ADVANCED OBSERVATIONAL MEANS FOT HIGH RESOLUTION HEATING DIADNOSTICS OF THE UPPER CHROMOSPHERE AND TRANSITION ZONE

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SOHO, TRACE and more recently HINODE observations have clearly shown that even the very quietest part of the solar chromosphere is very structured and dynamic with brightenings and waves. Diagnostics from this region are very difficult because spectral lines are neither formed in LTE nor under optically thin conditions that prevail higher in the Transition Zone. The gas goes from being dominated by the gas pressure in the photosphere to being dominated by the magnetic pressure in the upper chromosphere, involving steep gradients to obtain significant dissipation or heating. A proper understanding thus demands very high spatial resolution with accurate measurements of velocity and line width, uninterrupted in Space, across a broad range of temperature ("heights"), to distinguish between wave heating, convection dissipation of shuffled flux tubes or reconnection of current sheets between tangled magnetic flux strands in the chromosphere, Transition Zone and corona. Complex modelling suggests that the much of Transition Zone and corona is heated impulsively on a sub-resolution scale and that very high resolutions, spatial, spectral and temporal will be necessary to assess it by observations. We discuss Space and ground projects, as recommended by the ASTRONET European Vision for the future of Solar Physics for, on the Space side, very high resolution through a meter class UV and FUV interferometer coupled to 3D spectral imaging at 20 mas and 0.002 nm and, on ground, through an unbelievable 4 m class visible and IR 9 x 70 cm interferometric assembly at La Palma or, best, at Dome C (Antarctica) for unique 3D spectropolarimetry and ultimate coronagraphy at extremely high resolution of 20 mas also, by an appropriate permanent phasing of the individual "small" 70 cm telescopes by Adaptive Optics and cophasing 3 by 3 of the telescopes and triplets of telescopes by a dedicated technique (report on the Meudon functional breadboard Solar cophasing and imaging performances).