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LEGACY SURVEYS WITH THE JCMT: THE SCUBA-2 DEBRIS DISK SURVEY

The SCUBA-2 Debris Disks Survey Consortium

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Introduction: Many main-sequence stars are surrounded by dusty debris disks, continually replenished by colliding asteroids and comets in orbit around the stars. Studying the location, mass and morphology of these disks provides crucial information about the outcome of planet formation in these systems and is revolutionising our understanding of the planet formation processes. For the 10 or so disks which have been resolved, observed structures have been used to pinpoint the location of unseen planets; many more have had their disks characterised by their spectral energy distributions, showing that these disks are the extrasolar equivalents of the Kuiper and asteroid belts in the Solar System.

Legacy survey: The SCUBA-2 camera on the James Clerk Maxwell Telescope will be used to survey 500 nearby main-sequence stars to search for debris signatures. This will be the first such unbiased survey, as previous far-IR studies have had to omit many stars. The crucial value of the submillimetre is firstly, that the stellar photosphere signal is irrelevant and so any star can be examined; secondly, that cold disks can be discovered only at these long wavelengths; and thirdly, that the disk masses and temperatures (and hence sizes) may be reliably determined. The output of the survey will be robust statistics on the incidence of debris plus discovery of the underlying causes in terms of stellar environment and history. The nearest systems will also be imaged, contributing to planetary detection and planning missions such as Darwin/TPF.

Legacy value:

- A definitive and comprehensive database on debris disks that is accessible to all future researchers, with clear and simple criteria on what star it contains
- A target list for future high angular resolution studies with ALMA, and alerts for dusty systems that may be unsuitable for planet-search missions
- Answers to key scientific questions on the place of debris disks in our picture of evolving planetary systems

Science goals: The aim of the survey is to perform an unbiased search of 500 nearby main-sequence stars for disk emission at 850 μ m. The 5 main goals of the survey are:

- To determine unbiased statistics on the incidence of disks around nearby stars
- To constrain disk masses and temperatures for far-IR detections (e.g. IRAS, ISO, Spitzer)
- To discover numerous disks too cold to be detected in the far-IR
- To be the basis of source lists for future observing campaigns (e.g. using ALMA and JWST)
- To provide limits on the presence of dust that are vital to future missions (e.g. Darwin/TPF)

Survey plan: The survey will include 500 stars, comprising the 100 nearest stars observable from the JCMT in each of the spectral types A, F, G, K, and M. The aim is to obtain samples that are statistically robust and can be inter-compared, while keeping the survey completely unbiased with regards to choices of star. An unbiased survey is more likely to reveal properties not predicted by theory, in contrast to directed searches that often merely support existing ideas. The lack of bias is unique to this survey – no star will be rejected because of any of its intrinsic properties. The nature of the mass function of stars means that 5 subsamples cover different volumes, extending out to 42, 24, 20, 15 and 10pc for A, F, G, K, and M stars respectively. These volumes are similar to those being sampled with Spitzer and earlier with ISO, but the SCUBA-2 survey will be the first unbiased survey.

The survey will start in late 2006 on the JCMT and 350 hours has been allocated.