

High-resolution UV observations of small-scale energy release events in the solar atmosphere

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Magnetic flux emergence



- Magnetic flux emergence is a very dynamical process that involves all the solar atmospheric layers
- In the photosphere we can observe small-scale flux concentrations, appearing everywhere and interacting with each other and with the ambient

Interactions between new and pre-existing flux

- Many phenomena occur when emerging flux regions (EFRs) encounter the pre-existing magnetic environment
 - brightening, ejections, coronal heating, flares
- The main responsible is magnetic reconnection
- This is able to rearrange the field topology and to convert magnetic energy to
 - thermal energy
 - kinetic energy
 - particle acceleration



Photosphere: SDO/HMI sequence



- An EFR emerged in a unipolar plage
- P⁺ became smaller and disappeared
- New flux formed P⁻



Response to flux emergence in the upper atmospheric layers

- IRIS sequence shows UV brightenings and plasma ejections in the EFR site
- ALL SDO/AIA channels exhibit a counterpart of the event throughout the whole sequence
- UV bursts: repeated episodes lasting for hours



IRIS spectral features

UV burst core

- blueshifts
- components with different velocity
- spectral features
 - "absence" of O IV line
 - Mg II triplet emission
 - inverted C I / O I ratio
 - detection of Fe XII line Log T [K] ≈ 6.1

Contact region

- plasma at rest
- strong Mg II triplet

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Orange, blue, pink profiles: random positions over the UV burst Black profile: average over 6 quiet-Sun pixels

Eruptions at late stages

- Just after the end of IRIS observations, a sudden intensity peak occurred
- SDO/AIA shows the formation of a circular ribbon, typically found in fan-spine configurations with parasitic polarities
- Eruptions were observed, being followed by catastrophic cooling



Conclusions

- Energy release events in the upper atmosphere, driven by magnetic reconnection episodes
 - Cancellation of pre-existing flux with an EFR: P⁺ -> P⁻
 - Recurrent UV bursts, with counterparts in the corona
 - Eruptive activity at chromospheric and coronal levels
- Future contributions by Solar Orbiter / EUVST

