talk reviews data from several coronal hard X-ray events observed by the *Yohkoh* Hard X-ray Telescope and other instruments in the context of the radio observations.

SH32B-04 1430h

High-Energy Aspects of CMEs Associated with X-Class Flares in the Present Cycle

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We review the properties of X-class flares as observed by Yohkoh in the present solar cycle. More than a half of about four dozen X-class flares were caught by Yohkoh from an early phase. Most of these flares have durations not as long as long decay events (LDEs), and yet their association with coronal mass ejections (CMEs) is very high. They often correspond to extended or halo events. The flares not associated with CMEs do not show ejecta in soft X-rays. The flare core usually shows compact morphology. Within the sensitivity of the Yohkoh Hard X-ray Spectrometer, the hard X-ray spectra extend to the MeV range only in 20% of these flares, and their temporal variations are typically soft-hard-soft. Concerning their association with interplanetary proton events at 20 MeV, not all the proton-associated flares are associated with CMEs or located close to the well-connected longitudes. We plan to incorporate analysis of additional data such as metric/kilometric radio spectra to study when and where the shocks form.

SH32B-05 1445h

Flare Plasma Cooling from 30 MK down to 1 MK modeled from Yohkoh, GOES, and TRACE Observations during the Bastille-Day Event (14 July 2000)

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We present an analysis of the evolution of the thermal flare plasma during the 2000-Jul-14, 10 UT, Bastille-Day flare event, using spacecraft data from Yohkoh/HXT, Yohkoh/SXT, GOES, and TRACE. The spatial structure of this double-ribbon flare consists of a curved arcade with some 100 post-flare loops which brighten up in a sequential manner from highly-sheared low-lying to less-sheared higher-lying bipolar loops. We reconstruct an instrument-combined, average differential emission measure distribution $dEM(T)/dT$ that ranges from $T = 1$ MK to 40 MK and peaks at $T_0 = 10.9$ MK. We find that the time profiles of the different instrument fluxes peak sequentially over 7 minutes with decreasing temperatures from $T \approx 30$ MK to 1 MK, indicating the systematic cooling of the flare plasma. From these temperature-dependent relative peak times $t_{peak}(T)$ we reconstruct the average plasma cooling function $T(t)$ for loops observed near the flare peak time, and find that their temperature decrease is initially controlled by conductive cooling during the first 188 s, $T(t) \propto [1 + (t/\tau_{cond})]^{-2/7}$, and then by radiative cooling during the next 592 s, $T(t) \propto [1 - (t/\tau_{rad})]^{3/5}$. From the radiative cooling phase we infer an average electron density of $n_e = 4.2 \times 10^{11}$ cm^{-3}, which implies a filling factor near 100% for the brightest observed 23 loops with diameters of ≈ 1.8 Mm that appear simultaneously over the flare peak time and are fully resolved with TRACE. We reproduce the time delays and fluxes of the observed time profiles near the flare peak self-consistently with a forward-fitting method of a fully analytical model. The total integrated thermal energy of this flare amounts to $E_{thermal} = 2.6 \times 10^{31}$ erg.

URL: http://www.lmsal.com/~aschwand/publications/publ.html

SH32B-06 1520h

Predicting Energetic Proton Events from Solar Soft X-ray Temperatures and Hard X-ray Spectra

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Apparently disparate phenomena of anomalous low temperature solar soft x-rays and spectrally hardening hard x-rays are empirically related to interplanetary energetic proton events and to one another; most flares that exhibit low temperatures in soft X-rays also exhibit spectral hardening in hard X-rays. The converse, however, is not always true - some spectrally hardening flares are not low temperature in the case of some very intense soft X-ray flares although the former are nearly always associated with proton events. Anomalous low temperatures associate with proton events for nearly all moderate to large soft X-ray flares where the heliographic location on the Sun provides good connectivity with the Earth. Thus, these phenomena appear to be complementary, one being a good proton predictor for large flares and the other a good predictor for moderate sized flares. In general, however, the two phenomena appear to be manifestations of a single species of solar flare. The defining characteristics of this species of flare and how it is related to these phenomena and to the production of energetic proton events is not well know at this time, but certain inferences may be mode from theory as well as some of its other of its observed properties.

