Search for cometary activity in Centaurs of the OSSOS survey

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Abstract

The Centaurs are an intermediate population between Jupiter family comets and trans-Neptunian objects. They are of particular interest to understand the **physical origin of comets**. To date, **about 200 Centaurs have been detected** of which only 29 are active Centaurs with a cometary designation.
The Outer Solar System Origin Survey (OSSOS) observed a large sample of targets at large heliocentric distances, providing photometric and astrometric data (Bannister et al. 2016). **We estimate here the potential activity of objects discovered by the OSSOS survey up to 30 AU of heliocentric distance**.

The Sample

Release 8 of the OSSOS survey with R_{helio}<30 AU gives **390 photometric images**. This corresponds to a sample of **23 objects** including 9 Centaurs, 8 resonant objects, 5 scattered objects and 1 non-classified object.

Method

We developed routines to automatize the computation of the radial profile and the upper limits of the *Afρ* parameters in 5 steps. Below the example of *o3e01* observed the 8 february 2013.

DATA ANALYSIS

Step 1

We determine the centroid (X_c,Y_c) of the object with the standards IRAF functions.

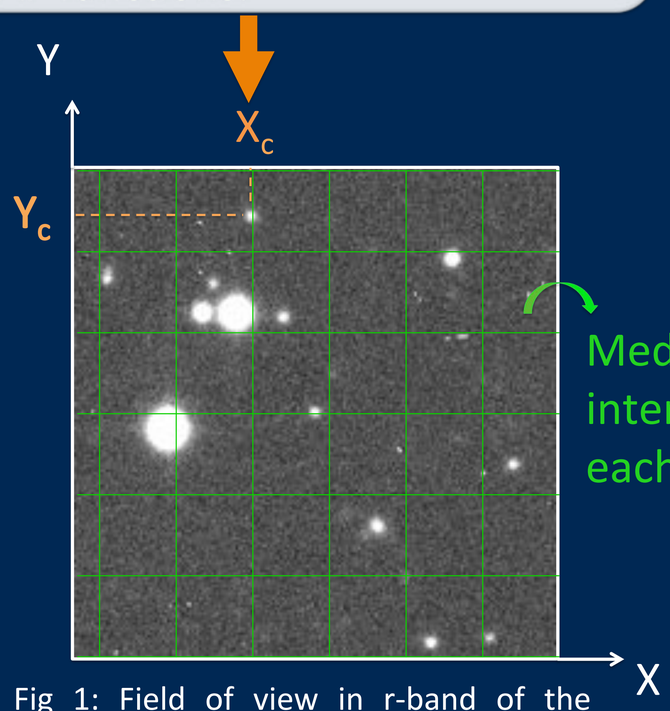

Fig 1: Field of view in r-band of the MegaPrime camera (0.90 deg^2) on the 3.6 m CFHT.

Step 2

To determine the sky noise we segment the image in squares of 30x30 pixels and compute the median of pixel intensities. The sky noise is then the minimum of medians.

Step 3

With the centroid (step 1) and the sky noise (step 2) we obtain the radial profile of the target (see Fig.2, green points). The psf is adjusted in in intensity to the maximum brightness of the targets.

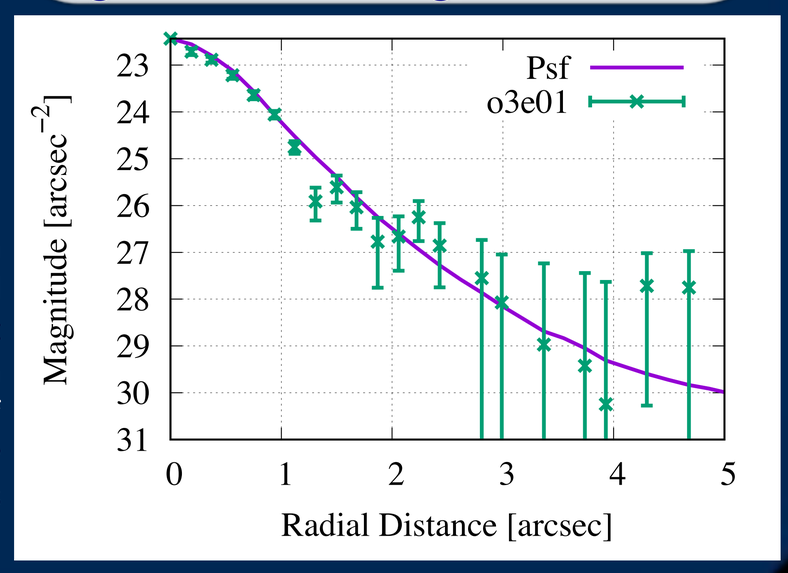

Fig 2: Magnitude as a function of the radial distance for the target (green points with errors bars) and the psf (mauve line). Any activity is found for this observation of *o3e01*.

OBJECT PROPERTIES

Step 4

From the coma flux estimation (F_{coma}=F_{target}-F_{psf}) we can determine the coma magnitude m_{coma} using the Pogson's formula. The coma magnitude is computed at 3 arcseconds.

Step 5

With the coma magnitude (step 4) we can compute the *Afρ(3")* parameter (Korsun et al. 2014) which gives an estimation of the cometary activity:

$$Af\rho = [2.4686 \times 10^{19} \times R_{helio}^2 \times R_{geo} \times 10^{0.4(m_\odot - m_{coma})}]/D$$

A = bond albedo
f = filling factor
ρ = linear radius of the field of view
R_{helio} = heliocentric distance
R_{geo} = geocentric distance
m_{coma}= magnitude of the coma
$m_\odot$= magnitude of the Sun
D=apparent diameter of the object

Results

Some upper limits of *Afρ* for *o3e01* (Table 1). All results will be avalaible in Cabral et al. (in prep).

	Object	R_{helio}(AU)	R_{geo}(AU)	$Af\rho_{max}$(cm)	q(AU)	a(AU)	e	mjd
1	o3e01	23.281	22.344	828	14.125	34.421	0.590	56386.42978
2	o3e01	23.281	22.344	1649	14.125	34.421	0.590	56386.47031
3	o3e01	23.281	22.344	1451	14.125	34.421	0.590	56386.51071
4	o3e01	23.279	22.335	792	14.125	34.421	0.590	56387.56945
5	o3e01	23.279	22.335	694	14.125	34.421	0.590	56387.57336
6	o3e01	23.279	22.335	629	14.125	34.421	0.590	56387.57724

Table 1: *Afρ* upper limits for *o3e01*. Parameters *q*, *a*, *e* and *mjd* are respectively the perihelion, the semi-major axis, the eccentricity and the modified julian date.

Conclusion

We could not find any active objects in the OSSOS sample. When including observations from literature, the ratio of active/ inactive Centaurs is about ~14%, indicating that the active Centaurs are not common.