40.05
Solar Variability Measured by SMM/ACRIM Compared with Ground-Based Photometry.

G.A. Chapman, A.D. Herzog, J.K. Lawrence, S.R. Walton (SFOD/CSUN), H.S. Hudson, B. Fisher (UCSD)

The total solar irradiance, measured by the SMM/ACRIM (Solar Maximum Mission/Active Cavity Radiometer Irradiance Monitor), during June and July 1988, is compared with sunspot and facular irradiance fluctuations measured at the San Fernando Observatory. This time period corresponded to the passage of a large sunspot group. The Ground-Based data are from the Cartesian Full Disk Telescope (CFDT). The photometer has a telescope of 5.5 cm aperture resulting in a spatial resolution of 5 arc-sec. Sunspot deficits are determined from those pixels that are darker than 8.5% of the quiet sun as seen through a 102A filter centered at 6723Å. The facular excesses are determined from those pixels that are brighter than 4% of the quiet sun in a 10 arcmin filter centered at 6723Å. This contrast criterion corresponds to a positive contrast greater than about 2.5-sigma above the quiet sun rms-noise. The Photometric Sunspot Index will be compared to the photometric sunspot deficit, based on pixel-by-pixel photometry. Results for several different photometric facular irradiances models will be presented. The best value for the quiet sun irradiance, after removing the sunspot and facular signals, is approximately 1365.7 W/m^2. This research was partially supported by Grants ATM-8817634 and AST-8803309 from the NSF, and NASA-88B and NASA-881213 from NASA.

40.06
Solar Luminosity Variability up to 10 mHz

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The ACRIM instrument on board SMM made precise measurements of the total solar irradiance during 1980-1989 through a mechanical shutter with 131.072-s period. For a three-month period in 1989, we turned this shutter off to permit continuous sampling, up to the limit set by the thermal properties of the sensor. This paper presents the initial results obtained from an initial time-series analysis of 232 orbits of these data during the latter half of August, 1989. From individual power spectra calculated for each orbit, we have determined the broad-band power spectrum in the domain of 0.48 < f < 61 mHz. These spectra exhibit a white noise floor at (3.46 ± 0.06) x 10^{-4} Hz^{-1} fractional variance units, > 20 mHz, which we attribute to instrumental noise. A red power-law continuum of the form (f/1 Hz)^{-1.45±0.03} Hz^{-1} fits the low-frequency portion of the spectrum, excluding the p-mode band, and intersects the white noise at about f = 10 mHz. The excess power in the p-mode band agrees with the integrated power expected from the known amplitudes of the low-degree p-modes. At 3 mHz, the envelope of the smoothed p-mode power density is about 60% above the background broad-band noise continuum. We will discuss the possible time variability of these spectral features.

40.07
A model of 3-dimensional compressible convection

M. Hossain and D. J. Mullan (Bartol)

We have developed a new code for simulating hydrodynamic convection in three dimensions. The code is fully compressible, and does not suppress sound waves. The code has been applied to a stratified medium, varying in pressure from top to bottom by factors of almost two orders of magnitude. The boundary conditions are taken to be periodic. In the vertical direction, the top and bottom boundaries are taken to be open and stress-free, to demand that as the solution evolves, the horizontal averages of both pressure and density remain equal to their initial values on these boundaries. We incorporate sub-grid modelling, and radiation losses are included by adding a diffusive energy loss to the energy equation such that the maximum flows have Mach numbers of a few tenths. Applying an initial velocity perturbation, we follow the evolution for hundreds of sound crossing times. The flows are dominated by convergent and divergent points, superposed on which are slower eddy-like motions which transport heat upwards. Downward fluxes of kinetic energy appear when the solutions achieve statistically steady state. Cuts through vertical planes indicate that the flow becomes globally ordered, with smaller structures stacked on top of larger ones. The vertical scales of the structures are close to the local pressure scale height.

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Session 65: Supernovae Oral Session, 2:00-3:30 pm Cochiti

65.01
Gamma-Ray Diagnostics of Supernova Explosions

Adam Burrows (Arizona) and Lib-Sin The (Clemson)

The importance of supernova radioactivities was just recently demonstrated with the serendipitous appearance of SN1987A in the LMC. Its optical, ultraviolet, and infrared luminosities from only one month after the neutrino burst to date have been shown to be powered by the radioactive decay of ^56Co, itself from the decay of ^56Ni. Importantly, a host of gamma-ray instruments have directly detected both the ^56Co gamma-ray lines at 947, 1228, and 2599 keV and their Comptonized hard X-ray continuum. These data are the first of their kind of a supernova of any type and have, in the main, been successfully modeled.

However, the 0.075MeV of ^56Ni that seems to have been ejected in SN1987A is dwarfed by the 0.3-1.0MeV of ^56Ni that is posited to be in the ejecta of a Type Ia supernova. It is now thought that these, the brightest and most uniform of supernova types, involve the explosive disassembly of a compact carbon/oxygen white dwarf near the Chandrasekhar mass (~1.4M_{sun}) and its partial thermonuclear incineration to ^56Ni.

The variety of other supernova types (e.g. Type IIp, III, Ib, Ic) must be associated with a variety of progenitor structures and ^56Ni yields. A consequence of this heterogeneity is that there is a spectrum of radioactive gamma-ray and hard X-ray signatures that can be used to type, characterize, and diagnose the explosions and explosion mechanisms. In this contribution, we discuss the g- and X-ray emissions from models for SN1987A, Type Ia's, and exploded Helium cores (Type Ib, Ib). We devise theoretical discriminants that will be useful when comparing with the hard-photon data anticipated from the GRO, Sigma/GRANAT, the NAE, and NASA's on-going high-energy balloon program.

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