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Iron matters: Its influence on what we think we know about the deep Earth's interior (Robert Wilhelm Bunsen Medal Lecture)

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Iron is not only the most abundant element in the Earth, but it is also the only major element with multiple electronic configurations (oxidation and spin state). The loss of a single electron or a change in the distribution of electrons between orbital states may appear minor at the atomic scale, but at the macroscopic level the effects can be profound. The oxidation state of iron varies through the mantle, from predominantly Fe2+ in the upper mantle and transition zone to roughly 50% Fe3+ in the lower mantle due to the strong affinity of (Mg,Fe)(Si,Al)O_3 perovskite for Fe3+, and spin crossover transitions have been discovered to occur in both of the dominant lower mantle phases. This presentation will examine the effect of both oxidation state and spin state of iron on the physical and chemical properties of the mantle, as well as on dynamic processes that occur within our planet.