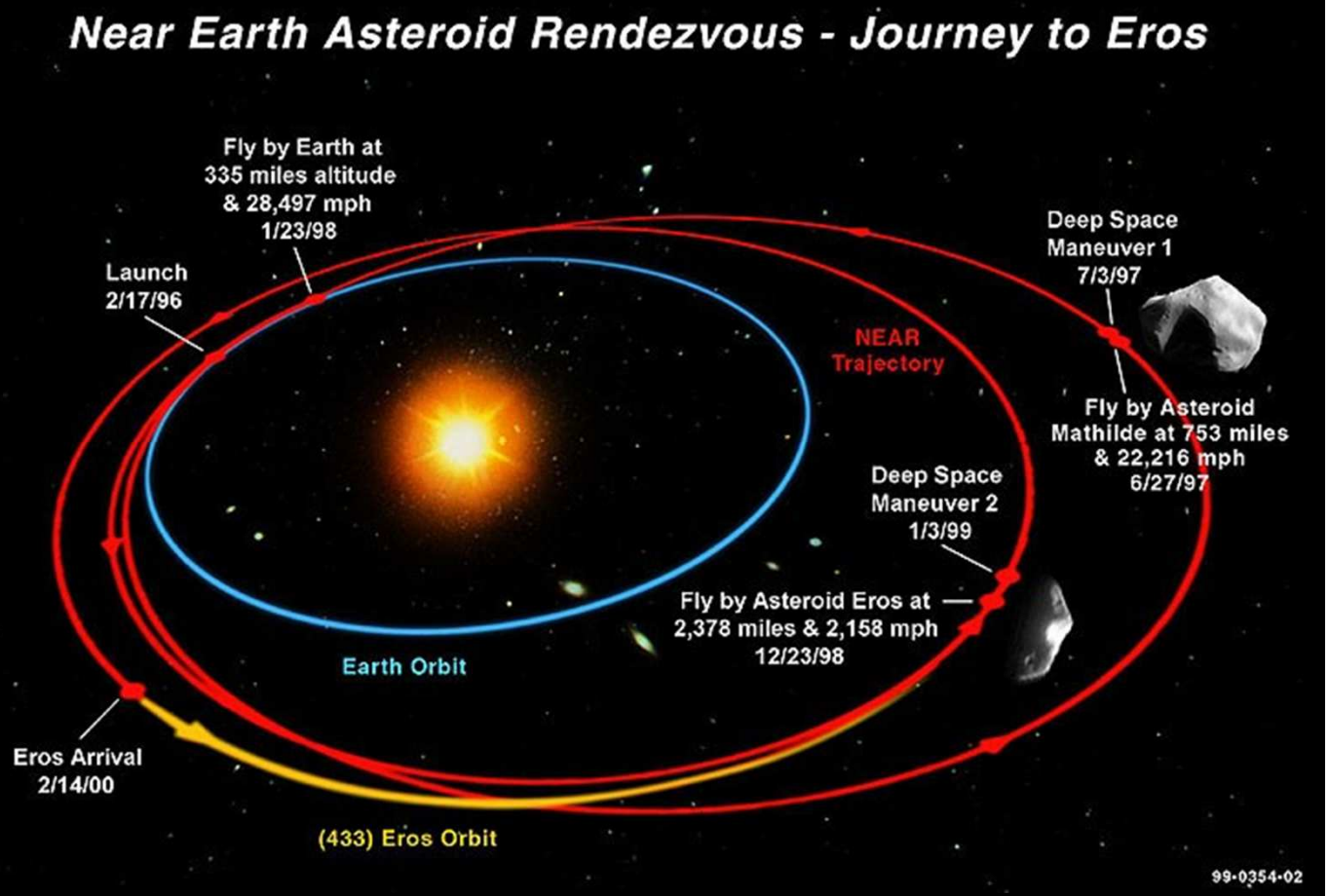
database

Plaque														Comment		Boîte				Champ (J2000)								
Carnet page	Carnet N	Sujet	Date	Heure	Pose	Objectif	Plaque	L	H	Auteur	Saisie ☺	Saisie date	Vérification ☺	Vérification date			n°	pos	Saisie ☺	Saisie date	Vérification ☺	Vérification date	AD h	AD m	AD s	DE h	DE m	DE s	Saisie ☺	Saisie date
	4117																												
	4118	Eros	25/09/1930	00:05	1:19	AT		13	18	Quénisset	JG	20/02/18					21		JG	20/06/18									
	4119	Eros	25/09/1930	00:05	1:19	TZ		13	18	Quénisset	JG	20/02/18					21		JG	20/06/18									

