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## T3: finding comet in the asteroid population

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## Motivation

Several objects discovered as asteroids had cometary features:

2002 EX <sub>12</sub>	→	169P (NEAT)
2004 TU <sub>12</sub>	→	162P (Siding Spring)
2004 YJ <sub>35</sub>	→	C/2004 YJ <sub>35</sub> (LINEAR)
2005 JQ <sub>5</sub>	→	P/2005 JQ <sub>5</sub> (Catalina)
2005 YQ <sub>127</sub>	→	P/2005 YQ <sub>127</sub> (LINEAR)
2006 CK <sub>10</sub>	→	C/2006 CK <sub>10</sub> (Catalina)

**2004 TU<sub>12</sub>**

Near Earth Asteroid

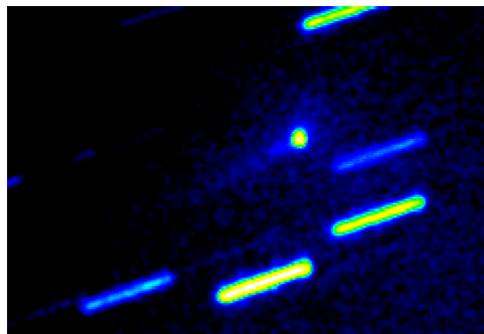
2004 Nov 12 (Masi et al., MPC I05)



**P/2002 EX<sub>12</sub> = 169P (NEAT)**

Near Earth Asteroid

2005 Aug 3 (Foglia, Galli, MPC 147)

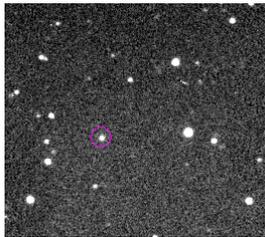


**2005 JQ<sub>5</sub>**

Near Earth Asteroid

2005 May 14

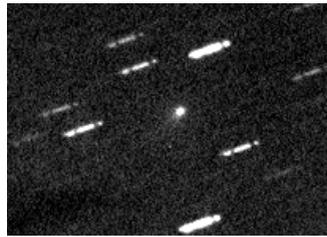
(Foglia, Galli, MPC 147)



**P/2005 JQ<sub>5</sub> (Catalina)**

2005 May 27

(Foglia, Galli, MPC 147)



**6C3D486 = 2006 CK<sub>10</sub>**

2006 Feb 4

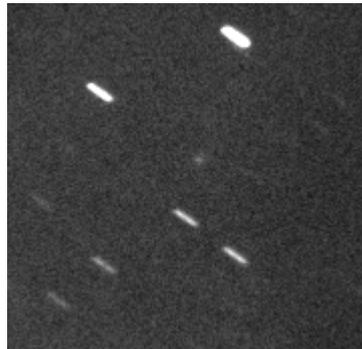
(Buzzi, MPC 204)



**C/2006 CK10 (Catalina)**

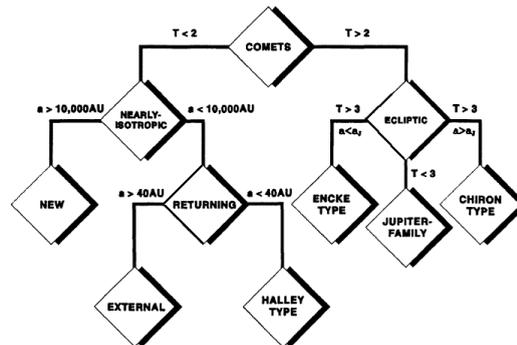
2006 Apr 7

(Foglia, Galli, MPC 147)



