35.08
Sources of Fine Structure and Frequency Drift in Microwave
Spike Bursts During Solar Flares

Observations of microwave spike bursts emitted during solar flares show fine structure in both frequency (with drift rates of order 1 GHz/sec) and time (with spikes having a duration of order 10 ns). The causes of this fine structure are not well understood. Previous studies, while successfully showing that overall characteristics of the spike bursts can be explained by the electron cyclotron maser instability, have not addressed the fine structure because they have assumed the plasma is homogeneous. In this paper, we investigate the sources of this structure by using one-dimensional, electromagnetic simulations of plasmas with a non-uniform magnetic field whose inhomogeneity arises from localized current systems. Emission features are found in which the frequency either varies with time, falls with time, or both rises and falls. The frequency drifts more rapidly as the growth rate of the maser instability increases. At high growth rates, emission features are of longer duration than at low growth rates and appear across a wider bandwidth.

Absorption and reemission of maser radiation in the second harmonic layer in the solar corona smears the fine structure of the radiation emitted from the source region, with the result that emission structures are of longer duration than they would be if observed after emission from the source region of the fundamental.

Session 36: Stellar Atmospheres and Spectroscopy
Oral Session, 2:00–3:30 pm
Cochiti

36.01
Monte Carlo Opacity Calculations Beyond the Configuration Averaged Transition Picture*
B. G. Wilson, J. R. Albritton, D. A. Liberman
Lawrence Livermore National Laboratory

We have developed a Monte Carlo Detailed Configuration Accounting (DCA) code for obtaining the emissivity and opacity of steady-state non-LTE as well as LTE plasmas. Because of the enormous number of relevant configurations in hot dense plasmas, our previous treatment of bound-bound absorptions were treated in no greater detail than as configuration average transitions. In order to remove this deficiency, and as an alternative to inadequacies inherent in employing Unresolved Transition Arrays (UTA), a statistically motivated method will be presented in which individual level-to-level transitions are included explicitly. Calculated opacities comparing DCA, UTA, and detailed level-to-level results will be presented.

*Work performed under the auspices of the U.S. Dept. of Energy by LLNL under contract W-7405-ENG-48.

36.02
The UK/US Opacity Project
D. Milhous (U. Of ILL.)

The equation of state used in the UK/US Opacity Project is based on minimization of the total free energy of: (1) translational motions of atoms and ions; (2) translational motions of partially degenerate electrons; (3) internal excitation of atoms and ions; and (4) Coulomb interactions within the plasma. The internal partition function is cut off by an occupation probability formalism.

Computations have been performed for six typical mixtures ranging from super-metal-rich to extremely metal poor. These provide both thermal quantities used in stellar modeling and occupation numbers for the Opacity Project.

Support for this work has come from NSF AST85-19209, NSF AST 89-14143, and the National Center for Supercomputer Applications.

36.03
New Solar Interior Opacities from the OPAL Opacity Code
F. J. Rogers and C. A. Iglesias (LLNL)

We have computed a table of Rosseland mean opacities for the solar interior using a new opacity code. The density-temperature entries in our table are the same as those published earlier (Bachall and Ulrich 1988, Rev. Mod. Physics. 60, 296) where the opacity values were obtained by interpolation using the Los Alamos Astrophysical Opacity Library. We have done calculations at each table point (no interpolations) for several metal compositions.

The new opacities show increases of 10-20% near the convection zone over the Los Alamos results and a few percent at the solar center.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

36.04
Extension of the Opacity Project to Collisional Processes: Excitation of Fe II
A. K. Pradhan, Dept. of Astronomy, Ohio State University

The Opacity Project entails accurate, large scale calculations for radiative processes involving essentially all atoms and ions in astrophysical plasmas, in particular stellar envelopes. The same theoretical methods from atomic physics may also be employed to treat collisional processes e.g. electron impact excitation, dielectronic recombination etc. of atoms and ions. We report on our extensive calculations on electron excitation of Fe II including a large number of transitions. The close coupling approximation, using the R-matrix method, is employed and both non-relativistic and relativistic calculations have been carried out. For the non-relativistic case 38 states of Fe II are retained in the eigenfunction expansion whereas the relativistic calculations include 41 fine structure states. Collision strengths and rate coefficients have been obtained for several hundred transitions in Fe II and eventually we aim to have calculated excitation rate coefficients for approximately 10,000 IR, Optical and UV transitions in Fe II. This work is supported by a National Science Foundation grant no. AST 8996215.

36.05
C III λ1909 and the Electron Densities in the Broad-Line Regions of Active Galactic Nuclei Revisited
D.E. Osterbrock (Institute for Advanced Study)

Time-variability studies of broad emission lines and the continuum in Seyfert 1 galaxies have indicated shorter time lags, smaller linear dimensions and higher electron densities in their BLRs than previously generally considered. Models of BLRs with mean N_e = 10^{11} and 10^{13} cm^{-2} are compatible with many of the observational spectral data, as shown by Ferland, Netser, Rees, Persson and others, contrary to earlier statements that the mean N_e ≤ 10^{10} cm^{-2}, based on the observed strength of C III λ1909. The physics of forbidden lines, as applied to C III, is reviewed, and the oversimplified