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Iron dust growth in the Galactic interstellar medium: clues from element depletions

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Iron is severely depleted from the interstellar gas, but the long-standing question "Where is the missing interstellar iron?" remains unclear. We address it using a model of dust evolution in homogeneous interstellar medium based on three-dimensional hydrodynamic simulations of the Galactic disk (Zhukovskka *et al.* 2016, Zhukovska *et al.* 2018). The model includes dependence of dust destruction in SN shocks and growth by accretion of gas-phase metals on local physical conditions. Dust destruction process efficiently releases Fe back to the gas phase. This results in the lower depletions compared to the observed value, if all Fe is placed in nanoparticles or silicate grains. In order to reproduce the observed trend of interstellar Fe depletion with gas density, our model requires that solid iron resides in two dust components: (i) metallic iron nanoparticles with sizes in the range of 1–10 nm and (ii) small inclusions in silicate grains (Fig. 1).

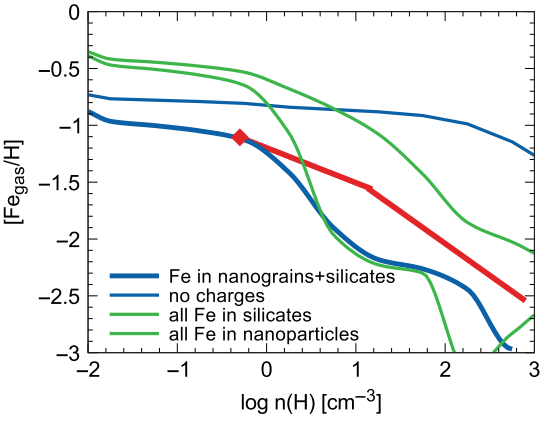

Figure 1. Red lines show the relation between Fe gas-phase abundance and gas density derived from observational data. It is best reproduced by the model in which 70% of Fe is locked in silicates and the rest resides in nanoparticles (blue solid line). The dashed line shows the same model without account for the grain charges. Green solid line and dash-dotted line show the models in which solid iron is in silicates and nanoparticles, respectively. Adapted from Zhukovska *et al.* (2018).

References

Zhukovska, S. and Henning, Th. and Dobbs, C. 2018, *ApJ*, 857, 94
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