Magnetic interfaces in the solar atmosphere: waves, instabilities and energy release

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Numerous Yohkoh and SOHO observations suggest that the events of impulsive plasma heating in the solar atmosphere (flares, nanoflares, blinkers, etc.) are due to the energy released during magnetic reconnection. Magnetic reconnection occurs in magnetic interfaces between interacting magnetic fluxes. Classical transport coefficients cannot explain the observed rates of energy release. As a consequence, several current-driven plasma micro-instabilities have been suggested as mechanisms causing anomalous resistivity and faster energy release. The common difficulty of models based on the current-driven instabilities is that the threshold currents for these instabilities are rather high and require very thin interfaces, which are subject to quick disruption. In this situation the fast Petschek regime of magnetic reconnection can hardly be obtained. In our study we take into account that inhomogeneous (shear) plasma flows and currents, as well as considerable guide magnetic field components are typical for coronal magnetic interfaces. We find that the shear plasma flows and current inhomogeneity drastically decrease the threshold currents for kinetic Alfven and ion-acoustic instabilities. As a result, these instabilities can develop anomalous resistivity much earlier, in relatively smooth and stable interfaces, which make the standard Petschek model more realistic for the solar corona. Moreover, inhomogeneous currents that are typical for the quasi-steady solar corona can also drive these instabilities, which can therefore contribute to the quasi-steady heating of the corona.