

INDIAN INSTITUTE OF ASTROPHYSICS

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SOLAR PHYSICS

Jagdev Singh has commenced a detailed examination of *K* spectroheliograms to detect a possible correlation between areas of the Ca II network and the phase of the solar cycle. Preliminary studies by Raju have indicated that line intensity ratios belonging to the ions of carbon, nitrogen and oxygen iso-electronic sequences are also sensitive to electron density and temperature. Assuming a multilevel atom model he has completed the computations for the ions: Ne IV, Mg VI, Al VII, Si VII, P IX and S X belonging to the nitrogen isoelectronic sequence.

Gokhale had found earlier that a large variety of phenomena associated with solar magnetic fields may be interrelated phenomenologically in terms of movements of magnetic flux tubes of flux 3×10^{18} Mx. Using certain plausible assumptions, he has attempted to explain the amount of magnetic flux in these flux tubes, their production in the convection zone and their emergence above the photosphere. Gokhale finds that such flux tubes may provide most efficient longitudinal transport of energy that is introduced into them transversely by convective flows at large depths in the convection zone.

INTERSTELLAR MEDIUM

Shah has extended his calculations for the case of reflection nebula with the star in the rear. In composite grains, the cores consisting of either graphite, silicon carbide or silicate have radii in the range 0.04 (0.04) 0.12 micron. The ice mantle is chosen such that the ratio of mantle-to-core volumes is 4.4, 11 (11) 88 per cent. Similar calculations for mixtures consisting of graphite, silicon carbide, silicate and dirty-ice grains in different proportions have been undertaken. The extinction efficiencies for small smooth homogeneous spherical metallic particles (granules) have been calculated using rigorous Mie theory of electromagnetic scattering. The plot of extinction versus size-to-wavelength parameter $X = 2 \pi a/\lambda$ indicate strong size-dependent resonance-like features for spheres composed of sodium, potassium and calcium. A detailed calculation using wavelength-dependent refractive indices have

revealed some unusual profiles by the small metallic particles in the domain of Rayleigh scattering.

STELLAR PHYSICS

A major addition to the facilities available at the 102-cm telescope has been the commissioning of the coudé spectrograph and the automated spectrum scanner. The coudé spectrograph with Camera A of 61-cm focus yields dispersions of 12.8 \AA/mm in the blue and 20 \AA in the red. Camera B of 285-cm focus gives 2.8 \AA/mm in the blue region. The collimator-camera ratio for Camera A is 10, thus leading to good efficiency. The automated scanner is coupled on-line to the TDC-12 computer and, with cold boxes containing photomultipliers of different spectral responses, is capable of scans from 3300 to 11000 \AA . Both these new facilities provide major new avenues of opportunity to the researcher at Kavalur.

A programme of study of abundances and kinematical properties of CH-poor, G-K giants has been commenced by Kameswara Rao. The main interest is to obtain with the scanner the strength of the CH, CN NH molecular bands and thus measure the enhancements or deficiencies of C and N. Preliminary results from scanner data show that in CH-poor stars, NH is enhanced (as expected from theoretical considerations) indicating carbon deficiency and nitrogen enhancement.

Parthasarathy has used a near-infrared photometer with intermediate-band filters that isolate wavelengths at 7014, 8601 and 10 223 \AA , to study the close binary system BM Orionis. Several close binaries have also been scanned by him with 50 and 100 \AA band pass, in the continuum wavelength regions from 3300 to 6600 \AA .

Spectra of Nova Cygni 1975 have been obtained during the period 1975 September to December. Prabhu has studied the emission profiles derived from the spectra of the early nebular stage of the nova. The velocity structure of the profiles and the time variation of both the velocities and intensities of the emission peaks of $H\alpha$ are interpreted as due to an expanding system of rings at different latitudes with respect to a common polar axis.

Kochhar has investigated the problem of the points of bifurcation along the sequence of rotating axisymmetric masses and considered the effect of a general magnetic field on them.

Bhattacharyya has commenced a programme, with the Kavalur 102-cm reflector, of lunar occultation observations for study of diameters of nearby stars and components of unresolved binaries. An occultation of Spica by the Moon was observed at Kavalur on 1976 March 18 using this equipment. The immersion event was at the bright limb and hence the light curve was obtained, by observing in the core

of the solar K-line, using a 5 \AA exit slit in the monochromator. The observed light curve shows clearly the presence of the two components and is currently being analysed.

