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Multi-Wavelength Modelling of the Beta Leo Debris Disc: 1, 2 or 3 planetesimal populations?

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In this paper we present a model of the Beta Leo debris disc, with an emphasis on modelling the resolved PACS images obtained as part of the Herschel key programme DEBRIS. We also present new SPIRE images of the disc at 250 microns, as well as new constraints on the disc from SCUBA-2, mid-IR and scattered light imaging. Combining all available observational constraints, we find three possible models for the Beta Leo (HD102647) debris disc: (i) A 2 component model, comprised of a hot component at 2 AU and a cold component from 15-70 AU. (ii) A 3 component model with hot dust at 2 AU, warm dust at 9 AU, and a cold component from 30-70 AU, is equally valid since the cold emission is not resolved within 30 AU. (iii) A somewhat less likely possibility is that the system consists of a single very eccentric planetesimal population, with pericentres at 2 AU and apocentres at 65 AU. Thus, despite the wealth of observational constraints significant ambiguities remain; deep mid-IR and scattered light imaging of the dust distribution within 30 AU seems the most promising method to resolve the degeneracy. We discuss the implications for the possible planetary system architecture; e.g., the 2 component model suggests planets may exist at 2-15 AU, while the 3 component model suggests planets between 2-30 AU with a stable region containing the dust belt at 9 AU, and there should be no planets between 2-65 AU in the eccentric planetesimal model. We suggest that the hot dust may originate in the disintegration of comets scattered in from the cold disc, and examine all A stars known to harbour both hot and cold dust to consider the possibility that the ratio of hot and cold dust luminosities is indicative of the intervening planetary system architecture.

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