Astrometry and light curves with SUBARU telescope

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(1) SYRTE, Observatoire de Paris, FRANCE

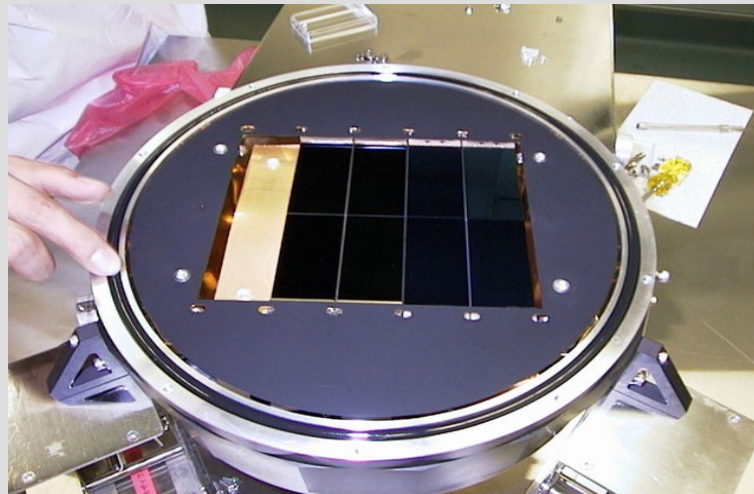(2) Mitaka National Astronomical Observatory (JAPAN)

(3) John Hopkins University (USA)

The Mauna Kea in Hawaii

SUBARU Telescope

- Built in 1998. It is one of the largest one mirror telescope in the world

- Made in Japan, located at Hawaii, Mauna Kea, 8.2 m.

- 10 CCDs in the Suprime Cam (use it) with 2k x 4k *px* each

- Field vision 34' x 27' with resolution 0,"202/pixel

  => each CCD 6.7 ' x 13.4 '

Supime Cam installation

Observational Program

- Two nights in Sept. 2002 (SMOKA Archive)

- 7 ½ hours sessions

- High frequency imaging in fixed ecliptic field

  - 1476 images R-band (first night)

  -    90 images B-band (first night)

- 120 s   exposures

- 137 images / CCD available

- ~ 18 images/hour/ccd

Scientific aims

- Study of asteroidal population

    (Main Belt, Trojan, Kuiper etc...)

- Light curves

    (Period, search of fast rotators)

- Asteroid size

- Taxonomic classification

- Data Mining (SkyBot)

- ~ 85 asteroids /CCD, some with sub-km size

MANY STEPS PROCEDURE

- Data recovery to SMOKA website (red and blue band)

- Astrometric correction % header with GSC2.3 (GBOT PIPELINE)

- Analysis of pictures and data recovery (about 137 images per CCD)

- Differential photometry % nearby star

- Blink with Aladin for asteroid motion
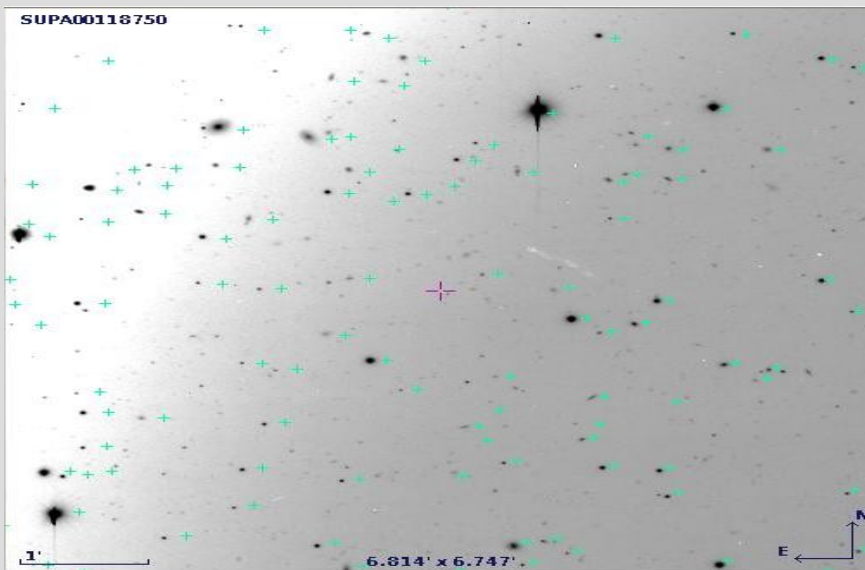
Lag with the Gsc 2,3 catalog
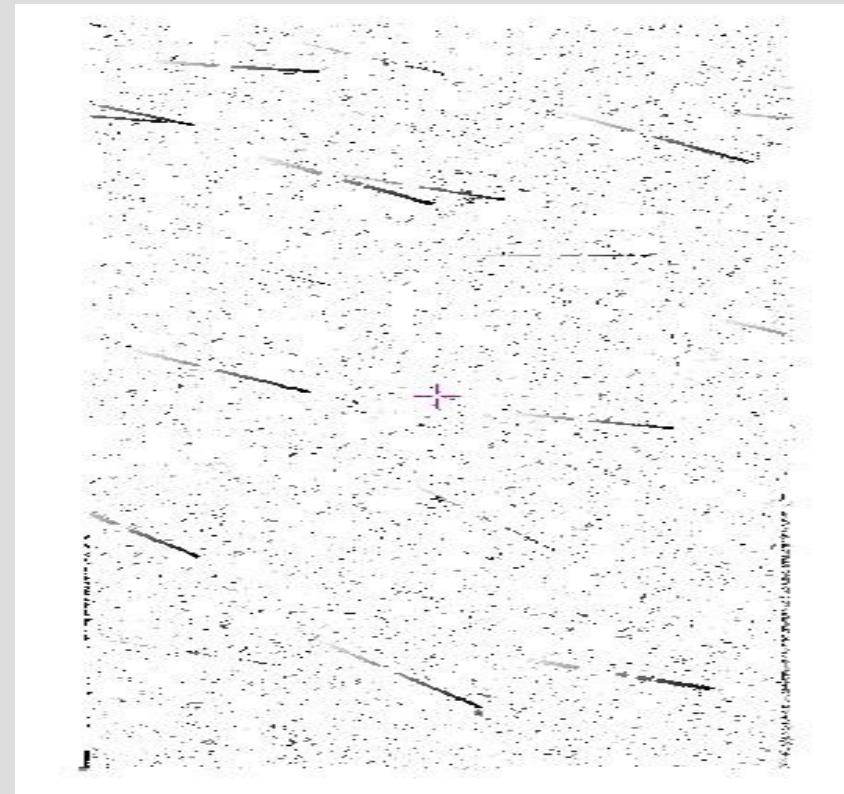
*Trails of asteroides during 55 minutes*

