Title: Wave dissipation in the magnetised solar atmosphere: Implications on heating and seismology

Introduction: High-frequency acoustic waves generated in the interior of the Sun can propagate in the outer solar atmosphere but get rapidly damped below the chromosphere due to radiative losses. However, in magnetised atmospheres, they get transformed into magneto-acoustic modes and propagate all the way up to the corona before eventually dissipating there due to high thermal conduction and other physical mechanisms. The magneto-acoustic waves are often probed for their relevance for solar atmospheric heating and for their unique application as seismological tools. While the Alfven waves are difficult to dissipate, the slow modes are known to be readily dissipated in the solar atmosphere. Recent studies reveal a significant reduction in the energy of slow waves before they reach the outer atmosphere. This decay is possibly due to radiative losses and shock dissipation but must also include other dissipationless energy losses, such as that due to reflection and mode conversion. It is very puzzling to find that despite the additional energy losses in the magnetised atmospheres, these waves actually reach the outer layers. A proper quantitative description of individual loss mechanisms is necessary to evaluate the true dissipation and thereby understand this puzzle.

Aim and objectives: The primary goal of this project is to obtain a comprehensive understanding of the propagation and dissipation of slow waves in a magnetised solar atmosphere so that we can find their relevance for solar atmospheric heating and utilise their properties for seismology. We plan to achieve these objectives using coordinated ground- and space-based observations, including multi-height spectropolarimetric data in combination with numerical simulations. Data from state-of-the-art telescopes such as the Swedish Solar Telescope (SST) and Daniel K. Inouye Solar Telescope (DKIST) will be used in the project.

Expected outcome: In the broader context, a comprehensive and coherent knowledge of how the acoustic wave energy available in the photosphere is propagated and dissipated across different atmospheric layers is expected. A clear understanding of this opens up numerous seismological applications enabling us to deduce critical physical parameters (e.g., transport coefficients) that are difficult to obtain directly from observations. Furthermore, the results are expected to improve our understanding of the fundamental dissipation mechanisms and possibly reveal the channelling of wave energy to other incompressible modes (through mode conversion) that might be important for coronal heating.

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Number of JRF positions: 01

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