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SOLAR SCIENCE: MODERN OBSERVATIONAL AND THEORETICAL APPROACHES.

Abstract

Modern ground- and space-based solar observations, e.g., The Daniel K. Inouye Solar Telescope (DKIST), Swedish Solar Telescope (SST), Solar Orbiter, Solar Parker Probe etc., along with numerical modeling, are an essential tool for our understanding of the physics of the Sun. These instruments provide solar researchers with hi-resolution observational data that require logical explanations using mathematical modeling. For instance, magnetohydrodynamic (MHD) waves play a significant role in the energy transfer between lower and upper layers of the solar atmosphere and can be used as a diagnostic instrument to study the internal structure and physical properties of various solar magnetic configurations, e.g. sunspots and pores. The proper interpretation of the wave modes detected in the observational data is essential for understanding the solar atmosphere's plasma processes and their connection to space weather. In this presentation, we review the theoretical modeling of MHD wave modes for direct comparison with the observational data. In particular we will focus on analysis of trapped MHD modes in the magnetic flux tubes with elliptical/realistic cross-section. The results help us interpret high-resolution ground- and space-based solar observations. With this presentation we also would like to bring more attention to the potential of the Middle East to develop, or participate in, the planning of, or, contribution to exciting state-of-the-art solar observational facilities and foster fruitful new international collaborations.