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Searching for signatures of dark matter using TeV gamma rays from the Sun with HAWC

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Very high energy gamma rays up to 200 GeV have been observed from the quiescent Sun. While this emission is thought to originate from hadronic cosmic rays interacting in the Sun's atmosphere, the mechanism is not well understood. Another potential source of gamma rays from the Sun is gravitationally captured dark matter. Weakly interacting massive particles (WIMPs) accumulating in the solar core can annihilate to long-lived mediators, which then decay to Standard Model particles. Gamma-ray emission from this process depends on the mass of the WIMPs, but is expected to become important above 1 TeV. Thus measurements of the Sun at TeV energies are crucial to constrain the properties of the WIMPs. The High Altitude Water Cherenkov (HAWC) Observatory is a wide field-of-view air shower array that is currently the only detector capable of measuring gamma rays from the Sun at multi-TeV energies. We present results from a search for excess gamma rays from the Sun using three years of data from HAWC. Our measurements provide the strongest upper limits on TeV gamma rays from the solar disk. We discuss the implications of these measurements on the origin of the solar gamma rays and present constraints for the spin-dependent WIMP-proton scattering cross section for masses above 1 TeV.

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