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The gaps in our understanding of flare energy release: prospects with MUSE and other observatories

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The overall paradigm of flare energy release is well-known. An energy-bearing coronal magnetic field relaxes via magnetic reconnection to a lower energy state, and the energy released is converted and dissipated in the radiation flash that is a solar flare. But what does that energy conversion and energy dissipation involve? There are strong and long-standing pointers to an important role for heating by non-thermal particles, but also observational hints that waves and turbulence have important roles. Furthermore, how is the energy release into the closed field of the lower corona - resulting in the flare - connected to the energy release into the wider corona that can result in a CME? Diagnosing waves and turbulence requires spectroscopic information, flares require high cadence particularly in their earliest phases, and probing the link to the early evolution of CMEs requires observation over a large field of view. MUSE can provide all of these in the EUV and, particularly when employed together with other facilities such as Solar-C and new ground-based observatories, is certain to fill many of the gaps in our understanding.

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