Comparative analysis of emission measure in an active region: hot vs cool components

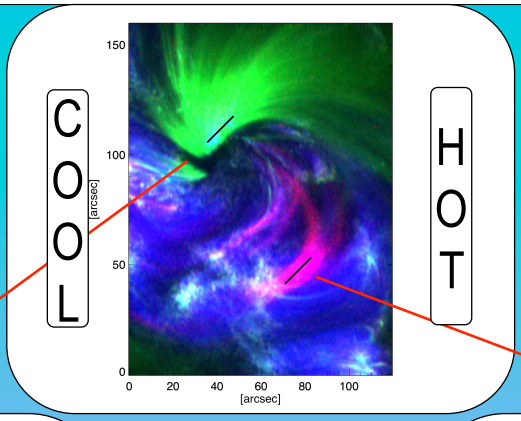
A. Petralia, P. Testa, F. Reale

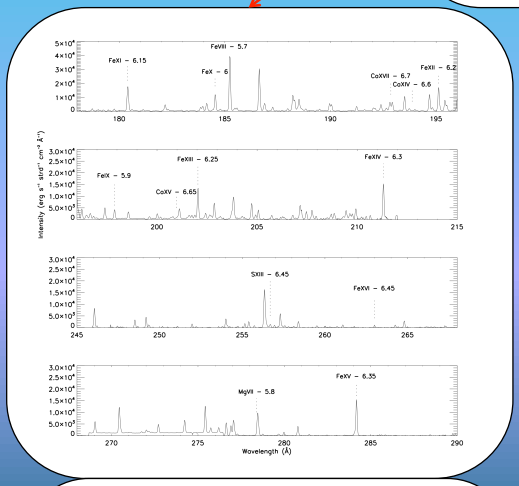
Dipartimento di Fisica e Chimica, Università di Palermo - INAF/Osservatorio Astronomico di Palermo, Italy

Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA

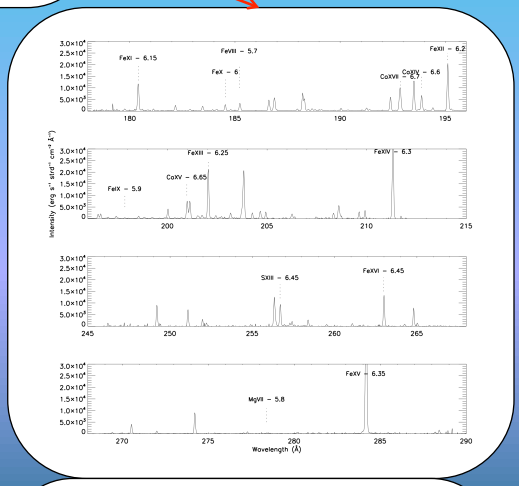
reale@astropa.unipa.it , apetralia@astropa.unipa.it , ptesta@cfa.harvard.edu

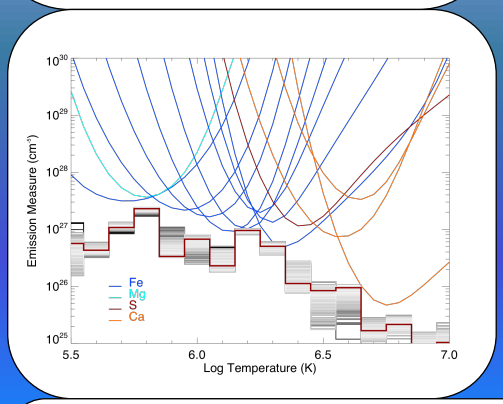
Recent analysis has revealed the presence of minor but very hot plasma (6-8 MK) components in active regions, which may be signature of nanoflaring activity in coronal loops. The evidence consists mainly of highly ionized line emission (e.g. Fe xviii, Ca xvii) observed with Hinode/EIS and of emission in channels of imaging instruments including such hot lines. The question is to assess tighter constraints to the temperature of such hot components. Important information comes from the global analysis of EUV spectra, from which we are able to reconstruct the temperature distribution of the emission measure along the line of sight. Here we report on the reconstruction of the emission measure in an active region where previous work had revealed the presence of the hot component. Our approach is to use a limited but carefully selected set of lines, in particular only one strong and well-identified line with peak formation temperature in each temperature bin, and to minimize the emission uncertainty. This allows us a very strong control on the emission measure reconstruction. We use the MCMC reconstruction method, and apply it to two selected zones of the active region, one including the hot component and one not including it. We also assess the importance of including spectral information from narrow-band EUV channels (SDO/AIA) and from X-ray filterbands (Hinode/XRT). We find very different emission measure distributions and, through the comparison between them and with the aid of images, we are able to provide constraints on the emission measure reconstruction and on the different emission measure components.



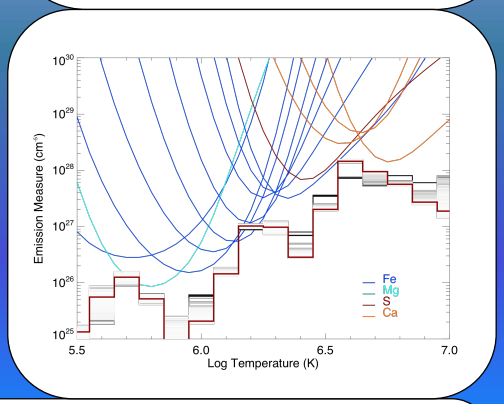


Hinode/EIS Spectra





DEM



Remarks

- The reconstruction is sensitive enough to clearly distinguish the difference between cool and hot components.
- The cool component is significant, although almost featureless, up to logT~6.3 and seems to set a lower sensitivity threshold at ~10^{26} cm^{-5} on the hot side.
- The hot component shows a well-known increasing trend and a clear peak at logT~6.6, but there is considerable emission measure at higher T.
- Including narrow-band EUV channels (SDO/AIA) and X-ray filterbands (Hinode/XRT) does not add significant information *(not shown)*
- The analysis seems to confirm the possible presence of a very hot tail of the emission measure distribution, but the result may still not be conclusive.