Understanding the energy release in solar flares and stellar superflares by quasi-periodic pulsations

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Flaring energy releases observed in atmospheres of the Sun and stars in all bands of the electromagnetic radiation and particle fluxes, are produced by the conversion of the magnetic energy stored in the plasma into heat and kinetic energies of nonthermal particles and bulk flows. Magnetic reconnection is commonly accepted as the mechanism for the energy release in flares. However a number of important details, such as the unexpected speed of the reconnection, partition and amount of the released energy, triggering, and so on, remain to be revealed. Moreover, those questions are connected with the flare forecasting in the context of space weather, and also with the question whether the Sun is capable to produce a devastating superflare, similar to those observed on sun-like stars. Often the EM radiation generated in solar and stellar flares shows a pronounced (quasi)-oscillatory pattern - quasi-periodic pulsations (QPPs), with characteristic periods ranging from a fraction of a second to several tens of minutes. We review the current understanding of QPP in solar and stellar flares, focussing on possible physical mechanisms generating them, address the similarity of QPP in flares and superflares and its implications for space weather, and discuss future directions and key unanswered questions of this emerging research field.