

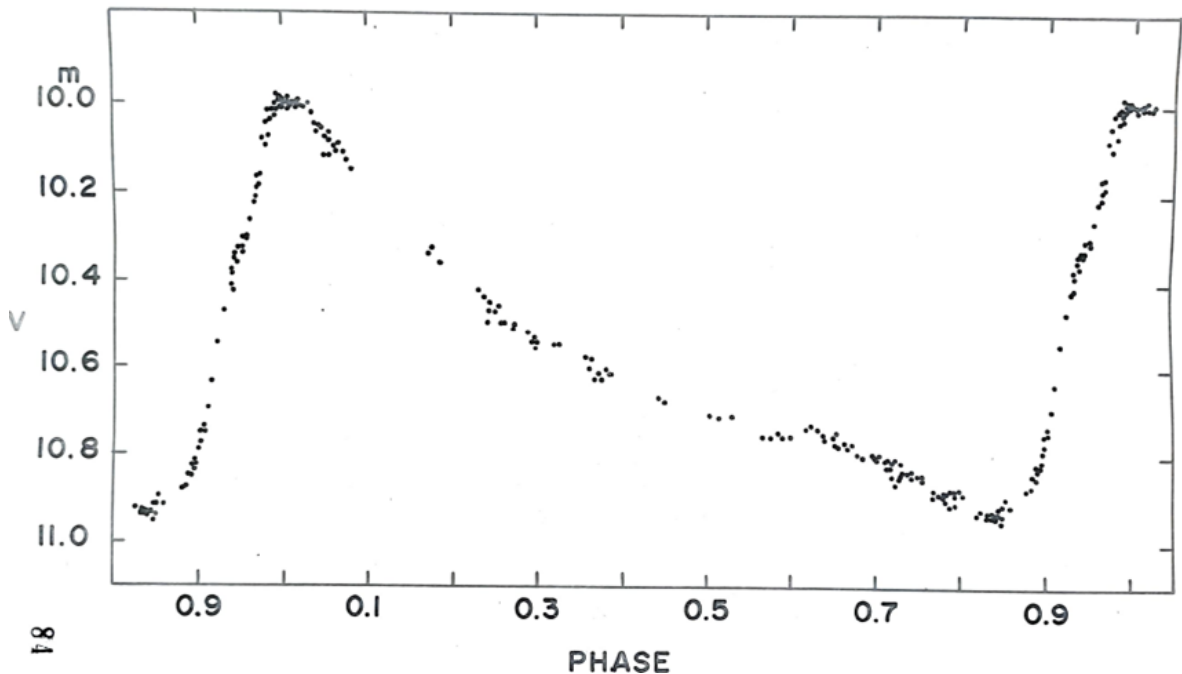


Highlights from Ph.D. Theses utilising data from the 104-cm Sampurnanand Telescope