PHYSICS OF BLACK HOLES

Kapoor has studied the propagation of photons emanating from an isotropic source moving about a black hole. This study is an extension of his work on gravitational synchrotron radiation done in collaboration with Narlikar & Chitre. Thus, rather than considering exactly tangentially emitted photons in the plane of the orbit of the emitting particle about the central black hole, arbitrary emission of photons in any direction was considered using geometrical optics. The work suggests that one does not see the isotropic point source as such, and, in fact, as the source orbits the black hole, the remote observer (assumed to be situated in the plane of the orbit) witnesses multiple imaging. As the source moves about the black hole, the pattern of images keeps changing shape, degenerating into hornlike images first and then into concentric rings of different redshifts corresponding to the cases of near and perfect alignment respectively of the source, black hole and observer.

COMETARY PHYSICS

Bappu & Parthasarathy have carried out extensive scanner observations on Comet West (1975n) in 1976 March during its post-perihelion passage. Scans with exit slits of 5 and 10 \AA with the computer-controlled scanner in the pulse counting mode have been obtained of the head of the comet over a range of heliocentric distances of the comet. Sodium emission was last seen on March 17, at a heliocentric distance of 0.685 AU . This is in conformity with our expectations of solar wind behaviour near sunspot minimum. Scans have also been obtained of the ionic spectrum of the tail at different distances from the cometary nucleus. Drift scans of the cometary coma in the light of C_2 , CN and the continuum have been obtained to study the brightness distribution in the coma and molecular lifetimes.

LOW-FREQUENCY ANTENNA SYSTEM

Work on the construction of the decameter-wave radio telescope has progressed satisfactorily. The antenna system consists of two arrays arranged in the form of a 'T'. The east-west arm consists of four lines of dipoles over a length of 1.4 km . The north-south arm has 90 rows of dipoles extending over half a kilometre. The total physical area of the antenna exceeds $50\,000$ square metres. The project is being carried out in collaboration with the Raman Research Institute.

SOLAR TERRESTRIAL RELATIONSHIPS

Sastri & Murthy have examined the possibility of a correlation between an X-ray flare from Sco X-1 detected in the course of a balloon flight on 1967 October 15 and an increase in the horizontal component of the magnetic field observed at the equatorial station at Kodaikanal. Their examination of the available evidence shows that the observed geomagnetic perturbation at Kodaikanal was not due to a sudden impulse (SI) or a solar flare effect (SFE) but was a genuine effect of the X-ray flare from Sco X-1.

Sastri undertook a statistical survey of the data on crochets observed at Kodaikanal during 1966–1970 and on the solar microwave bursts monitored at 2000 MHz at Toyokawa, Japan, with a view to finding a correlation between the two. From a study of quarter-hourly ionogram data of Kodaikanal on 1958 October 28 around the sunrise period, Sastri finds that, at least on this occasion, the upward moving kinks are due to moving ionization irregularities, caused probably by atmosphere gravity waves, which, when they reach the overhead position of the ionosonde, are lifted up by the $\mathbf{E} \times \mathbf{B}$ drift.

Sastri & Murthy have started a systematic study of the characteristics of travelling ionospheric disturbances (TID) at Kodaikanal. The ionosonde recorder was used for continuous monitoring of f_0F_2 at 1-min intervals. An examination of the data showed small-scale fluctuations super-imposed on the diurnal trend in f_0F_2 characteristic of equatorial stations, which they have attributed to atmospheric gravity waves.

THE 234-CM TELESCOPE

There has been much progress in the initial design of the telescope. The telescope is to be mounted on a yoke at the centre. The north bearing is of the horseshoe type. The primary mirror is to be a paraboloid and there will be a Cassegrain and a coudé focus. The focal ratios at these three locations are $f/3.25$, $f/13$ and $f/46$. Provision is made in the building for a large coudé laboratory that can accommodate large and heavy equipment of the future besides the conventional spectrographs and monochromators. The drive is to be computer controlled. A spur-gear drive using torque motors is envisaged. The declination axis will be at a height of about 16 m above ground level. The dome will be of 21 m internal diameter. Prime focus guiding will be from a remote station on the observing floor. The site survey at Chickamagalur continued through most of the year. Site testing at Horsley Hills is to commence shortly.

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