A collection of Notes from Important Papers Relating to Sunquakes and Solar Flares.

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Contents

1 Prelude

This document contains a collection of notes taken whilst reading various papers. Each section relates to one specific paper, although there maybe references to other papers included within said section. Any notes that are *emphasized* are my own thoughts, and are not statements that are contained in the paper. All notes are written in my own words, therefore, all notes can be used as text bodies for my own papers or thesis write up.

2 Hydrogen Balmer Continuum In Solar Flares Detected By The Interface Region Imaging Spectrometer (IRIS)

The following notes are taken from: Heinzel and Kleint (2014).

On page 1, in the introduction: As described by the collisional thick target model (CTTM Brown (1971)), electrons accelerated by the reconnecting coronal magnetic field, penetrate the into the lower atmosphere depositing energy along the way. Emission in the lower atmosphere is due to; heating, causing various line and continua emission; and collisions by non-thermal electrons exciting and ionizing the local plasma. If emission is of a wavelength comparable to the visible spectrum then the term white light flare is used to describe it. *That being said, white light flares also emit in wavelengths at the extremes of the visible range, such as NUV.* Continua emission contributing to white light flares are thought to occur via two processes, heating of the temperature minimum region, and hydrogen recombination at chromospheric altitudes Ding (2007). Downward directed hydrogen recombination continuum emission is associated with radiative backwarming of the photosphere, with the upward component being observable. The same hydrogen population also emits in EUV continuum below 912Å due to atomic Lyman transitions, emission which has been observed recently using the SDO/EVE instrument (Milligan et al., 2012, 2014). *searching for Milligan et al papers I stumbled across a paper that attempts to constrain plasma densities during a sample of X class flares. Might be very useful as a reference to draw upon for my own density approximations.* An estimate of the radiative energy in the optical has recently been made by Watanabe et al. (2013); Kerr and Fletcher (2014) and Milligan et al. (2014) using Hinode/SOT. The range of the spectrum covered by these estimates is small, and data is converted to energy units via fitting to a blackbody (BB) curve. This approach is not ideal, as the BB predicts low levels of emission in the Balmer continuum which contradicts increased levels produced using numerical simulations of the hydrogen recombination process. *There is no reference for the paper containing these hydrogen recombination simulations???? I found a nice paper by Adam Kowalski Kowalski et al. (2015), which may contain such simulations. May be it's worth emailing Adam to see if he wants to collaborate by running simulations based on my observations. Also, Milligan et al. (2014) may contain a reference to such simulations..* Observations of Balmer emission are desirable in order to determine the accuracy of such simulations and constrain models of WLF production. Most Balmer observations have been made form ground based telescopes at around the Balmer-limit of 3646 ÅṠome of this work detected the Balmer jump, whilst others observed a smooth transition from blue (Donati-Falchi et al., 1985) to Balmer continuum (Neidig, 1989). Observations contained in this paper are novel due to the fact that they are of a part of the spectrum which is beyond the Balmer limit. This helps to eliminate some of the usual difficulties in observing WLFs because flare contrast at this spectral range is greater than at visible wavelengths.

On page 2, in the Observations: S$\mu = \cos\theta = 0.83$. *This page has a nice figure showing locations of Balmer continuum as orange lines or blocks.*

On page 3, in the Observations: NUV channel provided by the IRIS spectrograph is technically capable of observing a wavelength range of 2783 to 2835 Å however, due to downlink constraints and to save time, only some of the is provided. This particular data set contains the "flare linelist" spectra which includes 2791 to 2806 Å 2813 to 2816 Å 2825 to 2828 Å and 2831 to 2834 Å wavelength windows, and is the level 2 science product. *level 2 includes dark current, flatfield and geometric calibrations.*

On page 3, in the Analysis of IRIS Flare Spectra:

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