50 Golden years of 104cm Sampurnanand
Optical Telescope

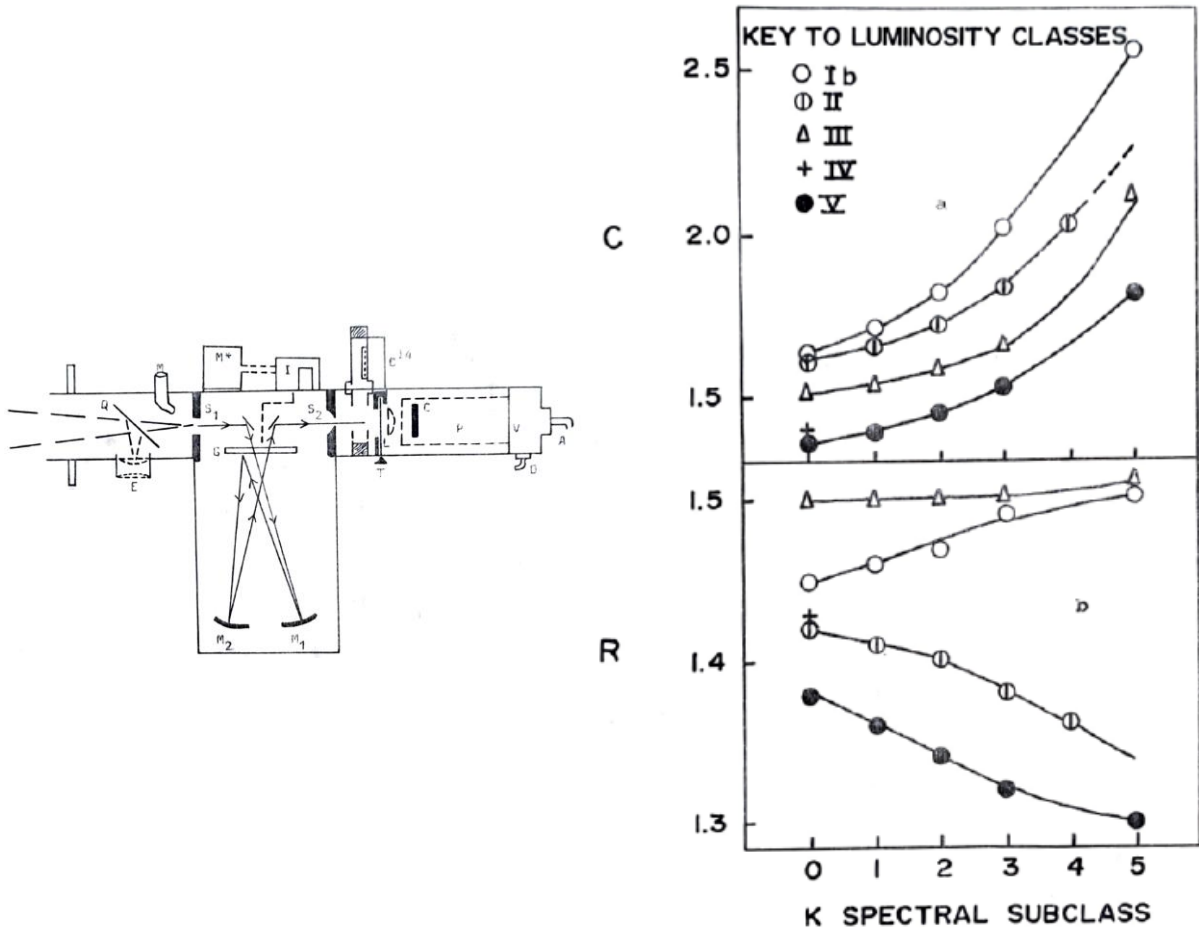
Short period Cepheid AR Per



Broad-band UBV photoelectric photometric 5 RR Lyrae stars were observed with a photometer mounted on 104cm ST in 1973. The physical properties such as period, luminosity and colour of these stars have been derived and a detailed study of empirical relations , e.g. period-radius, mass-period have been determined. This figure shows V-band light curve of AR Per. Similarly accurate curves for U-B and B-V colour have also been presented in the thesis.

Reference: Mahra, H. S., 1974, Ph.D. Thesis, Agra University.

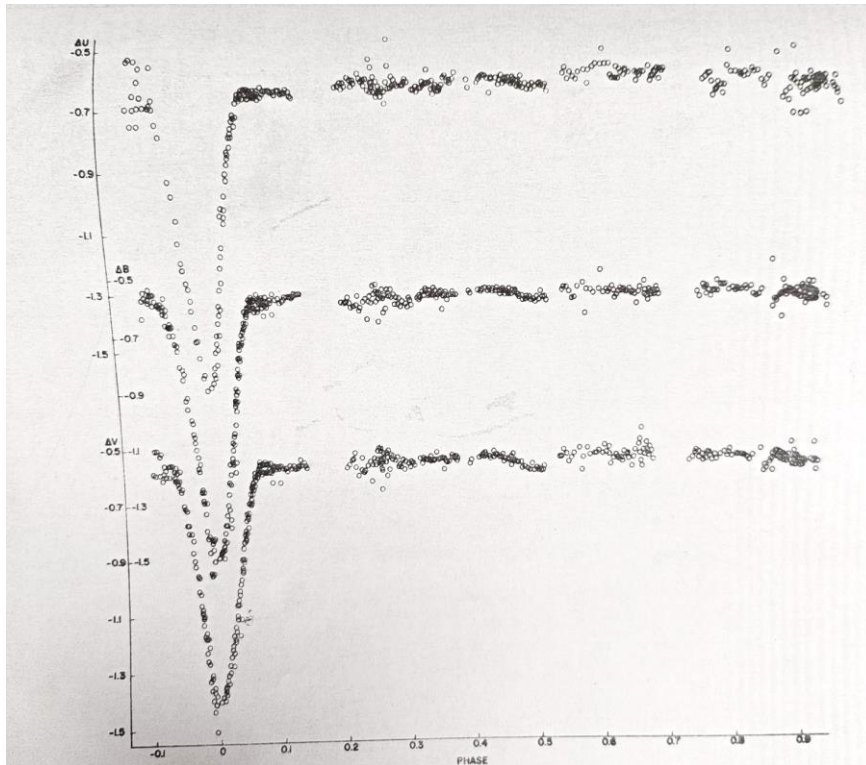
Spectro-photometric Studies of Late Type Stars



