THERMAL EMISSION OF THE ERIS - DYSNOMIA SYSTEM AS OBSERVED BY HERSCHEL/PACS

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Introduction: (136199) Eris' size and V-band albedo has recently been constrained by occultation measurements [1] and showed that Eris is very similar to Pluto in size. However, Eris' surface is much brighter than Pluto's (Eris' geometric albedo is close to unity), likely caused by the ice formed of the methane atmosphere that collapsed to the surface. Eris is the most massive dwarf planet known in the Solar System and this mass is known from the orbital parameters of its moon, (136199) Eris I Dysnomia [2]. The moon has a surface that is likely notably darker than that of Eris, indicated by its high brightness difference between the visual and near-infrared wavelengths [2]. Accurate measurements of the thermal emission spectrum of the system can give an independent determination of the main physical properties of Eris: radiometric effective size, geometric albedo, thermal inertia, surface temperature, object orientation (pole-on vs. equator-on). The thermal emission of Dysnomia may also be disentangled from that of Eris, providing direct size and albedo values for the moon for the first time.

Observations: We observed Eris with the PACS camera of the Herschel Space Observatory [3,4] in the framework of the "TNOs are Cool!: A survey of the trans-Neptunian region" Open Time Key Program (PI: Thomas Müller [5]) and of the OT1 program "Probing the extremes of the outer Solar System: short-term variability of the largest, the densest and the most distant TNOs from PACS photometry" (PI: Esa Vilenius). The measurements were taken in the three PACS bands (central wavelengths of 70, 100 and 160μm) in the scan map mode and with a measurement configuration that allows for an optimal background elimination, taking the data of the same target at two epochs. Altogether we have observed Eris for 10.67, 9.56 and 20.23 hours in the 70, 100 and 160μm channels.

Data reduction and modeling: We used the "TNOs are Cool!" OTKP's optimized pipeline for the PACS data reduction (described in [6,7]). Our PACS fluxes obtained were supplemented by the fluxes of previous Spitzer Space Telescope [8] and IRAM [9] observations. We used both Standard Thermal Model (STM) and Near-Earth Asteroid Model (NEATM) technics, as well as a thermophysical model (TPM, see e.g. [10] for a summary) to determine the main characteristics of Eris.

Results: We will present our derived radiometric size and albedo and compare them with the occultation derived values. We will discuss the influence of Dysnomia in our system-integrated thermal data and constrain its size and albedo. With the thermal spectrum from 24 to 1200 μm we will also investigate the thermal inertia of the surface material for the first time. The spectral shape is indicative of the object's orientation as well and allow us to decide on the pole-on or equator-on configurations. Our results will also include the 8.3 hour Herschel observations taken in February 2012.

References: [1] Sicardy et al., 2011, Nature, 478, 493 [2] Brown, M.E. & Schaller, E., Science, 316, 1585 [3] Pilbratt, G., et al., 2010, A&A, 518, L1 [4] Poglitsch, A., et al., 2010, A&A, 518, L2 [5] Müller, T.G., et al., 2009, EM&P, 105, 209 [6] Mommert, M., et al., 2012, A&A, accepted [7] Santos-Sanz, P., et al., 2012, A&A, accepted [8] Stansberry, J., et al., 2008, The Solar System Beyond Neptune, Physical Properties of Kuiper Belt and Centaur Objects: Constraints from the Spitzer Space Telescope, p.161. [9] Bertoldi, F.F., et al., 2005, Nature, 439, 563 [10] Müller, T.G., et al., 2010, A&A, 518, L146

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