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# Introduction: The High-energy Corona – Waves, Eruptions, Particles

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Flares and coronal mass ejections (CME) are the most violent manifestations of solar activity. They are the consequence of the explosive conversion of energy stored in coronal magnetic fields into plasma heating, the kinetic energy of supra-thermal to high energy particles and the mechanical energy of magnetic structures that are propelled through the corona and into interplanetary space. The corona is the seat of activity on a large variety of spatial and temporal scales, and presents us with a unique opportunity to sound the relevant plasma phenomena with imaging and spectrographic observations, as well as with in situ measurements near the Earth. This book addresses three key features: eruptions of magnetic structures, associated large-scale perturbations such as propagating waves and shocks, and energetic particles which carry a large part of the energy released during flare/CME events.

## 1 Particle Acceleration During Flares

The transient brightenings indicating the occurrence of a solar flare occur across the electromagnetic spectrum and involve a wide range of heights in the solar atmosphere. For many years the chromospheric H $\alpha$  line was almost the only tool for their study; hence the old name, “chromospheric flare”. Flare X-ray, EUV and radio emissions extend the study of flares into coronal regions where the flare originates, and also reveal the phenomena of particle acceleration that seem to be a central part of the flare process.

In order to introduce concepts, we show in Fig. 1 a widely used cartoon displaying key processes and the places and manners in which they are thought to occur (see the chapter by Hudson & Vilmer for further cartoons). Details are beyond doubt more involved, but this cartoon provides a useful framework for discussion. Energy stored in stressed coronal magnetic fields is thought to be explosively released in a current sheet, by magnetic reconnection of oppositely