

Title: Exploring EUV Spicules Using 304 Ang He II Data from SDO/AIA

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Abstract:

We present results from a statistical study of He II 304 Angstrom EUV spicules and macrospicules at the limb of the Sun. We use high-cadence (12 sec) and high-resolution (0.6 arcsec pixels) resolution data from the Atmospheric Imaging Array (AIA) instrument on the Solar Dynamic Observatory (SDO). All of the observed events occurred in quiet or coronal hole regions near the solar pole. Spicules and macrospicules are typically transient jet-like chromospheric-material features, the macrospicules are wider and have taller maximum heights than the spicules. We looked for characteristics of the populations of these two phenomena that might indicate whether they have the same or different initiation mechanisms. We examined the maximum heights, time-averaged rise velocities, and lifetimes of about two dozen EUV spicules and about five EUV macrospicules. For spicules, these quantities are, respectively, ~5---30 km, 5---50 km/s, and a few 100--- ~1000 sec. Macrospicules were ~60,000 km, 55 km/s, and had lifetimes of ~1800 sec. Therefore the macrospicules were taller and longer-lived than the spicules, and had velocities comparable to that of the fastest spicules. The rise profiles of both the spicules and the macrospicules matched well a second-order ("parabolic") trajectory, although the acceleration was generally weaker than that of solar gravity in the profiles fitted to the trajectories. The Macrospicules also had obvious brightenings at their bases at their birth, while such brightenings were not apparent for most of the spicules. Most of the spicules and several of the macrospicules remained visible during their decent back to the solar surface, although a small percentage of the spicules faded out before their fall was completed. Are findings are suggestive of the two phenomena possibly having different initiation mechanisms, but this is not yet conclusive. Qualitatively the EUV 304 Ang spicules match well the properties quoted for "Type I" Hinode Ca II spicules, even though we observed these 304 Ang spicules at a polar location, where typically only "Type II" spicules are seen in the Hinode Ca II images. A.C.S. and R.L.M. were supported by funding from the Heliophysics Division of NASA's Science Mission Directorate through the Living With a Star Targeted Research and Technology Program, and the Hinode Project. I.S. was supported by NSF's Research Experience for Undergraduates Program.