Narrow-band (5nm wide) observations of 51 late type stars in spectral range K0-5 were done at wavelengths 500, 600 and 700 nm using a photoelectric spectrum scanner mounted with 104cm ST in 1973. A schematic diagram of the scanner is reproduced above. The narrow-band magnitudes were used to determine color (C) and ratio (R) indices which were further used to define empirical relation for spectral subclasses. This figure shows indices for 27 stars. These stars were brighter than 6.5 visual magnitude.

Reference: Chaturvedi, J. P., 1974, Ph.D. Thesis, Gorakhpur University .

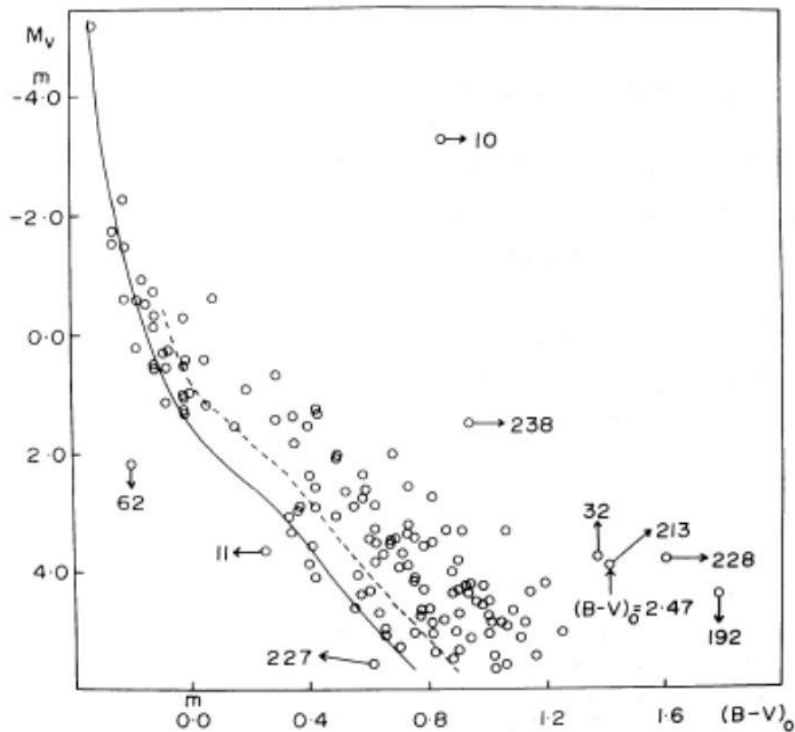
Studies In Eclipsing Binary Systems



This work presents the photoelectric observations of the systems GG Cas, CD Tau, TX Leo, CC Cas and XY Cep which are Algol-type variables. The absolute dimensions and detailed studies of the variables have been carried out. Evolutionary study of the systems has been discussed. The secondary Component of one of the system was found to be in supergiant stage. The relationship between period and mass ratio of eclipsing binary systems has also been studied.

Reference: Srivastava, J. B., 1976, Ph.D. Thesis, Agra University.