Example : Eros small asteroid

433 Eros
17 km long
Discovered in 1898
Near Earth Object
Mars crosser

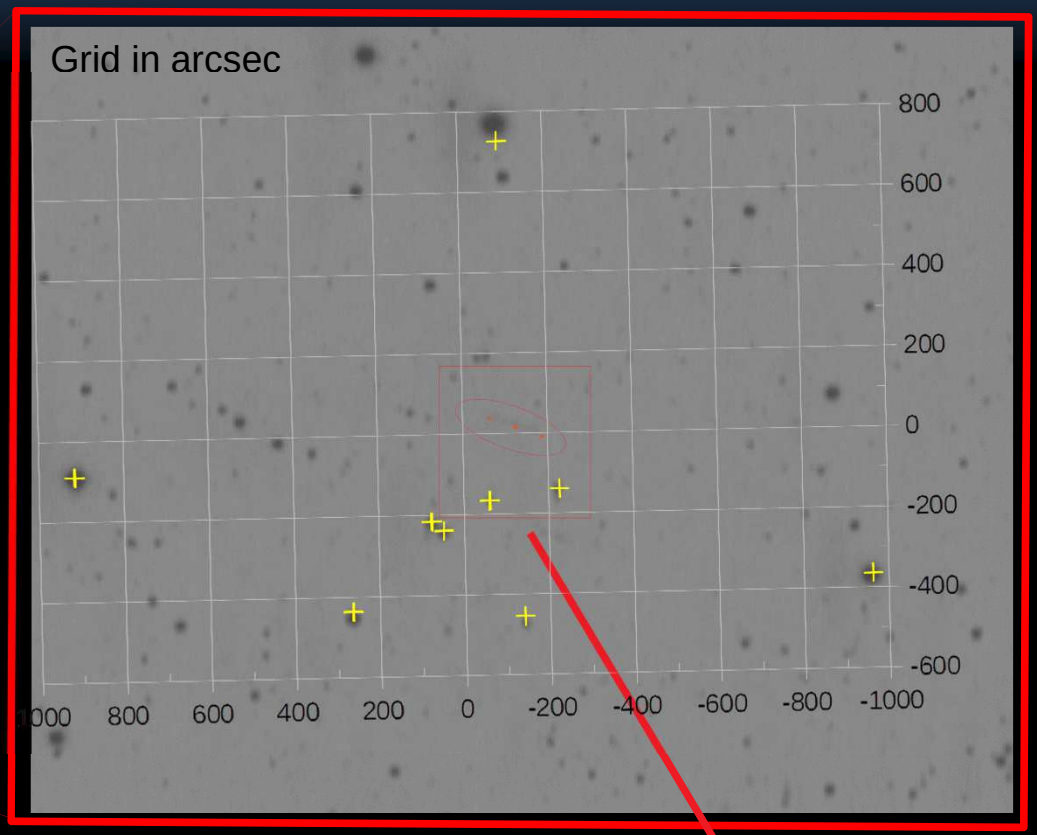
Used in 1930 to determine
the solar parallax



Eros has been visited in 2000
by the NEAR Shoemaker probe

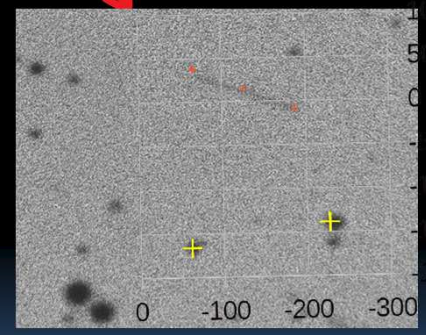
Preliminary scan

Raw plate



+ + + MPC* forecast
Start / middle / end of exposure

Eros position is accurate while the plate was not used as input to MPC



➡ Eros orbit computation is correct
➡ Juvisy plates and metadata are reliable

* https://www.minorplanetcenter.net/

Valuation of heritage

- Repackage the plates for the next century
  - Safer cover paper and box
- Logbook transcription
  - We need transcribers !
- Scan the plates
  - Looking for a worthy dedicated scanner
- Federate actions with other groups

NAROO project

- New Astrometric Reduction of Old Observations
  - IMCCE and partners

- XY air-bearing table by Microcontrol
- Granit base 1900mm x 1400mm (2 tons)
- 350mm x 350mm plate wide (5 minutes)
- Constraints by Heidenhein encoders to 1 nm
- Andor CMOS camera 5.5µm pixels

