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Makemake's thermal emission reconsidered

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Abstract

Makemake, one of the officially recognised dwarf planets in the Kuiper belt, has a bright surface with a geometric albedo $\gtrsim 80\%$ as determined from occultation observations (Ortiz et al., 2012; Brown et al., 2013). Makemake's thermal emission was measured with various instruments, including the MIPS camera of the Spitzer Space Telescope, the PACS and SPIRE instruments of the Herschel Space Observatory and the submm emission with ALMA (Stansberry et al., 2008; Lim et al., 2010; Lellouch et al., 2017). According to these measurements the thermal emission cannot be fitted with a single body with a single terrain – the high 24 and 70μm flux densities requires the presence of a 'dark terrain', either on the surface of Makemake or on an external source (e.g. a dark satellite). However, even these dark terrains cannot fully explain the observed flux densities (see Lellouch et al., 2017).

Here we present a partial re-evaluation of previous Spitzer/MIPS and Herschel/PACS data using the latest calibration and data reduction pipeline, and also include so far unpublished Spitzer/MIPS 24/70 and Herschel/PACS 70, 100 and 160μm measurements. We model the thermal emission considering the rotation of Makemake (Hromakina et al., 2019), its possible shapes and spin axis orientations (Ortiz et al., 2012; Brown et al., 2013), mass (Parker et al., 2018), and possible contribution from known and suspected satellites (Parker et al., 2016; Hromakina et al., 2019). Our evaluation provides the most complete picture on the thermal emission of this dwarf planet.-

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