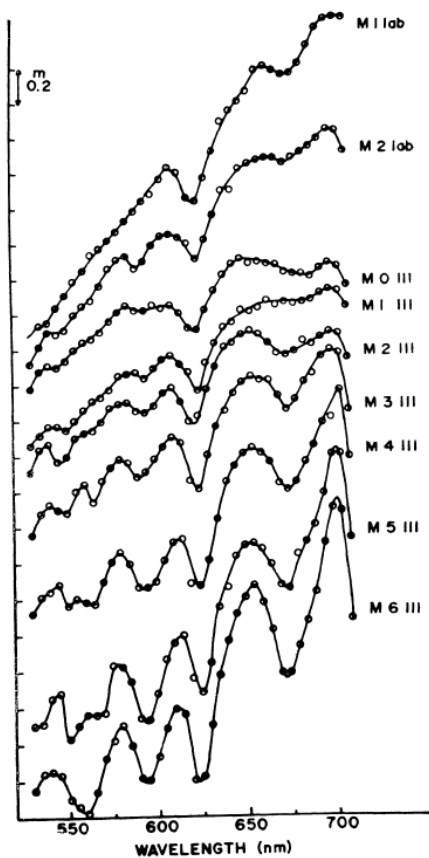
NGC 2264 - Young Star Cluster



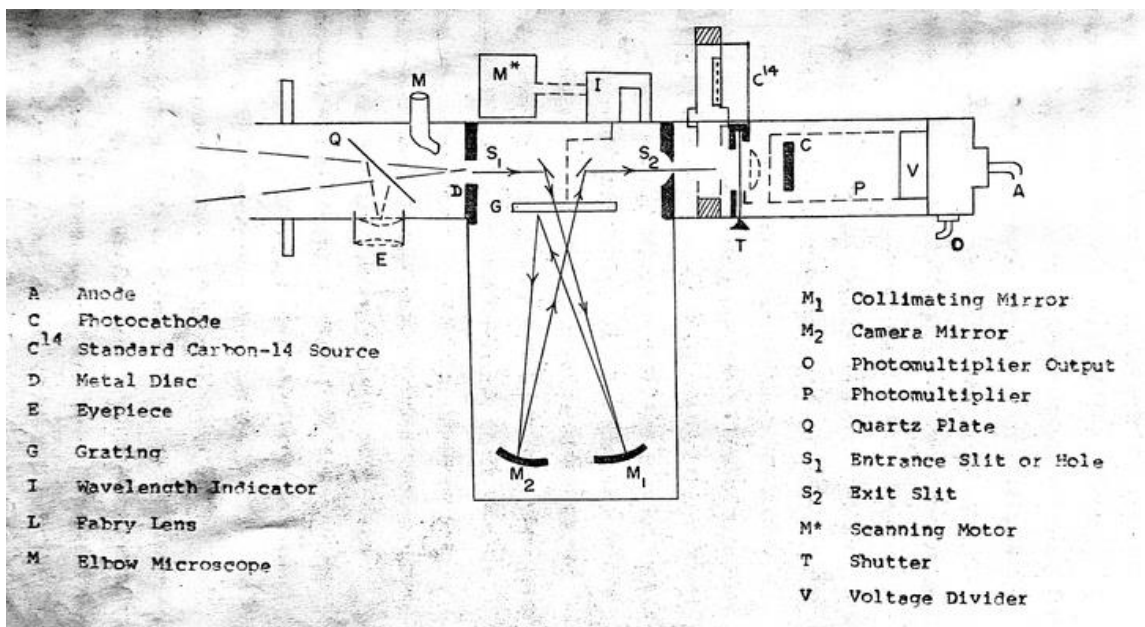
Photoelectric photometry of about 20 young open galactic star clusters were carried out with 104-cm ST during 1973 to 1980's. For most of them, cluster members were identified using proper motion data. Colour magnitude diagram for one the cluster namely NGC 2264 is displayed above. First paper on Photoelectric photometry of NGC 1778 was published in Pramana. This work indicated that duration of star formation in young star clusters could be several Mega years and slope of the Initial mass function above one solar mass is like Salpeter. Mass being one of the primary parameters which dictates the evolution of stars, such studies were used for constraining theories of star formation and early evolution of star clusters.

