The slow-spin zone at the core of the sun

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(PhysOrg.com) -- The dense, hot, radioactive core of the Sun rotates significantly more slowly than the layer next to it, the radiative zone, a Stanford solar physicist has concluded.

According to Peter Sturrock, professor emeritus of applied physics, the idea of a slower core has been hinted at before, but his paper published in the *Astrophysical Journal* provides for the first time a precise rotation rate. The core, he writes, spins round once every 28.4 days, whereas the radiative zone rotates once every 26.9 days, and the surface rotates faster still—once every 25.2 days.

Sturrock deduced from available observational data that the nuclear furnace of the core does not burn perfectly symmetrically. There appears to be a localized "hot spot" in the core that affects the Sun's neutrino flux and its surface brightness as the core rotates.

Sturrock came to his conclusions after mathematical analysis of the data from the ACRIM space experiment that monitors the total radiation from the sun, and from two neutrino observatories, one in the Homestake Mine in South Dakota and the other (the GALLEX experiment) in the Gran Sasso mountain in Italy. He found precisely the same regular "flashing" in the two sets of neutrino data, and the two corresponding sets of irradiance measurements. "It is like watching the light on a police car—you see a flash every time it comes around," he said. The rate of flashing is actually the rate of rotation.

Sturrock compared this research, which involves combining data from four different datasets, to listing to a quartet: "You get a lot more out of listening to all four instruments playing at the same time than you do to listening to them one by one."

In a separate study reported in the same article, Sturrock found that measurements from the Super-Kamiokande experiment in Japan show a different kind of variability, one that is best understood in terms of the sun's internal magnetic field. This result is significant for neutrino physics, since it implies that—in addition to their known spin—neutrinos have a nonzero magnetic moment.

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