Application

- Get the flux, RA, DEC of the asteroid for each exposure

- Get the time into pictures header (MJD) 7,32 hours of time exposure

- Plot the light curve for magnitude variation

- Substract the star magnitude variation to get to good light curve

Light curve of 2001 JF84 asteroid (not known)
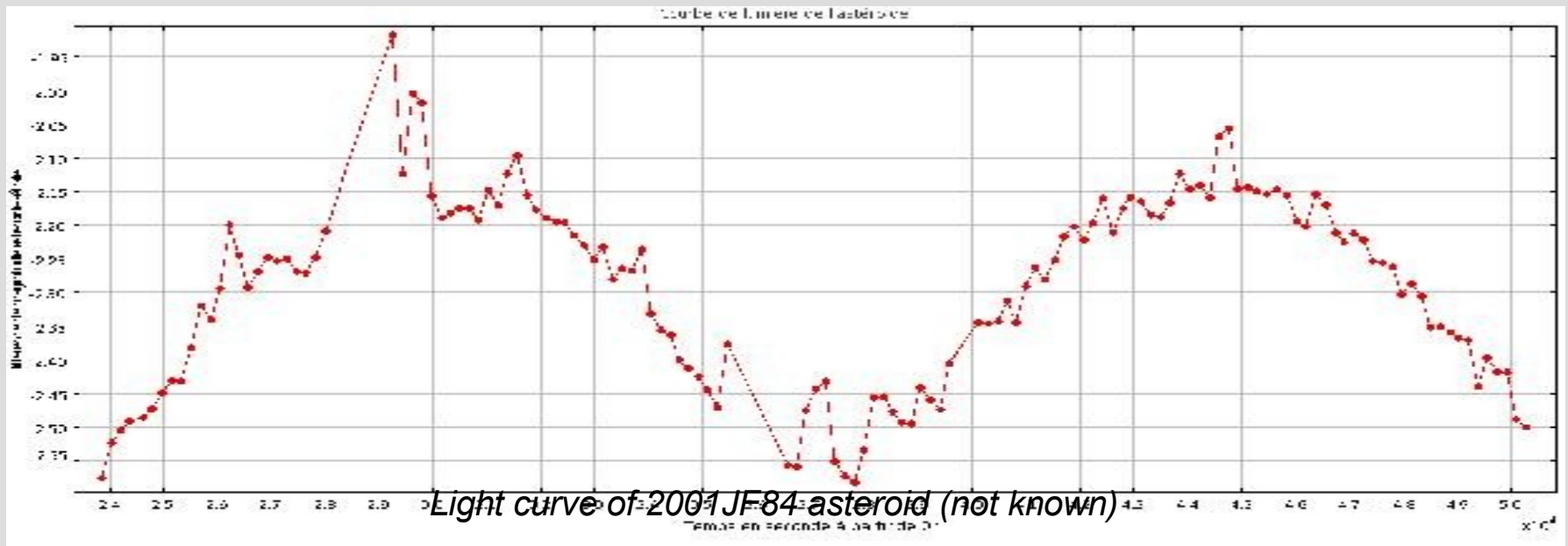
Asteroid data