Reference: Ram Sagar, 1979, Ph.D. Thesis, Gorakhpur University.

Absolute Energy Distribution in Stars

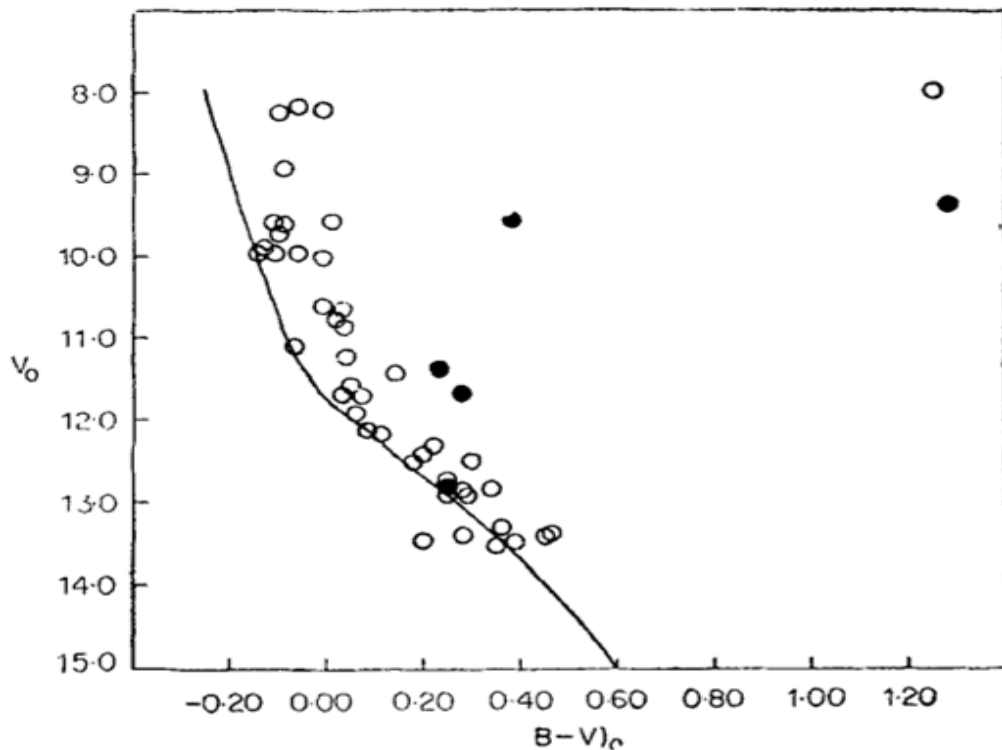


Several A-F in δ Scuti pulsation strip, classical Cepheids, and carbon stars are observed to find their absolute energy distribution (SED) using the photoelectric spectrum scanner as shown in Figure below. Classification of M-type stars was important results in this thesis. By comparing these SED with model atmosphere and black body curve, basic parameters like effective temperature, radius, mass and gravity of these stars were determined. The pulsation mass and evolutionary mass of Cepheid variables were also estimated.



Reference: Rautela, B. S., 1981, Ph.D. Thesis, Kumaun University.