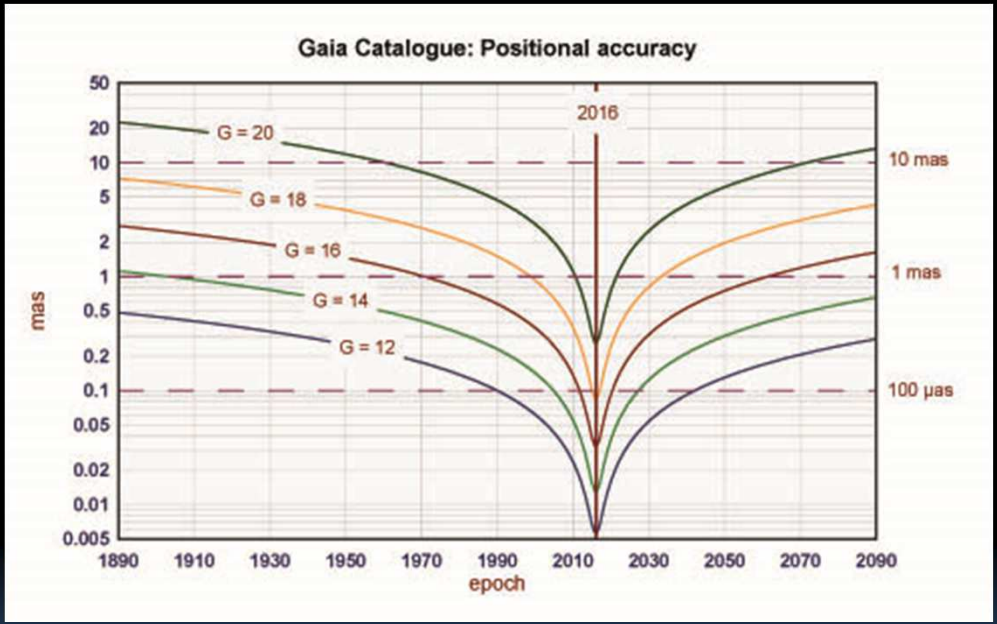
- 100m^2 of the Paris observatory in Meudon
- Rooms : computers, machine, archives
- Air-regulation to 20°C ± 0.1°C,
  50%RH ± 10%RH
- Overpressure for cleaning rooms

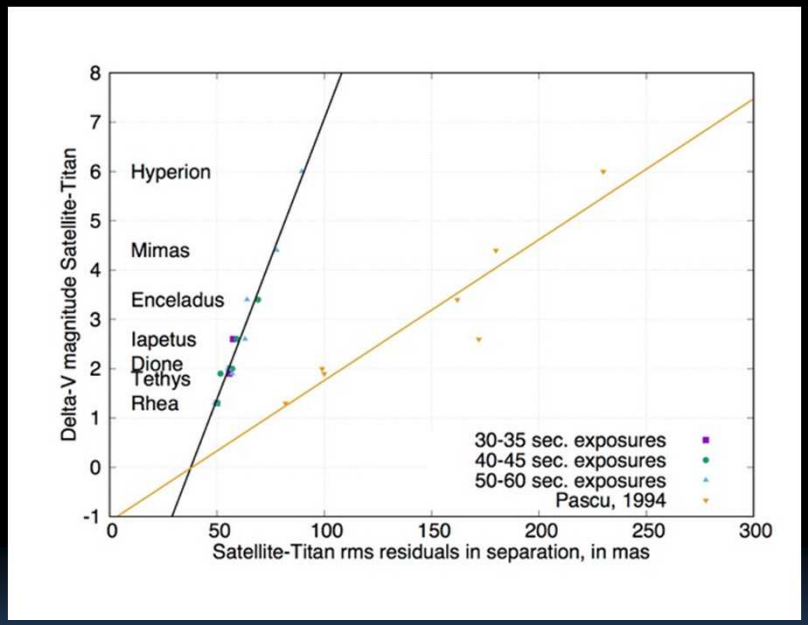
Scientific valuation

- Astrometry in the Solar Sytem
  - Asteroids
  - Comets
  - Planetary systems

➡ Pre-discovery of small bodies
(Find an object on an old plate before its discovery)

- Improving ephemerids and dynamical models





Scientific valuation

- Improving dynamical models
  - Long-term evolutions
  - Positioning for space probes
  - Tides and dissipations
  - Internal elements
  - Formation scenarios