**Generation of $^{54}$Cr Isotope Anomalies in Meteorites by Inhomogeneous Molecular Cloud Core.**

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**Isotope Anomalies of $^{54}$Cr in Various Meteorites:** It was found that evaluated formation ages of various meteorite parent bodies and the degree of $^{54}$Cr anomalies in those meterites are in a good agreement [1], except for CAIs [2]. Sugiura and Fujiya [1] examined a possibility that the correlation was caused by an input of $^{54}$Cr-rich grains ejected from a nearby supernova assuming that the input material lands on a certain ring of the solar nebula at the certain time. Though the increase of the $^{54}$Cr content seems to be reproduced by the model, a spike of $^{54}$Cr anomaly contained in CAIs does not fit. So, we should look for other models. On the other hand, recent work shows that inside the molecular cloud cores that would form stars and protoplanetary disks could be inhomogeneous [3]. This suggests that the isotope anomalies found in present day meteorites may be caused by the isotope heterogeneity in the original molecular cloud core.

Here, we examine a model that may reproduce the observed anomalies including the one by CAIs assuming the inhomogeneous molecular cloud cores.

**Model:** We assume that isotopically heterogeneous dust grains are inhomogeneously distributed in the initial molecular cloud core; especially, $^{54}$Cr-rich grains are concentrated in the centeral part of the cloud core. We calculate the concentration of $^{54}$Cr-rich grains as a function of the time and the place in the solar nebula. Principal model parameters include the initial angular velocity of the molecular cloud core ω, which determines the size of growing solar nebula, and the strength of the gas turbulence in the solar nebula α, which controls the radial flow of the gas and the diffusive motion of dust grains. The mass infall from the molecular cloud core is supposed to last 0.4 Myr.

**Results:** Figure 1 shows calculated $^{54}$Cr-rich grain concentrations as a function of time. Model parameters are $\omega = 3\times10^{-15}$ s$^{-1}$ and $\alpha = 10^{-4}$. In the early phase (< 0.4 Myr), the concentration decreases because of the addition of the other dust from the core. Later (> 0.4 Myr), the concentration increases due to the diffusive motion in the nebula. These features are consistent with observations [1, 2].

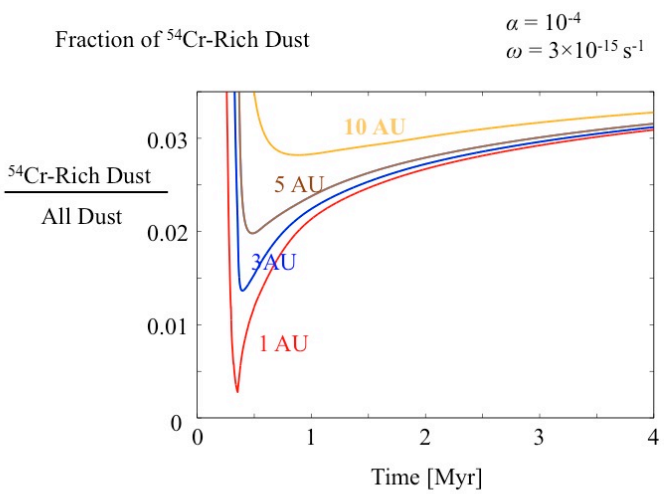


**Figure 1:** Temporal variations of the fraction of $^{54}$Cr-rich dust grains at different places in the solar nebula. Just after the beginning of the formation of the solar nebula, the fraction drops suddenly. Then, it increases gradually. These behaviors are consistent with features obtained by [1, 2].

**References:** [1] Sugiura and Fujiya (2014) *Meteorit. and Planet. Sci.* **49**, 772-787. [2] Trinquier *et al*. (2009) *Science* **324**, 374-376. [3] Kuffmeier, M. *et al.* (2016), *Astrophysical Journal* **826**, id. 22.