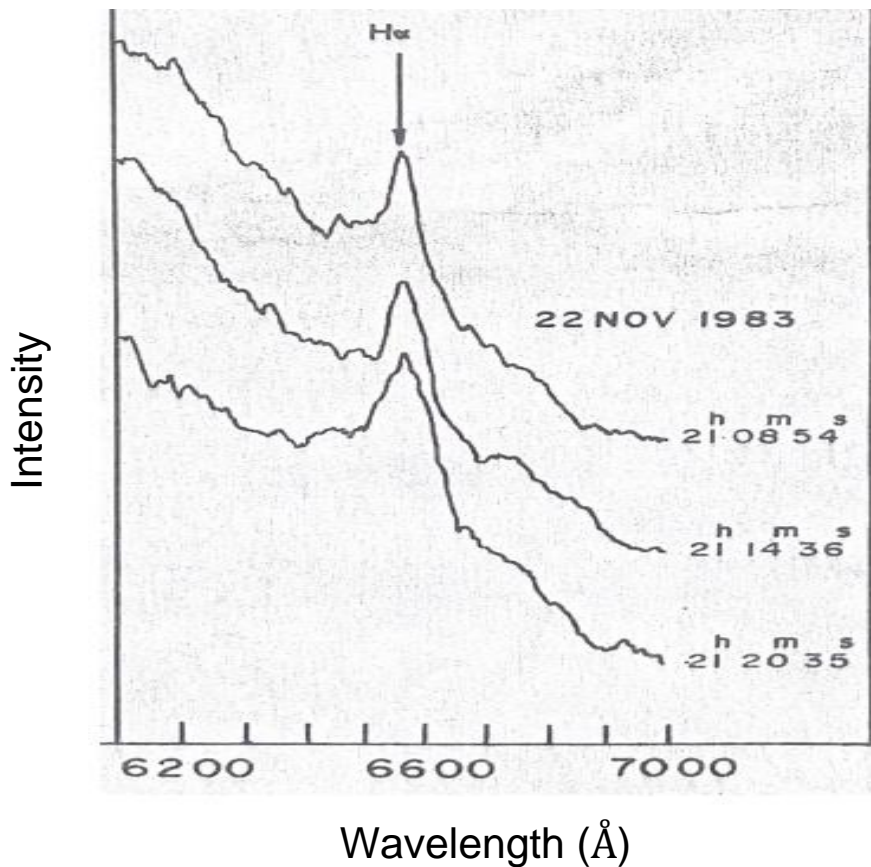
NGC 1778 - Open Cluster



This thesis is based on the photometric observations on six open clusters in UBV bands using the 104cm ST after the telescope was released for science observations. NGC 1778 is the first open cluster that was observed using ST during November 1973 and January 1974. The diagram above is the observed CMD of NGC 1778. In fact these were the first photometric observations to initiate research on open clusters in the country. In 8 years since 1973 a dozen clusters were successfully observed with ST. Study on 6 clusters (NGC654, NGC1778, NGC2539, NGC6913, IC1805, Tr1) is included in the thesis.

Reference: Joshi, U. C., 1981, Ph.D. Thesis, Kumaun University.

