

# **Mining NEAs and Asteroids in the CFHTLS**

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**Abstract: We are searching for the CFHTLS "candidate images" probable to hold detections of Near Earth Asteroids (NEAs), Potentially Hazardous Asteroids (PHAs), and other asteroids (numbered and un-numbered) available to date in the MPC databases. Both precovery and recovery apparitions are reported based on the MPC asteroids databases. To predict serendipitous detections, we query the SKYBOT server (IMCCE Paris) using a PHP script developed locally and the CFHTLS observing log database holding the progress of the three surveys.**

## **INTRODUCTION**

**There are almost 370,000 asteroids known today, and more than 4600 NEAs and 860 PHAs, and their numbers continue to increase rapidly. To secure and improve their orbits, astrometry derived from large surveys is welcomed. The wide field of MEGACAM and the CFHTLS prompted us for a search of the "image candidates" probable to hold NEAs, as well as other asteroids detections.**

**Additional to positions derived at epochs following an asteroid discovery ("recovery"), astrometry derived from detections previous to discovery ("precovery") could bring valuable information to secure and improve its orbit.**

## **MINING THE SKYBOT SERVER**

**Given an input consisting in a center and a field of view, an observing date and a place, one can use the SKYBOT server developed at IMCCE Paris to query all known asteroids probable to appear accidentally in the field.**

**Although SKYBOT reply is relatively fast (about 1 min for a field of 1x1 deg), about 20,000 CFHTLS would take close to 15 days to run! Fortunately, SKYBOT also accepts some parallel querying. It took us about three days to run all the 5600 fields available in the observing log of the Very Wide survey, running up to 5 parallel processes.**

## **CFHTLS OBSERVING LOGS**

**We used the CFHTLS observing logs available to date (Very Wide, Wide, and Deep) to query SKYBOT for the possible apparitions of known asteroids. The Very Wide component was our main interest in search for asteroids, based on which we will communicate our results to this meeting.**

## **THE "CHECKNEA.PHP" SCRIPT**

**We built a simple PHP script (300 lines of code) to mine any potential imaging archive. Previously to CFHTLS, we have used this script for the 10,000+ plates archive at the Astronomical Observatory in Bucharest, Romania.**

**We employed the MPC asteroids catalogues to extract their classifications in order to select between NEAs, PHAs, numbered and unnumbered, also to extract the discovery dates to report precoveries and recoveries. These figures can be used for future statistics, also to prioritize future possible data analyse. The script will be improved soon to include a magnitude limit, based on exposure time, filter, air mass, and observing conditions.**

## **FIRST RESULTS**

**Based solely on positions and some (2 months) old MPC asteroids database, we obtained for the Very Wide Survey the following numbers of candidate images:**

<b>Asteroid/Epoch</b>	<b>Nr of candidate images (~5600 searched fields)</b>	<b>% of Total</b>
<b>NEAs Precoveries</b>	<b>124</b>	<b>2</b>
<b>NEAs Recoveries</b>	<b>254</b>	<b>4</b>
<b>PHAs Precoveries</b>	<b>18</b>	<b>0.3</b>
<b>PHAs Recoveries</b>	<b>62</b>	<b>1</b>
<b>NUMBERED Precoveries</b>	<b>527</b>	<b>9</b>
<b>NUMBERED Recoveries</b>	<b>50997</b>	<b>9 per field</b>
<b>UNNUMBERED</b>	<b>70370</b>	<b>12 per field</b>

## **CONCLUSIONS**

**Serendipitous detections of known NEAs and other asteroids can be derived in the CFHTLS, giving the high capabilities of the MEGACAM/CFHT and our CHECKNEA script querying the SKYBOT server. Based on the CFHTLS Very Wide component (Apr 2007) with no magnitude filtering, we derived the following:**

- **Close to 20 PHA precoveries and other 60 PHA recoveries are expected;**
- **Close to 125 NEA precoveries (2%) and more than other 250 NEA recoveries (4%) are suspected;**
- **About 9% of the fields are probable to hold more than 500 numbered asteroid precoveries, while 9 numbered asteroids are expected to be recovered in every field, along with other 12 unnumbered asteroids!**

**The script will be refined soon to include some filters on limiting magnitude, proper motions, observing filter, sky conditions, and errors in positions. Output logs including the CFHTLS candidate images and the candidate asteroids will be provided later, updated based on the updated MPC asteroids database and the CFHTLS progress.**

**Identifying the objects and measuring the positions is a task which needs to be prioritized for the future. Obviously, the 80 PHAs and 375 NEAs are the most interesting circumstances, while for the rest, precoveries are more interesting.**