two-dimensional classifications through measurements of T10 and CN bands and continuum points. Observations were obtained on nearly every night of an 18–night run in November - December 1990 and again during a 12–night run in January 1992 with the 1.0-m and 1.5-m telescopes at Cerro Tololo Inter-American Observatory.

The observed amplitudes of variation differ greatly from filter to filter. The variations appear to be due to two causes: changes in the temperature and T10 band strength of the red giant, and changes in the strengths of emission lines. The largest change occurred in the filter of longest wavelength (10975 Å) where the flux brightened abruptly by 0.7 mag between 1990 Dec. 5 and Dec. 6, probably as a result of emission in the hydrogen line Hβ, and stayed bright for at least 7 days. The flux in the continuum near 10400 Å was unchanged during this period. The T10 band strength at 7120 Å implied spectral types ranging from M1 to M4 but may be affected by line emission; a weaker T10 band measured at 7810 Å implied types in the range M4 - M5.

**Session 45: Max '91 - II**

**Oral Session, 2:00–5:30 pm**

**Regency North**

45.01

**Extended Solar Flare Emissions Observed by COMPTHEL**


Since the launch of the Compton Gamma-Ray Observatory in April, 1991, a number of solar flares have been observed by COMPTHEL within its ~1 steradian field-of-view. At least one of these, that of June 15, 1991, showed extended γ-ray emission which lasted for several tens of minutes after the impulsive phase of the flare. This particular event was unusual in that the impulsive phase of the flare occurred during orbital night, consequently, COMPTHEL did not begin collecting data from the sun until some 50 minutes after the onset of the flare. Nonetheless, γ-rays (including 2.2 MeV line emission) were detected during this forty period, possibly indicating a very extended phase of particle acceleration. The present status of the analysis of these data, including that of both the γ-ray and neutron emissions, will be presented. The imaging nature of the COMPTHEL experiment also facilitates a search for extended flare emission from other events which might be difficult to detect with traditional (non-imaging) γ-ray detectors. The preliminary results from such a search will also be presented.

45.02

**Gamma Rays from Pion Decay: Evidence for Long Term Particle Trapping in Solar Flares**

N. Mandzhavidze (Univ. of MD), R. Ramaty (NASA/GSFC)

We analyze the energy spectrum and time dependence of the 50 MeV to 2 GeV gamma rays observed from the 1991 June 11 solar flare. We show that the emission detected at the late phase of this flare with EGRET on the COMPTON Observatory can be best explained by a model in which the bulk of the particles were accelerated during the impulsive phase and subsequently trapped in a coronal magnetic loop. We fit the observed spectrum with a combination of pion decay radiation and primary electron bremsstrahlung. The trapping of the ions and relativistic electrons in the loop on time scales of hours requires that the level of the plasma turbulence and strength of the ambient coronal magnetic field be sufficiently low. The comparison of the 1991 June 11 data with data available for the 1982 June 3 and 1991 June 15 flares indicates that all three of these flares probably produced pions under similar conditions.

45.03

**SMM/GRS Measurements of Flare Anisotropy during Cycle 22**

W.T. Vestrand and D.J. Forrest (SSC/UNH)

During the rise toward the 22nd Solar Maximum, the Gamma-Ray Spectrometer (GRS) aboard the Solar Maximum Mission (SMM) satellite detected gamma-rays from nearly 100 flares with energies greater than 300 keV. The position distribution for those flares shows a limb brightening over the distribution predicted for isotropic emission. The subset of events detected above 10 MeV shows an even larger fractional limb excess. In contrast, the sample of flares detected at 30 keV during the same period by theHard X-ray Burst Spectrometer on (HXRBS) SMM shows a position distribution that is consistent with the predictions for isotropic emission. These Cycle 22 measurements therefore exhibit the same energy dependent limb brightening observed during Cycle 21. An important difference in the samples is that the Cycle 22 measurements at 10 MeV show several events that are located well on the disk. We argue that the detection of these disk events indicates that the transport of high energy particles in flare loops probably plays an important role in regulating the flare radiation pattern.

45.04

**Simultaneous Hard X-ray, Soft X-ray, Millimeter and Microwave Observations of a Solar Flare**

S. M. White, M. R. Kandu, J. Lim and N. Gopalaswamy (UMd)

We present non-imaging data across a wide range of wavelengths for a solar flare which occurred on 1991 June 13. This flare is of interest because it shows a spike in hard X-rays at the beginning of the event which had a relatively hard X-ray spectrum, and was followed by a much softer impulsive phase. We present the BATSE and OSSE observations (from the Gamma Ray Observatory): the former have good time resolution, while the latter provide well-resolved spectral information. These are contrasted with the GOES soft-X-ray data on the hot thermal component in the corona, and radio observations up to 86 GHz which are sensitive to both the nonthermal and thermal components of the flare. The 86 GHz data from the BIMA millimeter interferometer show a spike in the impulsive phase coincident with the hard X-ray spike above 100 keV, as well as a long-duration thermal phase which appears to be consistent with an origin in the same material seen by GOES. We discuss the implications of the observations for particle acceleration in this flare.

45.05

**Solar Radio Pulsation Event Observed by the VLA and OVRO**

M. J. Aschwanden (UMd, NASA/GSFC), T. S. Bastian (NRAO), D. E. Gary (Caltech)

We investigate interpretational aspects of the radio pulsation event which has been observed by the Very Large Array (VLA) and the Owens Valley Radio Observatory (OVRO) on December 21, 1990 (1930 UT), during the second MAX '91 observing campaign. The VLA was observing with a time resolution of 0.4 s at 0.33, 1.4 and 4.9 GHz, while OVRO used a time resolution of 0.2 s at 1.2,