Avyarthana, Ghosh - IUCAA/ CESSI-IISER, KOLKATA

Fan Loops Observed by IRIS, EIS and AIA

Active region fan loops are formed between 0.8-1 MK and are best seen by AIA 171 Å and EIS Fe VIII and Si VII lines. These are one of the most complex and longest living loop structures in the solar corona. Near-simultaneous observations of the non-flaring AR 11899 (near the disk-center) on 19th November, 2013 with the Interface Region Imaging Spectrometer (IRIS), the EUV Imaging Spectrometer (EIS) on-board Hinode and the Atmospheric Imaging Assembly (AIA) and the Helioseismic and Magnetic Imager (HMI) on-board the Solar Dynamics Observatory (SDO) were used to do a comprehensive study of the plasma parameters in these loops. The EIS intensity maps show they gradually fade at higher temperatures. The footpoints of these loops are maintained at approximately constant pressure with electron densities of log Ne = 10.1 cm-3 at log [T/K] = 5.15 (O IV) and log Ne = 8.9 cm-3 at log [T/K] = 6.15 (Si X). This suggests that the fan loops are multi-stranded. Using EM-Loci technique, the electron temperature across the loops reveals two components – one at log [T/K] = 4.95 (deduced from the IRIS lines) and the other at log [T/K] = 5.95 (picked-up by the EIS lines). However, the loops remain nearly isothermal and constant at log [T/K] = 5.95 at greater heights. The measurement of Doppler shifts using the IRIS lines suggests that the plasma at the footpoints of these loops is predominantly redshifted by 2-3 kms-1 in C II (log [T/K] = 4.40) , 10- 15 kms-1 in Si IV (log [T/K] = 4.90) and 15-20 kms-1 in O IV (log [T/K] = 5.15). These observations can be explained by low frequency nanoflares or impulsive heating, and provide further important constraints on the modeling of the dynamics of fan loops.