Fifth Hinode Science Meeting: Exploring the Active Sun
ASP Conference Series, Vol. 456
L. Golub, I. De Moortel, and T. Shimizu, eds.

Hot Plasma Detected in Active Regions by HINODE/XRT and SDO/AIA

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Abstract. Multiple ratios of Hinode/XRT filters showed evidence of a minor very hot emission measure component in active regions. Recently also SDO/AIA detected hot plasma in the core of an active region. Here we provide estimates showing that the amount of emission measure of the hot component detected with SDO is consistent with that detected with Hinode/XRT.

The presence of flare-hot plasma in active regions outside of major flares is a critical issue to assess the role of coronal heating made by short pulsed events (e.g. nanoflares). Evidence for this very hot plasma is currently debated.

From the analysis of Hinode/XRT filter ratios of AR10923 it has been inferred the presence of a very hot plasma component ($\log T \sim 6.8$) with a small emission measure ($\sim 1\%$) with respect to the major hot ($\log T \sim 6.3$) component (Reale et al. 2009). This component is steady and widespread in the region. The presence of such a very hot component has been recently confirmed with a different method from the analysis of another active region observed with SDO/AIA (Reale et al. 2011). Here we check the relative weight of this component. We consider the central part of the active region AR11117 (28 Oct 2010) shown in Figure 1. SDO/AIA 94A channel is sensitive both to warm ($\sim$ 1 MK) and very hot (6-8 MK) plasma. We screen out the warm component by subtracting the emission scaled from the warm 171A channel. We subtract also the hot ($\sim 2-3$MK) component scaled from the 335A channel. The ratio of the total remaining 94A channel (6-8 MK) rate to that in the 335A channel (2-3 MK) rate is $\sim 1\%$. Since the sensitivity of the channels is comparable (Reale et al. 2011), we can approximate this as also the ratio of the emission measures. Figure 1 shows the relative height of the loci of the emission measures obtained from the measured SDO/AIA rates.

In conclusion, Hinode/XRT and SDO/AIA coherently support the presence of a minor ($\sim 1\%$) very hot (6-8 MK) emission measure component in active regions. This is a strong signature of nanoflaring activity that may therefore play an important role in heating active regions. We look forward confirmations from spectroscopy, and future high-resolution X-ray spectroscopy would be particularly appropriate.

Acknowledgments. FR, MG, GP acknowledge support from Italian Ministero dell'Università e Ricerca and Agenzia Spaziale Italiana (ASI), contract I/023/09/0.

References

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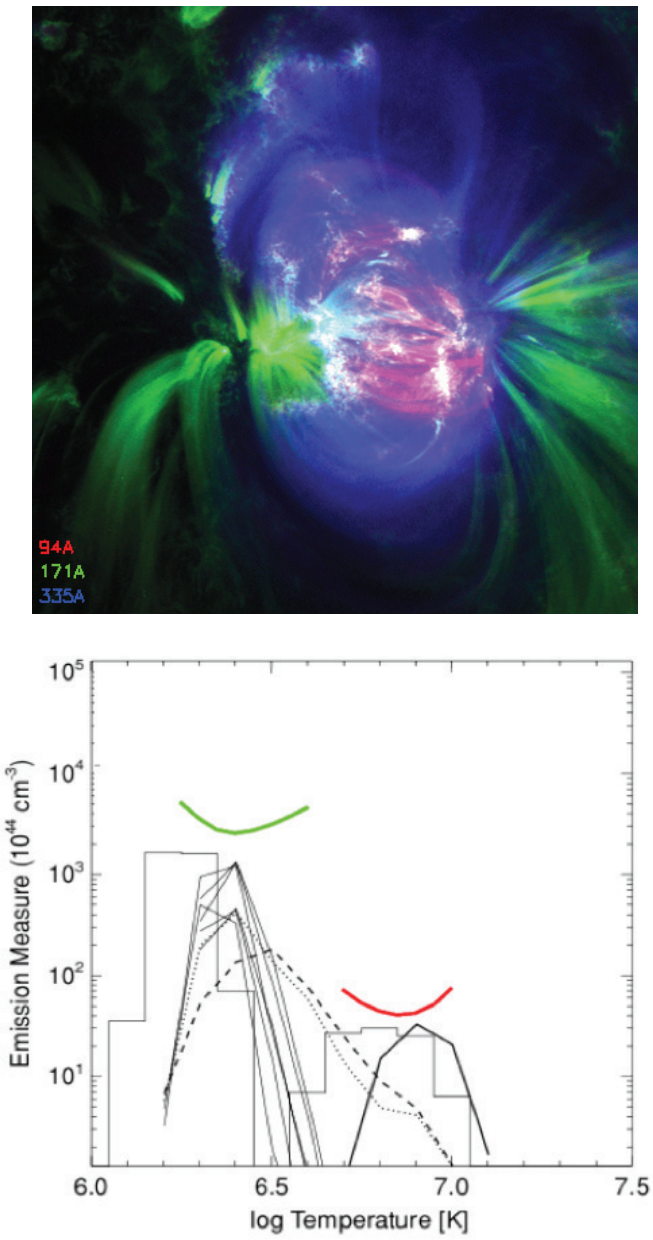

Figure 1. Left panel: active region AR11117 observed with SDO/AIA on 28 Oct 2010 in the labelled channels. With this choice of the color scales, very hot plasma (6-8 MK) is pink and is widespread in the core of the active region. Right panel: Emission Measure: XRT vs AIA. Black lines and histograms: emission measure distributions obtained from the analysis of an active region observed with Hinode/XRT (from Reale et al. 2009). Color lines: Loci of the emission measures obtained from the measured SDO/AIA rates in 94 A (red) and 335 A (green) channels. The absolute scale of the AIA lines is arbitrary.