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New Measurements of Mass Independent Isotope Effects and the Origin of the Solar System

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Since their discovery in 1973 of large and mass independent oxygen isotopic compositions in meteorites, resolution of the source of these anomalies has been problematic. Initially, it was assumed that these compositions must derive from nuclear processes, such as supernovae, since deviation from mass dependent isotopic compositions was considered impossible. With the experimental demonstration of mass independent isotopic fractionations in chemical processes, that assumption was invalidated. The nuclear model, for many reasons, has been abandoned and the observed meteoritic oxygen isotopic compositions derive from chemical processes. Originally, Thiemens and Heidenreich considered the process of isotopic self shielding. There have been several new models developed invoking self shielding in the pre solar nebula. As an alternative, the role of molecular and isotopic symmetry as a general feature has also been proposed and is being tested.

The isotopic self shielding of carbon monoxide in the short UV is proposed to be the source of the anomalies, though it has never been tested. This talk will discuss various experiments and observations of relevance that have recently been made, including sulfur.

This talk will present the newest models, experiments, and meteoritic measurements of mass independent chemistry.