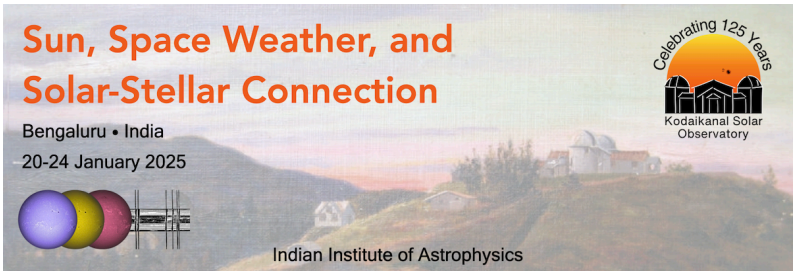

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Propagation and damping of 3-min slow waves from photosphere to corona along the umbral fan loops

Coronal fan loops rooted in sunspot umbra constantly show 3-min period propagating slow magnetoacoustic waves (SMAWs) in the corona. However, the origin of these waves in the lower atmosphere is still unclear. Here, we present study of these waves along a clean fan loop system using the multi-wavelength imaging and spectroscopic observations from IRIS and SDO. We traced the origin of these waves at the photosphere by utilizing amplitude and frequency modulations of 3-min waves from the corona to the photosphere via transition region and chromosphere. These modulation periods are in the range of 20–35 min at all the heights. Tracing of these loops also provide first observational evidence of cross-sectional area expansion of loops with height from the photosphere to corona. We estimated the energy flux of propagating 3-min SMAWs from the photosphere to corona along the fan loops and obtained damping length to be 208±7 km. We further investigated the role of area expansion of these loops on the damping of these SMAWs. We deduced the decay of total wave energy content within the loop cross-sectional area with height and estimated the damping length in this case to be 303±10 km. Henceforth, we present the actual damping of SMAWs after incorporating the geometric effect of area expansion of the loops. Finding reveals the role of area expansion of loops with height in the apparent and actual damping of waves from the photosphere to corona. Result also provides clear evidence of magnetic coupling of the solar umbral atmosphere through the propagation of 3-min waves along the fan loops at different atmospheric heights.

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Contribution Type

Theme

Solar Magnetism in High-Resolution

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