

Microwave Emission from Spinning Dust Grains

There is strong evidence for a substantial population of ultrasmall dust grains (see Draine & Lazarian 1999a, and references therein). These grains will be spinning, will have electric dipole moments, and will therefore produce electric dipole radiation. The rotational excitation of such grains has been discussed by Draine & Lazarian (1998a,b), and the rotational emission spectrum has been predicted (see Figure below). for reasonable assumptions concerning the size distribution of the ultrasmall grains.

It appears that the rotational emission from these grains has already been detected, in the form of a dust-correlated microwave background.

References

- de Oliveira-Costa, *et al.* 1997, *Astrophys. J. (Letters)*, **482**, L17
- de Oliveira-Costa, A., Tegmark, M., Page, L.A., & Boughn, S.P. 1998, *Astrophys. J. (Letters)*, **509**, L9
- Draine, B.T., & Lazarian, A. 1998a, *Astrophys. J. (Letters)*, **494**, L19-22.
- Draine, B.T., & Lazarian, A. 1998b, *Astrophys. J.*, **508**, 157-179.
- Draine, B.T., & Lazarian, A. 1999, in *Microwave Foregrounds*, ed. A. de Oliveira-Costa & M. Tegmark (San Francisco: Astr. Soc. Pacific)].
- Kogut, A., *et al.* 1996b, *Astrophys. J. (Letters)*, **464**, L5
- Leitch, E.M., Readhead, A.C.S., Pearson, T.J., & Myers, S.T. 1997, *Astrophys. J. (Letters)*, **486**, L23
- Lim, M.A., *et al.* 1996, *Astrophys. J. (Letters)*, **469**, L69

Figure 1: Emissivity per H atom due to vibrational emission from large grains plus rotational emission from small spinning grains. The emission spectrum for the small spinning grains is computed assuming “Cold Neutral Medium” conditions ($n_{\text{H}} = 30\text{cm}^{-3}$, $T_{\text{gas}} = 100\text{K}$), and 5% of the cosmic carbon abundance in a population of ultrasmall grains with a log-normal size distribution given by eq.(62) of Draine & Lazarian 1998b, with $a_0 = 3 \times 10^{-8}\text{cm}$, $\sigma = 0.5$, and $a_{\text{min}} = 3.5 \times 10^{-8}\text{cm}$ (for these parameters the “half-mass” point of the log-normal size distribution is at $7 \times 10^{-8}\text{cm}$). From Draine & Lazarian 1999a.