SH32B-07 1535h INVITED

Energy Content in Flares From Gamma Ray Spectroscopy

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How the energy content of energetic particles is shared between electrons and ions is a fundamental consideration for understanding the acceleration processes in solar flares. The accelerated electron spectrum greater than about 30 keV can be deduced from measurements of the hard X-ray bremsstrahlung spectrum. The accelerated ion spectrum from a few MeV/nucleon to about 70 MeV/nucleon can be deduced from ratios of measured gamma-ray lines. The recent application of these methods to combined HXRBS and GRS SMM gamma-ray data from 19 strong gamma-ray line flares indicated aproximate equipartition of the energy between electrons and ions. The techniques used for these determinations will be discussed with emphasis on the ion spectral determination. A new extended study of more than 135 SMM flares will also be discussed.

SH32B-08 1600h

Energetic Ions Accelerated during the large solar flare of 24 May 1990: high energy gamma-ray observations

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The large flare of 24 May 1990 (GOES X9.3, N36 W76) was observed at X-ray/gamma-ray energies by PHEBUS aboard GRANAT (Talon et al., 1993, Solar Phys., 147,137) and described in detail in Debrunner et al., 1997 (ApJ, 479,997). The flare comprised an impulsive phase detected at gamma-ray energies up to 75 MeV, followed by a long duration tail at high energies. The long lasting emission was dominated by high energy gamma-ray continuum and by > 500 MeV neutrons. Here we combine the observations of the gamma-ray continuum in the 10-100 MeV photon energy range with calculations of pion-decay gamma-ray radiation to constrain the accelerated interacting ion distributions at energies above 300 MeV. We compare this information with the numbers previously obtained for this event (Debrunner et al., 1997), for ions above 30 MeV from the de-excitation gamma-ray line emission as well as from the observations of neutrons from ground-based monitors. We find that the complete set of gamma-ray observations cannot be reproduced with a single power law ion spectrum extending from gamma-ray line emitting energies to those characteristic of pion decay emission. Similar ion energy distribution behaviour has been reported for the energetic flare of 15 June 1991, and we discuss our results in the light of this previous finding. Finally we comment on the different characteristics found for interacting and escaping protons.

SH32B-09 1615h INVITED

Early HESSI Results and Prospects for Future Missions

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The primary objective of High Energy Solar Spectroscopic Imager (HESSI) Small Explorer mission is to investigate the physics of particle acceleration and energy release in solar flares, where the accelerated 10-100 keV electrons (and possibly MeV ions) appear to contain > 10-50 % of the energy released. HESSI utilizes rotating modulator collimators together with cooled germanium detectors to image X-rays/gamma-rays from 3 keV to 17 MeV. It will provide the first hard X-ray imaging spectroscopy (2 arcsec, 1 keV), the first high resolution (1-5 keV) spectroscopy of solar gamma-ray lines, and the first imaging (36 arcsec) of solar gamma-ray lines and continuum. HESSI is planned for launch in October 2001. I hope to present the first results from HESSI and discuss future missions to study high energy solar phenomena.

SH41A MC: 135 Thursday 0830h

Van Allen Lecture - Magnetospheric Imaging: Promise to Reality

Presiding: **J T Gosling,** Los Alamos National Laboratory

SH41A-01 0835h INVITED

Magnetospheric Imaging: Promise to Reality

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There is no abstract available for this presentation.

SH41B MC: Hall D Thursday 0920h

Shocks and Shock Manifestations Over the Solar Cycle II *(joint with SM)*

Presiding: **A Figueroa-Vinas,** NASA/Goddard Space Flight Center

SH41B-0748 0920h POSTER

A Preliminary List of Shocks seen by Wind, from Launch till August 2001

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From Wind launch until September 1, 2001 a list of 279 fast mode interplanetary shock passages is presented. The list contains one-point observations, mostly at Wind, and since 1998 many two-point observations (Wind and ACE spacecraft). The possible cause