

The dust budget crisis in high-redshift submillimetre galaxies

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We apply a chemical evolution model to investigate the sources and evolution of dust in a sample of 26 high redshift submillimetre galaxies (SMGs) from the literature. We find that dust produced only by low--intermediate mass stars (LIMS) falls a factor 100 short of the observed dust masses of SMGs, the well-known 'dust-budget crisis'. This means that LIMS cannot be the only source of dust in SMGs. The inclusion of supernova dust in our models means we can reproduce the observed dust mass in 40% of our SMG sample. Even after accounting for dust produced by supernovae, the remaining deficit in the dust mass budget suggests that higher supernova yields, and/or substantial grain growth in the interstellar medium are required in order for the predicted dust mass to match observations. The metallicity of the SMGs in our closed box model reaches $2.3 Z_{\text{sun}}$ on average, which is higher than the measured metallicity in some SMGs. This implies that inflows of pristine gas with a rate of 1-2 times the star-formation rate are required in order to reduce the metallicity to observed values.