53.12
Solar Brightness Temperature in the Region of the Temperature Minimum from Radiometrically Calibrated Submillimeter Spectra

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Submillimeter solar spectra between 20 and 90 cm\(^{-1}\) (500 - 110 μm) have been measured from balloon altitudes and compared with spectra of a radiometrically calibrated 1165 K black-body source taken in flight. Source depths for the continuum radiation at these wavelengths include the temperature minimum region of the solar atmosphere and so this comparison provides a measure of solar brightness temperature through these depths. Particular care was taken to maintain a constant thermal background upon the instrument throughout both the solar and calibration measurements. High spectral resolution (0.015 cm\(^{-1}\)) ensured that spectral contamination from absorption lines of residual stratospheric H\(_2\)O, O\(_3\) and O\(_2\) was minimal.

The measured temperature minimum of 4300 (+130/-200) K at about 65 cm\(^{-1}\) is in close agreement with model M of the Verner/Ruvald/Leecher solar atmosphere, but appears to be somewhat sharper than their prediction. This result is in conflict with the recent suggestion that the temperature minimum value might change periodically over the solar activity cycle.

53.13
Secondary Condensational Instability*

L.P. Goldberg (Glassboro State College) and R.B. Dahlburg (Naval Research Laboratory)

We determine by means of a numerical simulation the two-dimensional stability properties of the one-dimensional secondary equilibrium state of a radiation-driven thermally unstable fluid reported by Oran, Mariika, and Boris [1]. For the simulation we employ the THERM2D numerical algorithm [2]. The secondary steady equilibrium state is perturbed by broadband random excitations in the velocity field, and then allowed to evolve. We find that strong secondary instabilities occur, and that the perturbed system moves toward a two-dimensional state. The mass density forms clump-like structures, while the temperature exhibits a kink-like structure. High velocity vertical flows are seen in the vicinity of the mass-density maxima.

Analysis of this phenomenon is difficult due to the complexity of the governing differential equations. We present the first phase of a linear stability analysis. After linearizing the governing equations and performing a normal mode analysis, we formulate a generalized eigenvalue problem for the linear stability of the secondary equilibrium.


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53.15
Small-Scale Eruptive Filaments on the Quiet Sun

L.M. Herman and S.F. Martin (Caltech)

We conducted a study of a little known class of eruptive events on the quiet sun. Small-scale eruptive filamentary structures were identified in a systematic survey of 32 days of H\(_\alpha\) time-lapse films of the quiet sun acquired at Big Bear Solar Observatory. When fully developed, these structures have an average length of 15 arc seconds before eruption. They appear to be the small-scale analog of large-scale eruptive filaments observed against the disk. At the observed rate of 1.9 small-scale eruptive features per field of view per average 7.0 hour day, we estimate the rate of occurrence of these events on the sun to be greater than 600 per 24 hour day. The average duration of the eruptive phase was 20 minutes while the average lifetime from formation through eruption was 70 minutes. A majority of the small-scale filamentary structures were spatially related to cancelling magnetic features in line-of-sight photospheric magnetograms. Similar to large-scale filaments, the small-scale filamentary structures sometimes divided opposite polarity cancelling fragments but often had one or both ends terminating at a cancellation site. Their high numbers appear to reflect the much greater number and mixture of small-scale than larger scale aggregates of opposite polarity photospheric magnetic flux on the quiet sun. From their characteristics, evolution and relationship to photospheric magnetic flux, we conclude that the structures described in this study are small-scale eruptive filaments and are a subset of all filaments. Support is acknowledged on grant AFOSR-82-0018.

53.16
Observation of the Density Sensitive Line Mg V 1324 Å in a Solar Sunspot


We have observed the 1324.43 Å line of Mg V (identified in Sandlin et al., Ap., 214, 899) in Spacelab 2 observations by the High Resolution Telescope and Spectrograph of a downflow in a sunspot from NOAA AR 4682 on 1 August 1985. The 2z^2p\(^{1}g\) - 2z^2p\(^{3}P\) transition in Mg V is spin forbidden and the upper level population is density sensitive in the 10^-10 cm\(^{-3}\) range of electron density. We have calculated level populations for a five level atom using A values and collision strengths from Bhatia et al., (Astr. Ap., 80, 22) extrapolated to Z = 12. The Mg V ion peaks in abundance in a model solar atmosphere at 2.3x10^10 K (Jordan, M.N.R.A.S., 142, 501), fairly close to the temperature of maximum abundance of O V. We have calculated the density ratio R = (O V 1371 Å) / (Mg V 1324 Å) using the allowed 1371 Å line of O V which is commonly observed in the solar atmosphere. This gives a density sensitive ratio in the n = 10^-10 cm\(^{-3}\) range. The observed ratio value in the sunspot flow corresponds to the low end of this range.

53.17
The Formation and Decay of Sunspots in Enhanced Solar Network

S.H.B. Livi (Instituto de Fisica, Univ. Federal do Rio Grande do Sul, Brazil) and S.F. Martin (Caltech)

The development and decay of a cluster of small, new sunspots was observed for three consecutive days within an area of enhanced network. The data consists of time-lapse videomagnetograms at 6103 Å and filtergrams at 6103 Å and H\(_\alpha\), all recorded at Big Bear Solar Observatory. All of the new sunspots were of negative polarity and formed within negative polarity network magnetic fields. The individual sunspots in the cluster formed and decayed as the associated fragments of network coalesced and dispersed. These observations clearly show that the concurrent emergence of new bipol-