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The Solar Wind Abundance Mystery

By analyzing in situ measurements of the fast solar wind, we have found a systematic decrease in the abundance of Helium (measured by Wind) and the degree of Iron fractionation (measure by ACE and Ulysses) during the recent extended solar minimum relative to the previous minimum. These observations were also temporally accompanied by a decrease in the supergranular network emission length scale (measured by SOHO), signaling a reduction in the strength of the magnetic field and the scale over which mass and energy are transported into the quiet solar atmosphere. Together, these findings reveal that a significant change in the heating process likely took place during the recent minimum. Additionally, a decay in the helium abundance has been observed over multiple solar cycles, possibly indicative of long-term changes in the background magnetic field and energy input into the solar wind.