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Interplay between modelling and observations of the upper solar atmosphere

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Numerical simulations based on 3D MHD models have been used create and sustain a hot upper atmosphere of the Sun for various solar features, e.g. quiet Sun, bright points, or active regions. These models provide self-consistent explanations for quite a range of observational features e.g. for Ellerman bombs or UV bursts. They allow to follow the changes of the magnetic field, e.g. while field lines are braided, and by this show where and when energy is dissipated and what the consequences are for (synthesised) line profiles from the transition region and corona. However, many questions remain open. For example, numerical models usually show very high contrast in synthesized emission, while on the real Sun the majority of the emission is originating from a diffuse background. Is this background seen in the observations just a mixture of small-scale unresolved features, or are there some processes at work that we so far do not capture by numerical models? Coronal imaging from Solar Orbiter at an unprecedented spatial resolution do show not only features smaller than before, but also show, e.g., diffuse patches almost the size of a supergranule or thick loops that are stable for surprisingly long times. For all these features MUSE will provide information on profiles of coronal emission lines at a spatial resolution roughly matching Solar Orbiter EUV imaging. This will provide new constraints and challenges for our understanding of the upper solar atmosphere.

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