Hunt for Molecules
F. Combes, F. Casoli, E. Falgarone, L. Pagani (eds)

DUST FROM REIONIZATION

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Abstract. The possibility that population III stars have reionized the Universe at redshifts greater than 6 has recently gained momentum with WMAP polarization results. Here we analyse the role of early dust produced by these stars and ejected into the intergalactic medium. We show that this dust, heated by the radiation from the same population III stars, produces a submillimetre excess. The electromagnetic spectrum of this excess could account for a significant fraction of the FIRAS (Far Infrared Absolute Spectrophotometer) cosmic far infrared background above 700 micron. This spectrum, a primary anisotropy (ΔT) spectrum times the ν^2 dust emissivity law, peaking in the submillimetre domain around 750 micron, is generic and does not depend on other detailed dust properties. Arcminute–scale anisotropies, coming from inhomogeneities in this early dust, could be detected by future submillimetre experiments such as Planck HFI.

1 Summary

More accurate measurements of the cosmic microwave background (CMB) implies a need for a better understanding of the different foregrounds. We study the impact of dust in the very early universe $5 < z < 15$. WMAP data on the CMB polarization, Kogut et al. (2003) provides a strong evidence

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for a rather large Thomson opacity during the reionization of the Universe: $\tau_e = 0.17 \pm 0.04$ (68% C.L.). Although the mechanism of producing such an opacity is not fully understood, Cen, R.(2002), Cen, R.(2003) has shown that early, massive population–III (Pop III) stars could ionize the Universe within $5 < z < 15$.

Self-consistent treatment of dust production and interaction with early UV light from these stars leads to a definite electromagnetic spectrum shown in Fig. 1. Details can be found in Elfgren & Désert (2004). We are now studying the anisotropies of the dust emission that could be measured with Planck in the submillimetre domain (HFI 353 GHz band). The existence of early dust may have a considerable impact on the existence of early molecules. This has not been yet investigated.

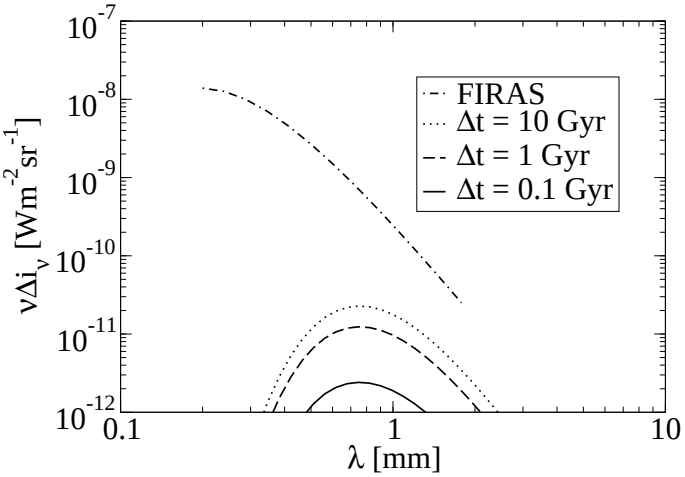

Fig. 1. Comparison of the modeled intensity for the early dust emission in excess of the CMB with the observed FIRAS spectrum (dashed red curve) of the cosmic far IR background as detailed by Lagache et al. (1999). The expected level of the spectrum depends on the asumptions about dust lifetime in the intergalactic medium but is below the observed level. Nevertheless, the shape of the spectrum is invariant and peaks at 800μm.

I here salute Pierre Encrenaz's passion for the last seven words played on sixteen strings.

References

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