ABSTRACTS

68.03

Testing the Electric Field Model in Solar Flares

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We are analyzing solar flares that show evidence for strong stationary Ca XIX emission at the start of impulsive hard X-rays. An example is an M3.3 event that occurred at 0857 UT on 1992 September 6 in active region AR 7270. The flare was observed in Ca XIX by Yohkoh BCS and simultaneously in hard X-rays by CGRO BATSE. A strong stationary component of Ca XIX emission was already present at the start of impulsive hard X-ray emission, indicating a temperature $T \sim 10^{6}$ K and an emission measure $EM \sim 7 \times 10^{54}$ cm$^{-3}$. Simultaneous Yohkoh SXT Be-filter images imply a simple loop structure for the main soft X-ray source, with a characteristic cross-sectional area of $A \sim 10^{17}$ cm$^{-2}$ and a half-length $L \sim 10^4$ cm. The detection of strong stationary soft X-ray emission before the peak of hard X-rays cannot be explained easily by the thick-target driven chrompheric evaporation model.

To explain these observations, we adopt a DC-electric field model in which preflare thermal Ca XIX emission is produced by current heating dominating early in the flare, and nonthermal EUV emission is produced by electron run-away acceleration dominating during the impulsive phase. We present a novel method for deriving the strength and temporal variation of the electric field.

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68.04

EGRET Analysis of the Solar Nuclear Line Flares of June, 1991


During June 1991, the Energetic Gamma Ray Experiment Telescope on the Compton Observatory observed the four energetic flares occurring on June 4, 6, 9 and 11 from the active solar region 0659. Spectral and temporal data were obtained with EGRET's large NaI detector and imaging spark chamber. The June 11 flare was observed to have gamma-rays exceeding 1 GeV and last for hours after the impulsive phase. The NaI spectra have been fit with a power law spectrum, a neutron capture spectrum and a solar excitation spectrum. From these fits, the fluences of the 2.223 MeV neutron capture line and the 4.43 MeV carbon excitation line have been estimated for each flare. An additional spectral component corresponding to neutron induced activity in the Compton Observatory is required for the intense flares of June 4 and June 6. This component provides an indication of the arrival times of solar neutrons at the observatory.

68.05

The Allowed Lines of O IV Near 1340 Å in High Electron Density Solar Flares

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Intersystem lines of O IV near 1400 Å have long been used as electron density diagnostics for solar plasmas at temperatures of around 160,000 K. In addition, however, several allowed lines of O IV near 1340 Å should become visible in conditions of high plasma electron number density ($N_e > 10^{12}$ cm$^{-3}$), such as during a solar flare. We present observations of the 1340 Å and 1400 Å regions of the solar spectrum for two solar flares, obtained by the SORB spectograph on board Skylab. We examine three candidate lines for allowed O IV in the flare spectra which occur at the correct wavelengths, but show that two of these are actually blends dominated by resonantly excited molecular lines of H$_2$. The third candidate line, at 1343.51 Å, was identified as the O IV allowed line. We present the density and temperature sensitivity of the ratio of allowed and intersystem O IV lines $R = I(1343.51 \text{Å})/I(1407.39 \text{Å})$. The 1343.51 Å line is clearly present in the first solar flare spectrum, and the ratio value implies an electron density of log $N_e = 12.6$. The second flare has a much weaker 1343.51 Å profile, but again the ratio value implies a high electron density. Both these electron density values are in good agreement with estimates for each flare from independent diagnostic ratios. The simple presence alone of a clearly observed O IV 1343.51 Å emission line implies an electron density greater than $10^{12}$ cm$^{-3}$.

68.06

Electromagnetic Properties of Langmuir Solitons and Solar Type III Radio Bursts

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A broad survey of Ulysses high time resolution observations of solar type III associated Langmuir waves is presented. The Langmuir waves appear to be mostly in strongly turbulent state. They occur as intense broad and narrow emission peaks corresponding to envelope and collapsing solitons respectively. The electromagnetic emission properties of both envelope and collapsing solitons are presented in the context of solar type III radio bursts.

68.07

Evolution of a Solar Active Region and Flare Productivity

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We have studied the evolution of an active region (AR 7515) in terms of flare productivity. This region appeared on the east limb on May 23, 1993 and continued its onward march across the disk. We followed its evolution until June 2. This region produced many small flares. We studied the topology, both magnetic and structural of the flaring region as observed at 17 GHz by the Nobeyama radio Heliograph (NRH) with a spatial resolution of 10 arcsec. During June, the Yohkoh SXT has a spatial resolution of 2.5 arcsec. Among other things, we find: (i) Flares are related with the appearance of a new region/loop which interacts with a pre-existing loop; this interaction acts as a flare trigger. (ii) There exist multiple sets of interacting loops in the same active region. Different bursts on the same day seem to come from different sets of interacting loops. (iii) Sometimes two or more sets of interacting loops can activate at the same time, giving rise to different peaks in the same burst. In the decay phase of some bursts there may appear a new or reactivated region/loop which becomes the source of new burst emission. (iv) A simple spiky burst in general originates from a narrow region and by implication from a compact set of interacting loops.

68.08

Variability in Sunspot Associated Microwave Emission: Umbra Oscillations?

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We report on microwave observations of sunspot associated emission that shows variability over a time scale of minutes. To our knowledge, this is the first time such rapid variability has been observed in microwave radiation from a sunspot. These observations were obtained by the Very Large Array.