Our observed spectra, scanned with SPO's fast microdensitometer, clearly show strengthening of C_2 lines in the penumbra relative to the photosphere and much weakening in the umbra in agreement with the predictions made by our molecular equilibrium calculations (Lee et al., 1981), corroborating the presence of C_2 lines in sunspots.

Pulsations of Plane Polytropic Configuration

Kyu-Hong Choi
Yonsei University

The periods and pulsation modes of the first four overtone pulsations are derived for plane polytropic configurations of indices n=1, 1.5, 3 and 5.

The periods of the fundamental modes for plane polytropic configuration are found to be consistent with the observed values for active galaxies or quasars.

Photoelectric Observations of NGC 2264*

Suk-Minn Kwon and See-Woo Lee
Seoul National University

To investigate physical properties of an extremely young open cluster, NGC 2264, we have performed *UBV* photometric observations during the period between January and March 1982. The color-magnitude diagram of the cluster was transformed into the theoretical H-R diagram, from which the age of the cluster was estimated. Discussing some positional pecularities of some members in H-R diagram, we shall examine the pre-phase of the zero-age main sequence for this cluster.

Distribution of Density, Temperature and Abundance in the Orion Nebula

Dong-Woo Kim and Seung-Soo Hong
Seoul National University

In order to derive the distributions of electron density, temperature and gas phase metal abundances within the Orion Nebula, we have performed non-LTE analysis to the radio observations of recombination lines and continuum flux over the frequency range from 0.1 GHz to 100 GHz. Our derived distribution of density is essentially the same as the result by Lockman and Brown (1975) in the following sense: The Orion Nebula has a very dense core of ~0.1pc size at the center, and this central core is surrounded by a rapidly declining density-region of ~0.5pc thickness, which is followed by an extended low density envelope of ~1pc radius. However, we have explicitly included the thermal balance condition in our non-LTE analysis, hence our derived distributions have internal consistencies. This enables us to derive the radial abundance variations of Oxygen and Nitrogen. The gas phase concentrations of these cooling elements have about the solar values at the very central part of the nebula, then decrease slowly ourward, and finally become about one quarter of solar values in the outer extended envelope. Such an outward decrease of gas phase abundance is interpreted as an outward increase of dust concentrations in the Orion Nebula.

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