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# Search for dust trails associated with NEOs in WISE data

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## Abstract

We present the preliminary results of our search for debris trails along the orbit of NEOs, using the thermal-IR images collected in 2010 by the WISE mission. We will focus in particular on a subset of NEOs that are known or suspected to be related with meteor showers.

## 1. Introduction

In 1983 the IRAS satellite obtained the first direct detection of debris streams along the orbit of Solar System objects, when it observed very elongated regions of infrared emission along the orbit of at least eight different periodic comets [2, 3]. A handful of other trails were detected, but they could not be associated with any progenitor known at the time. It is possible to hypothesize that some of these trails were of asteroidal origin.

During its nominal 10 month mission in 2010 the NASA infrared space telescope WISE obtained multiple images of the entire sky in two thermal wavelengths (centered around 12 $\mu$m and 22 $\mu$m), with a sensitivity about 500 times greater than IRAS. It is possible that a large number of debris trails could be visible in those images, and at least some of them could be located along the orbit of asteroidal objects; if found, they will give us extremely interesting view of the process that leads to the formation of asteroidal meteoroid streams, and a direct comparison with the more usual streams of cometary origin.

## 2. The targets

Since the main goal of this search is to possibly cast some light on the existence and nature of meteoroid streams of asteroidal origin, the search mostly focuses on NEOs that are proposed to be related with meteor showers observed on the ground. As a starting point, we are using an updated version the list of possible stream-parent associations we proposed at the $42^{nd}$ DPS meeting in Pasadena, CA [1], that includes about 60 possible associations.

## 3. The search

The search effort focuses mostly on the two long-wavelength bands obtained by WISE, named Band 3 and 4 and centered around 12 $\mu$m and 22 $\mu$m. Both bands are located around the peak of the expected thermal emission of an object in the inner solar system, making the dataset perfect for this type of searches. The all-sky coverage of the mission also allows us to detect possible trails at any longitude along the orbit of the object.

### 3.1. Around the object

The first location to inspect in a search for a debris trail is the immediate vicinity of the object itself, where the density of the released material is expected to be maximum (in particular for recent ejection events).

The WISE mission directly detected about 25% of the asteroidal objects in our list, in some cases with very good SNR. We extracted all the Band 3 and 4 images containing the detected objects, and inspected each one looking for extended trail-like structures along the direction of the orbital plane. No trail was detected, but in most cases this portion of the trail was not placed at the optimal geometry (it was far from the Earth, or from the Sun), reducing the expected signal.

As an additional note, one of the best candidate in our association list, 2010 QA5, was discovered in August 2010 by the WISE itself. With a Tisserand parameter $T_J = 2.75$ and an aphelion distance around Jupiter's orbit, this object is likely an extinct nucleus of a Jupiter-family comet. However, a careful inspection of the WISE images, and of deep optical images obtained from the ground, showed no sign of activity

or debris trails around the portion of its orbit close to the object.

### 3.2. Along the orbit

The second part of the search is to look for an extended structure (or a portion of it) along the full 360° of longitude along the object's orbit. This should allow us to detect trails that are dispersed along the entire orbit (such as the cometary trail of 10P/Tempel already observed by IRAS and WISE), but also fainter trails, that are either present only at a specific longitude range, or too faint to be detectable around the entire orbit.

For each object, we used the most up to date orbital elements (often improved with our own ground-based astrometry of the parent) to locate the fields where a section of the orbital plane was imaged by WISE. Each field is then visually inspected, looking for trail-like structures matching in position and direction with what is expected for the object.

At the time of this abstract the search is still ongoing. We will present our results, together with any possible detection, during the meeting.

## 4. Summary and Conclusions

The WISE mission, with its unrivaled deep all-sky survey images, is the perfect tool to search for debris trails along the orbit of asteroidal objects, at the wavelength of their thermal emission. A detection of some of these trails will reveal very interesting information on the extension and spatial densities of the structures, that can be integrated with ground-based information obtained from meteor showers to cast some light on the formation processes of asteroidal meteoroid streams.


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