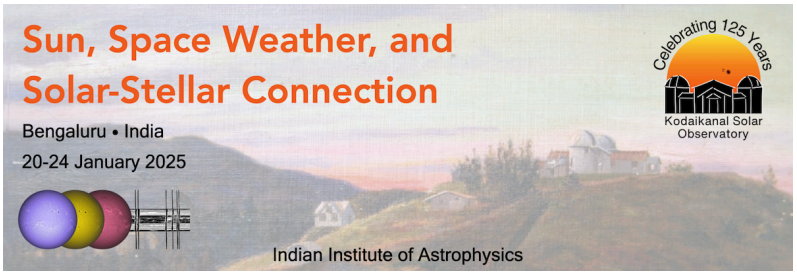

Contribution ID: **43** Type: **Contributed talk**

Solar Orbiter/EUI Observations and a Bifrost MHD Simulaton of Fine-scale Dot-like Heating Events in Emerging Flux Regions

Wednesday, January 22, 2025 4:50 PM (15 minutes)

Solar coronal EUV/X-ray bright points (CBPs) are believed to be major contributors to quiet solar coronal heating. Solar Orbiter's EUI/\hri\ observations of an emerging flux region (a typical CBP) in 174 \AA, emitted by the coronal plasma at ∼1 MK, reveals the presence of numerous tiny bright dots. These dots are roundish with a diameter of 675±300 km, a lifetime of 50±35 seconds, and an intensity enhancement of 30\% ±10\% from their immediate surroundings. About half of the dots remain isolated during their evolution and move randomly and slowly (<10 \kms). The other half show extensions, appearing as a small loop or surge/jet, with intensity propagations below 30\,\kms. Many of the bigger and brighter \hri\ dots are discernible in SDO/AIA 171 \AA\ channel, have significant EM in the temperature range of 1–2 MK, and are often located at polarity inversion lines observed in HMI LOS magnetograms. The Bifrost MHD simulations of an emerging flux region do show dots in synthetic \fe\ images, although dots in simulations are not as pervasive as in observations. The dots in simulations show distinct Doppler signatures – blueshifts and redshifts coexist, or a redshift of the order of 10 \kms\ is followed by a blueshift of similar or higher magnitude. The synthetic images of \oxy\ and \siiv\ lines, which form in the transition region, also show the dots that are observed in \fe\ images, often expanded in size, or extended as a loop, and always with stronger Doppler velocities (up to 100 \kms) than that in \fe\ lines. Our results, together with the field geometry of dots in the simulations, suggest that most dots in emerging flux regions form in the lower solar atmosphere (at ≈1 Mm) by magnetic reconnection between emerging and pre-existing/emerged magnetic field. The dots are smaller in \fe\ images (than in \oxy, and \siiv\ lines) most likely because only the hottest counterpart of the magnetic reconnection events is visible in the hotter emission. Some of these dot-like heating events might be manifestations of magneto-acoustic shocks (driven from the lower atmosphere) through the line formation region of \fe\ emission. Because these fine-scale heating events carry magnetic energy of the order of 10^{26} erg, they contribute significantly to a CBP's heating, and mark where exactly the heating happens within CBPs.

Contribution Type

Theme

Energetic Phenomena

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