Using Spinning Dust Emission To Constrain The Evolution Of Dust Grains In Cold Clumps

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Within many molecular clouds in our Galaxy there are cold, dense regions known as cold clumps in which stars form. These dense environments provide a great location in which to study dust grain evolution. Given the low temperatures (10 – 15 K) and high densities ($\sim 10^5$ cm^{-3}), these environments are dark at mid-IR wavelengths and emit strongly at wavelengths $\geq$ 160 μm. The lack of mid-IR emission can be attributed to one of two reasons: i) a deficit of the small dust grains that emit stochastically at mid-IR wavelengths; or ii) small dust grains are present, but due to the high densities, the stellar photons cannot penetrate deep enough into the clumps to excite them. Using mid-IR observations alone it is impossible to distinguish between these two scenarios and hence it is impossible to determine how the dust grains are evolving in these environments. However, by using spinning dust emission at cm wavelengths it is possible to break this degeneracy. Recent modelling by Ysard et al., (2011) show that if small dust grains are present in these clumps, then even though the stellar photons cannot excite them to emit at mid-IR wavelengths, these dust grains will be spun-up by collisions and hence emit spinning dust radiation. If spinning dust were detected in these clumps it would prove that there are small dust grains present and that the lack of mid-IR emission is due to a lack of stellar photons. Conversely, a lack of spinning dust emission would indicate a deficit of small dust grains in these clumps. Since small dust grains require harsh radiation fields to be destroyed, a lack of small dust grains is likely a result of dust grain coagulation. With this in mind, we present preliminary results illustrating our method of using spinning dust observations to determine the evolution of small dust grains in these environments.