Contribution ID: **251** Type: **Oral (Non-Student) / orale (non-étudiant)**

Coronal Temperature Determinations Using the Dielectronic Satellite Lines of Fe XVII and Fe XVIII

Friday 20 June 2014 09:45 (15 minutes)

We have been developing spectroscopic approaches to use the strength of dielectronic recombination (DR) satellite lines in the L-shell spectra of iron to infer the electron temperature of stellar coronae. In this approach, the strength of DR satellite lines relative to the associated parent line p, I_{DR}/I_p, is used to determine the temperature. The advantage of this method is that it does not require knowledge of ionization equilibria because both I_{DR} and I_p start from the same target ion. Moreover, this ratio varies steeply with temperature and, thus, in principle provides a very accurate measure of the temperature. However, the DR satellite lines are weak in L-shell iron spectra, and in the past appropriate lines had not been identified. We show that useful DR satellite features can found in the spectrum of the star Capella. These features are satellite lines to collisional parent lines in Fe XVII and Fe XVIII. The atomic data (radiative rates, autoionization rates, and energy levels) needed to apply this method are supplied by the Flexible Atomic Code, a multi-reference Møller-Plesset code, and laboratory measurements using the Livermore electron beam ion trap. We have derived several temperatures from this method, which are in general agreement with those derived from the standard ionization balance method.

Work by the Lawrence Livermore National Laboratory was performed under the auspices of the Department of Energy under Contract No. DE-AC52-07NA-27344. This work was supported by NASA Astrophysics Research and Analysis program award NNX12AH84G.

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Session Classification: (F1-6) Atomic, Molecular and Optical Physics - DAMOPC / Physique atomique, moléculaire et photonique - DPAMPC

Track Classification: Division of Atomic, Molecular and Optical Physics, Canada / Division de la physique atomique, moléculaire et photonique, Canada (DAMOPC-DPAMPC)