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Formation and Evolution of the Dust in Galaxies. II. The Solar Neighbourhood

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Over the past decade a new generation of chemical models have included the dust in the treatment of the ISM. This major accomplishment has been spurred by the growing amounts of data on the highly obscured high-z Universe and the intriguing local properties of the Solar Neighbourhood (SoNE). We present here a new model able to simulate the formation and evolution of dust in the ISM. The model follows the evolution of 16 elemental species, with particular attention to those that are simultaneously present in form of gas and dust, e.g. C, N, O, Mg, Si, S, Ca and Fe. In this study we focus on the SoNe and the MW Disk as a whole which are considered as laboratories to test the physical ingredients governing the dust evolution. Infall of primordial gas, birth and death of stars, radial flows of matter between contiguous shells, presence of a central bar, star-dust emission by SNae and AGB stars, dust destruction and accretion are taken into account. The model reproduces the local depletion of the elements in the gas, and simultaneously satisfies other constraints obtained from the observations. The evolution of the element abundances in the gas and dust has been well reproduced for plausible choices of the parameters. The Mg/Si ratio, in particular, drives the formation of silicates. We show that for most of the evolution of the MW, the main process for dust enrichment is the accretion in the cold regions of the ISM. SNae dominate in the early phases of the evolution. We have examined the main factors controlling the temporal window in which SNae govern the dust budget both in low and high star forming environments. The role played by AGB stars is discussed. We find that IMFs with regular slope in the range of massive stars better reproduce the observed depletions. The results obtained for the SoNe lead us to safely extend the model.

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