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Inferring impulsive heating of quiet solar corona using machine learning

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Accurate understanding of the solar coronal temperature demands the study of Quiet Sun (QS) regions. In this work, we study quiet Sun data from 171 Å, 193 Å and 211 Å passbands of the Atmospheric Imaging Assembly (AIA) on board the Solar

Dynamics Observatory (SDO). We develop an uncertainty quantified machine learning inversion model to the empirical, statistical impulsive heating forward model of Pauluhn and Solank (2007) to infer the event frequency, timescale and the power law slope (α) from the observations. On performing inversions across approx. 300,000 light curves per passband, we find that there are $\approx 2 - 3$ impulsive events per min, with a lifetime of about 10 - 20 min. The α distribution is found to peak above 2 for all passbands. We then explore correlations among the frequency of impulsive events, their timescales and peak energy. The correlations suggest that conduction losses dominate over radiative cooling losses, and there might be a reservoir of energy either depleted by frequent, small events or infrequent, large events. All these findings suggest that impulsive heating is a viable heating mechanism in QS corona.

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