

Science with Large Solar Telescopes: Addressing Key Science Questions with New Observing Modes

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We review the capabilities of existing and future large solar telescopes with an emphasis on the key science questions that these instruments must address. Large solar telescopes coming online now, as well as the 4-meter ATST coming online in 2018 are tasked with extending high resolution and polarimetric investigations from the lower atmospheric regions into the higher regions and connecting the dynamics between the two. The overall goal is to understand the interaction of flows and magnetic fields in the convection zone down to $O(10)$ km scales and the magnetohydrodynamic transport, storage, and release of energy in the upper atmosphere leading to coronal heating and eruptive events. The ATST in particular will have unique opportunities to address this goal with new observations of the infrared atmosphere at very high spatial resolution and with coronagraphic capabilities. We discuss some of the multi-instrument ATST observing programs that will investigate such topics as small-scale magnetoconvection and energetic events in the lower atmosphere and energy release in filament eruptions.