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First Indication of Terrestrial Matter Effects on Solar Neutrino Oscillations

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We present a strong indication that the elastic scattering rate of solar ^8B neutrinos with electrons in the Super-Kamiokande detector is larger when the neutrinos pass through the earth during night time. We determine the day/night asymmetry to be $-3.2 \pm 1.1(\text{stat}) \pm 0.5(\text{syst})\%$ which deviates from zero by 2.7σ . A non-zero Super-Kamiokande day/night asymmetry implies that the flavor oscillations of solar neutrinos are affected by the presence of matter within the neutrinos' flight path. Super-Kamiokande's day/night asymmetry is consistent with neutrino oscillations for $4 \cdot 10^{-5} \text{eV}^2 \leq \Delta m_{21}^2 \leq 8 \cdot 10^{-4} \text{eV}^2$. The recoil electron spectrum shape is consistent with no distortions due to neutrino oscillation within 0.9σ . The impact of the measurements of the average elastic scattering rate, the day/night asymmetry, and the recoil electron spectrum shape is discussed.

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