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TNOs are Cool: A Survey of the Transneptunian Region - Physical Characterization of 16 Plutinos using PACS observations

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Abstract

We present the physical characterization of a set of 16 Plutinos, which were observed by the PACS instrument onboard Herschel. The characterization was performed using a thermal model and results in diameter and albedo estimations including uncertainties. We discuss our results and compare them to other TNO subpopulations.

1. Introduction

Since the discovery of the first Transneptunian Objects (TNOs), a number of different dynamical classes of this primordial population have been identified. One of these classes, the Plutinos, is named after their most prominent member and populates the 2:3 resonance of Neptune. Despite the fact that some of the orbits of Plutinos are highly eccentric and can even overlap with that of Neptune, they represent the most densely populated, stable and therefore oldest populations among resonant TNOs [1]. Their origin was first explained by [2], showing that a radial outward movement of Neptune led to resonance capture. Escaping Plutinos can populate the Centaur region and even be a source of Jupiter Family Comets [3].

2 Data & Methods

Observations were performed using the PACS instrument [4] as part of the Herschel Open Time Key Programme 'TNOs are Cool!' [5]. This project was awarded some 370 h of Herschel observing time for the investigation of about 140 TNOs with known orbits. The goal is to characterize individual objects and the full sample using radiometric techniques, in order to probe formation and evolution processes in the Solar System and to establish a benchmark for understanding the Solar System debris disk.

The Plutino sample was selected solely on the basis of its Herschel observability, and covers a wide range of dynamical properties in the Plutino population; it therefore serves as a probe for the whole population. The sample includes prominent targets like Pluto and Huya. The complete list of targets is given in Table 1.

Table 1: Plutino Sample

Pluto	Huya	2000 GN171
2001 KD77	2001 QF298	2002 VU130
2002 XV93	2003 UT292	2004 EW95
1996 TP66	1999 TC36	2002 VR128
2002 VE95	2003 AZ84	2003 VS2
2006 HJ123		

In order to derive estimates of diameter and albedo, an asteroid thermal model (Near-Earth Asteroid Thermal Model, NEATM, [6]) was applied, which was tested and verified in [7]. Uncertainties in both diameter and albedo were estimated by applying a detailed Monte-Carlo analysis. The Monte-Carlo routine makes use of a method to rescale flux uncertainties and returns asymmetric uncertainty estimates, both leading to a more realistic error estimation.

3 Preliminary Results and Discussion

As of writing this abstract, only preliminary data were available. Preliminary modeling results point to a population of intermediate sized objects with albedos ranging from 0.04 to 0.19. Pluto, being the exception, has a much larger diameter and higher albedo and is used as a test case to show the applicability of a simple thermal model to objects holding an atmosphere. Where available, results agree very well with existing diameter and albedo estimates (mostly [8]).
Correlations between orbital and physical parameters are analyzed. Figure 1 shows diameter and albedo estimates as a function of heliocentric distance, leading to the impression of more distanced objects being larger. However, this trend is probably the result of a selection bias preferring larger objects at higher distances.

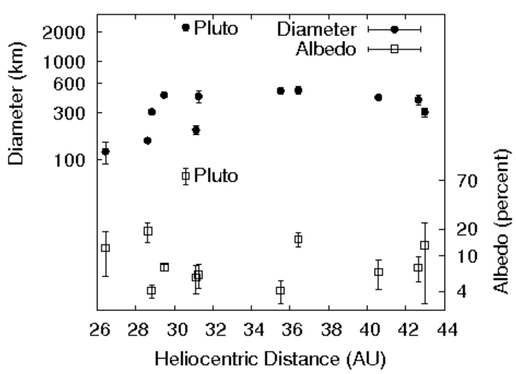

Figure 1: Preliminary diameter and albedo estimates as a function of heliocentric distance. A trend of increasing diameter with heliocentric distance seems obvious, but is probably due to a detection bias.

Final results will be presented at the meeting.

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