Temperature and Density Structure of a Recurring Active Region Jet

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We present a study of a recurring active jet simultaneously observed by SDO/AIA, Hinode/XRT and Hinode/EIS on October 31, 2011. We discuss the physical parameters of the jet such as density, differential emission measure, peak temperature, velocity and filling factor. We calculated electron densities using the Fe XII ($\lambda$186/$\lambda$195) line ratio in the region of the spire ($N_e = 7.6 \times 10^{10}$ cm$^{-3}$) and the footpoint ($1.1 \times 10^{11}$ cm$^{-3}$). A differential emission measure (DEM) analysis was performed at the region of the jet-spire and the footpoint using EIS observations and also by combining AIA and XRT observations. The resulting EIS DEM values are in good agreement with those obtained from AIA-XRT. The synthetic spectra contributing to each AIA channel confirms the multi-thermal nature of the AIA channels in both regions. There is no indication of high-temperatures, such as emission from Fe XVII ($\lambda$254.87) (log $T$ [K] = 6.75) seen in the jet-spire. In case of the jet-footpoint, both synthetic spectra predict weak contributions from Ca XVII ($\lambda$192.85) and Fe XVII ($\lambda$254.87). With further investigation, we confirmed the emission from the Fe XVIII ($\lambda$93.932 Å) lines in the AIA 94 Å channel in the region of the footpoint. We also found good agreement between the estimated and predicted Fe XVIII count rates. The study of temporal evolution of the jet-footpoint and the presence of high-temperature emission from the Fe XVIII ($\lambda$93.932) (log $T$ [K] = 6.85) line leads us to conclude that the hot component in the jet-footpoint is initially present but had cooled down by the time EIS was observing.