- Find the period

- Find the ratio betwen semi major axis and semi minor axis of ellipsoid

- Go to Minor Planet Center to check if asteroid known

- Submit light curve and results
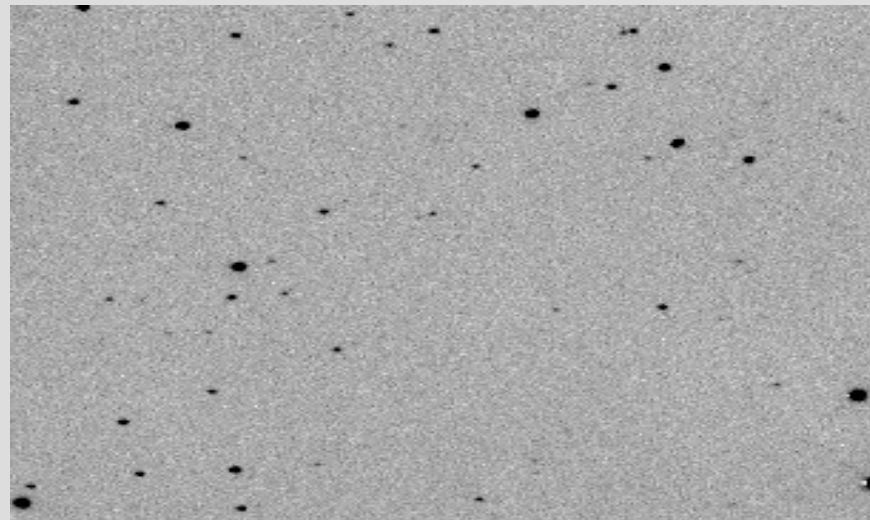
Examples of blink to find asteroids

Formulation for orbital elements

$$a = \frac{1}{2\gamma} \left(\gamma - 2k\lambda \pm \sqrt{|\kappa|} \right),$$
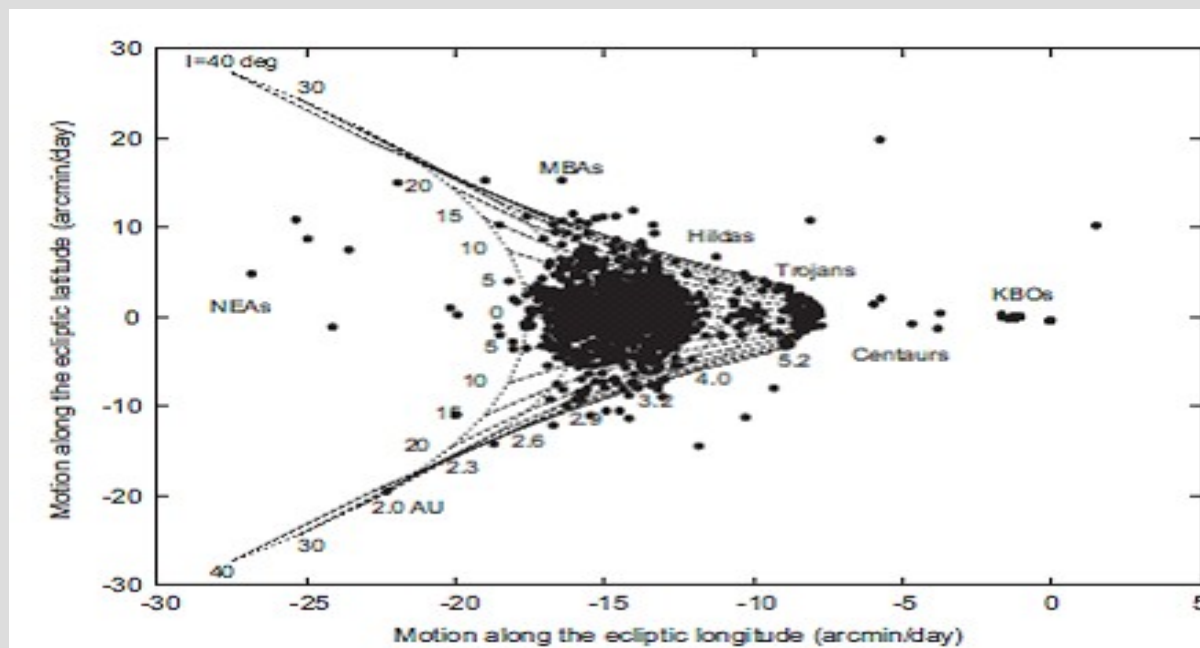
$$\tan I = \frac{|\beta|}{\lambda + k/(a-1)},$$

$$\gamma = \lambda^2 + \beta^2,$$

$$\kappa = \gamma^2 - 4k\lambda\gamma - 4k^2\beta^2,$$

Asteroid classification

- Recovery of a(UA) and i(°)

- Recovery of the latitude and longitude motions components with RA and DEC

- Determine the orbital classification of Asteroid

Yoshida & Nakamura (2007)