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Connecting the Chemical Composition of Stars and Exoplanets

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The interactions between stars and their orbiting exoplanets are extremely important. Whether direct or indirect, their relationship has a significant impact on the formation, evolution, and potential habitability of the planet. Measuring the interior or surface composition of an exoplanet is not possible with current technology, nor is it the goal of any upcoming NASA or ESA space missions. However, stars and planets are formed during the same events and from the same raw materials. Studying the compositions of stars via the abundance of specific elements enables meaningful connections to be made to the make-up of small planets (< 2 R_Earth). I will discuss how stellar elemental abundances from the Hypatia Catalog -- the largest stellar abundance database for stars near to the Sun (hypatiacatalog.com) -- may be used to determine key planetary building blocks (Fe, Mg, Si, Al, Ca). Applying the star-planet chemical connection, small planets can be classified as rocky and Earth-like, overly dense super-Mercuries, or puffy water-worlds/mini-Neptunes. This in turn allows us to make strides towards understanding the planetary surface composition, tectonic processes, and other planetary geochemical cycles. The future for exoplanet science is dependent on building bridges between astronomy, geology, planetary science, astrobiology, and the data science communities. It is by using the resources and experiences from all of these disciplines that we can holistically characterize potentially habitable planets and uncover more subtle trends within exoplanet data.