## Target Selection

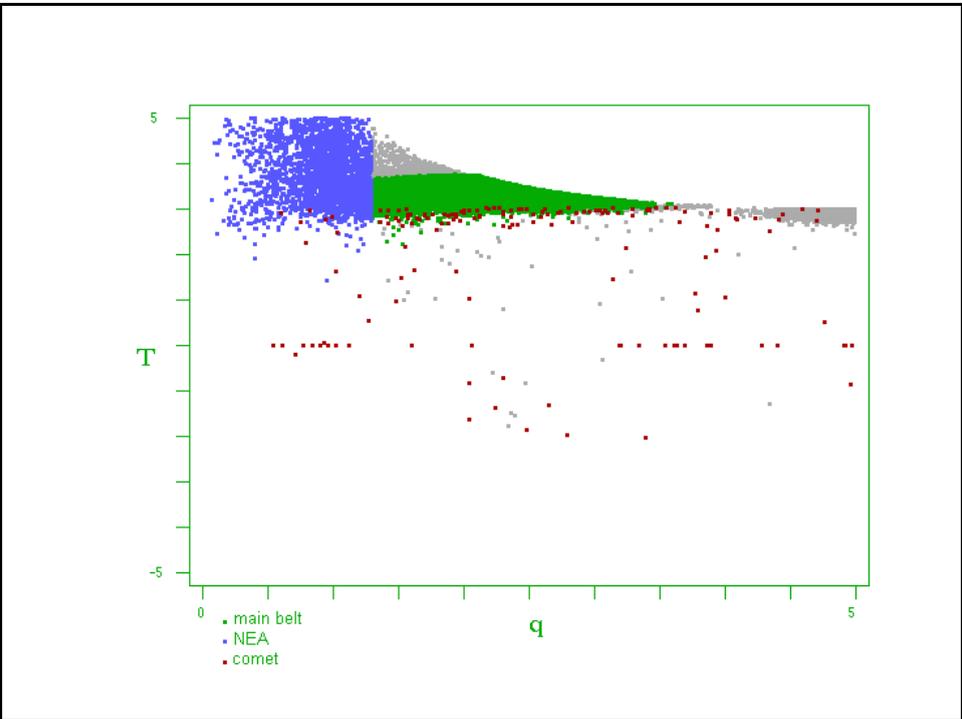
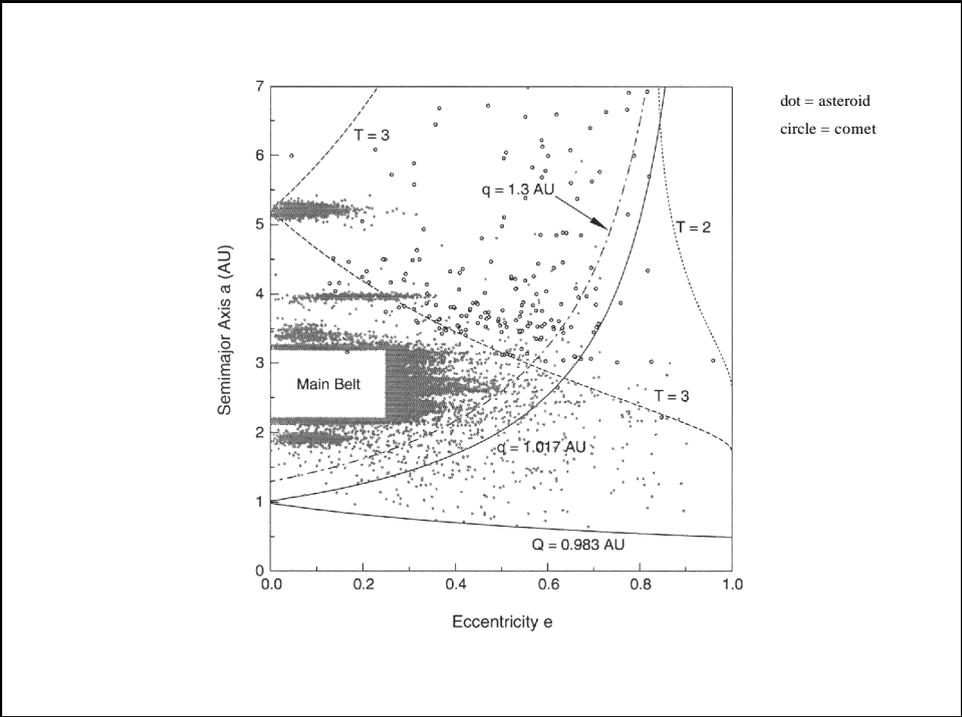
Levison's comet taxonomy is based on the Tisserand parameter respect to Jupiter (T)



T = Tisserand parameter respect to Jupiter

$$T = \frac{a_J}{a} + 2 \cdot \sqrt{\left(\frac{a}{a_J}\right) \cdot (1 - e^2)} \cdot \cos(i)$$

- a semi-major axis
- $a_J$  Jupiter's semi-major axis
- e eccentricity
- i inclination



Minor bodies with  $T < 3$  are under the Jupiter's gravitational influence and probably they should be cometary nuclei of the Jupiter Family Comet class.



T should be the discriminant parameter for target selections to find comets in the asteroid population.

## Observing Program

To find comets in the asteroid population we suggest an observing program called T3 (Tisserand 3) to observe all asteroids with  $T < 3$ .

Most of the surveys do not check their images to find the possible cometary feature of detected minor bodies that are usually classified as asteroids.

Further observations would be useful to confirm physically the dynamical behaviour of the minor body.

Frequently an e-mail message is sent to interested observers and it contains the observations opportunities with the following conditions:

magnitude limit 20.0

elongation from Sun  $\geq 45^\circ$

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Minor Planet   Design code  Tper   Tj Opp a   e   i   R.A.   Decl.   Delta r   Mag   Elong.
no name                yyyy mm dd                hh mm.mm dd pp.p   A.U. A.U.   V   °
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  944 Hidalgo    00944    0000 2005  1 21 2.07  16 5.749  0.660  42.6 12 50.53 + 6 21.7  3.277 4.244  16.9 162.6E
-
    2000 Dq110    K00Db0Q 0004 2005  12 20 2.20   2 3.356  0.631  58.3  9 12.88 +23 21.1  1.186 1.803  19.4 110.6E
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A computer program written by S. Foglia extract data from the MPCORB.DAT file of the Minor Planet Center.

L. Buzzi is the coordinator of the message alert and obtained results are distributed to observers.

## Observational's Technique

Whenever the cometary behaviour is not obvious, i.e. no tail and no coma are visible in the images, FWHM parameter of the target is compared to those of several stars with similar magnitude.

In order to have a secure SNR we usually obtain several images of the target that are added using the well known *Track & Stack* method of **Astrometrica** computer program.

To measure FWHM of the target a stacked image is obtained with the motion vector of the minor body, while to obtain FWHM of stars the same image is "restacked" using a 0.0" motion vector.

If a cometary behaviour is found, other observers will be advised as soon as possible in any way (phone or email), an independent confirmation is well acknowledged by Minor Planet Center.

It is good to obtain further confirmation by professionals and we've started outstanding collaborations with several astronomers.

## Obtained Results

Negative Observations

**(52872) Okyrhoe**

Positive Observations:

**2005 SB<sub>216</sub>**

If you are interested in the T3 observing program

please contact

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Web service will be available as soon as possible at the  
following URL:

**<http://asteroidi.uai.it/>**