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A Review on correlation between sunspot umbra and solar flare

Sunspots, consisting of a dark umbra surrounded by a lighter penumbra, are visible manifestations of strong magnetic activity on the solar surface. The umbra, as the region of concentrated magnetic flux, is closely linked to the buildup and release of energy that drives solar flares. This review synthesizes findings from recent research exploring how umbral dynamics contribute to flare activity. Studies have shown that magnetoacoustic waves within the umbra can act as triggers, that structural and magnetic reconfigurations of sunspots accompany flare events, and that internal umbral motions respond dynamically during flaring. By bringing together these perspectives, this review highlights the crucial role of the sunspot umbra in solar flare processes and discusses its potential use as a diagnostic tool for improving space weather forecasting.

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