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The chemical composition of the Solar System

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The stage for studying element and isotopic distributions with the goal to understand the origin of the chemical elements was set about a century ago when it was already recognized that meteorite compositions can provide clues, and when Russell (1929) did the first comprehensive quantitative analyses of elements on the photosphere and found that abundances of non-volatile elements in meteorites compared reasonably well. By the 1950s, improvements in detection sensitivities and quantitative analysis for solar and stellar spectroscopy, and also for analytical chemistry of numerous meteorite classes gave abundance data that served as testbed for nucleosynthesis models. By now, only 68 of 83 elements have been analyzed in the sun because issues with line strengths, number of lines, their accessibility in the spectrum and blending hamper measurements of all elements in the solar photosphere.
The use of the CI-chondrites (carbonaceous chondrites of the Ivuna type) as solar system standard rocks for non-volatile elements was encouraged by Urey (1952) but it took until the 1970s to settle which type of chondritic meteorite is best suited to derive solar system abundances. Among primitive meteorites, the CI-chondrites are least affected by chemical volatility fractionations. About 40 elements have well-determined abundances in the sun and CI-chondrites that match quite well (except for very volatile elements H,C,N,O with gaseous compounds, and the noble gases). On the downside, only 5 CI chondrites were collected after they fell (out of more than 1,000 observed falls), and less than 25 kg total of them is left for study. Optimal CI chondritic abundances require multiple well-determined elemental analysis, and recently a surge of new elemental and isotopic measurements provided improvements, but also some problems. The abundances for all 83 naturally occurring elements and their isotopes can be evaluated statistically and, for quality-control, be compared to abundance systematics in other astronomical objects for elements with very similar chemistries and/or nucleosynthesis origins. Updates to our previous evaluations of CI-chondrite compositions for the solar system abundances will be presented and compared to recent photospheric data.
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Summary

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Primary author: LODDERS, Katharina (Washington University)

Presenter: LODDERS, Katharina (Washington University)

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