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ALMA observations of the variability of the quiet Sun at millimeter wavelengths

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Using Atacama Large Millimeter/submillimeter Array (ALMA) observations of the quiet Sun at 1.26 and 3 mm, we study spatially resolved oscillations and transient brightenings, i.e. small, weak events of energy release. Both phenomena may have a bearing on the heating of the chromosphere. At 1.26 mm, in addition to power spectra of the original data, we degraded the images to the spatial resolution of the 3 mm images and used fields of view of equal area for both data sets. The detection of transient brightenings was made after the oscillations were removed. At both frequencies we detected p-mode oscillations in the range 3.6–4.4 mHz. In the corrected data sets, the oscillations at 1.26 and 3 mm showed brightness temperature fluctuations of ~1.7–1.8% with respect to the average quiet Sun, corresponding to 137 and 107 K, respectively. They represented a fraction of 0.55–0.68 of the full power spectrum and their energy density at 1.26 mm was 0.03 erg/cm^3 . We detected 77 transient brightenings at 1.26 mm and 115 at 3 mm. Although the majority of the 1.26 mm events occurred in cell interior, their occurrence rate per unit area was higher than that of the 3 mm events. The computed low-end energy of the 1.26 mm transient brightenings ($1.8 \times 10^{23} \text{ erg}$) is among the smallest ever reported, irrespective of the wavelength of observation. However, their power per unit area is smaller than that of the 3 mm events, probably due to the detection of many weak 1.26 mm events.

Student poster?

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