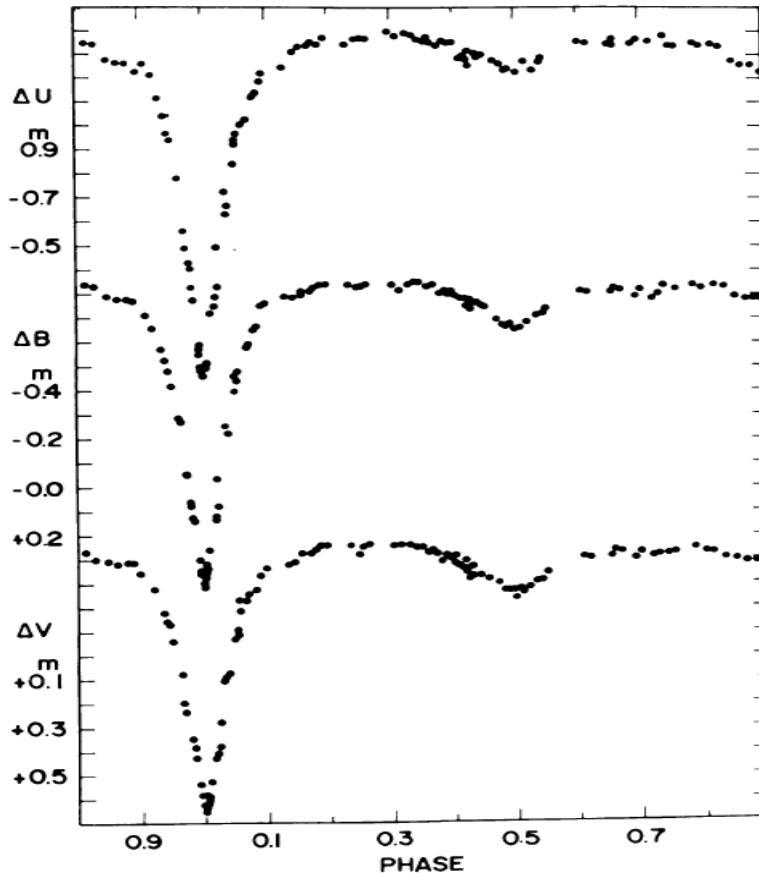
Spectrophotometric Studies of Be Stars



The spectrophotometric data of 70 Be stars were obtained in the optical region to investigate the influence of their envelopes on their continuous spectra. In order to transform the observations into absolute value α Lyr was observed with same instrumental setup. Interstellar reddening, distance modulus, spectral energy distribution, effective temperature and peculiarity were determined and compared to the LTE models. Our analysis shows that the Be stars in general show lower effective temperature than the normal B-type stars. We found that many Be stars possess near ultraviolet and near infrared excess and variations in strength of H α in their

Reference: Goraya, P. S., 1985, Ph.D. Thesis, Punjabi University

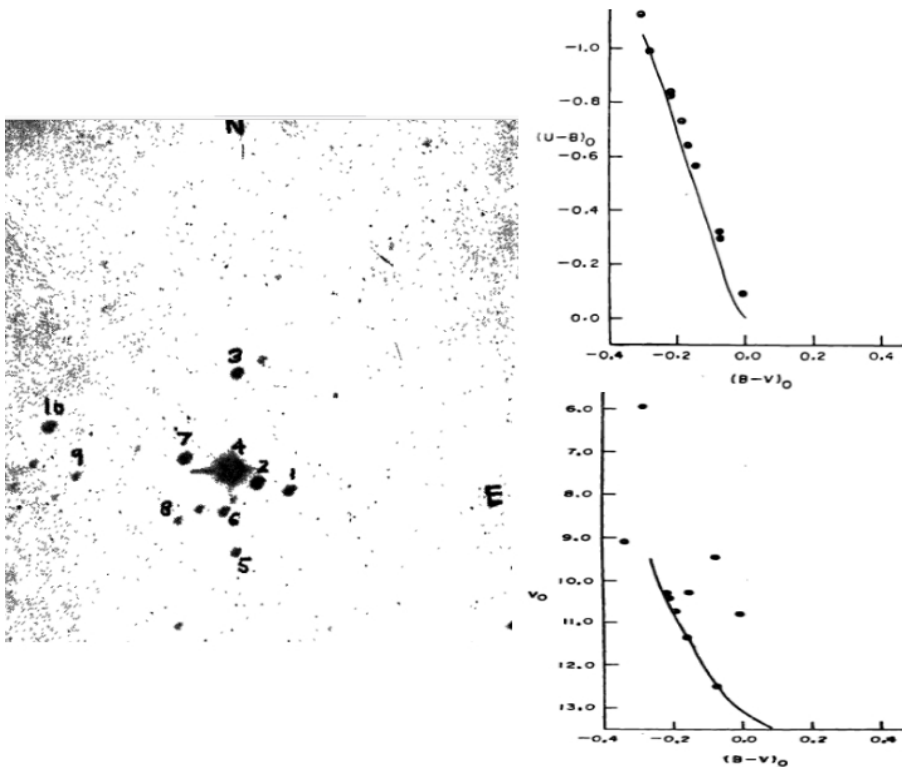
DI Peg - Eclipsing Binary



The photoelectric photometric light curve of DI Peg has been investigated. The observations were carried out with 104-cm telescope during the period October to December 1979. Fig 1. depicts the light curve of DI Peg in UBV filters. The analysis of DI Peg shows that it is a short period ($P=0.71$ days) semi-detached eclipsing binary in which a K3 subgiant eclipses a brighter star during the primary minima. Photometric observations show that hotter component is surrounded by a disk of circum-stellar material. Examination of the times of primary minima from 1962 to 1980 reveals that binary star DI Peg is in its mass transfer phase.

Reference: Chaubey, U. S., 1985, Ph.D. Thesis, Kumaun University.

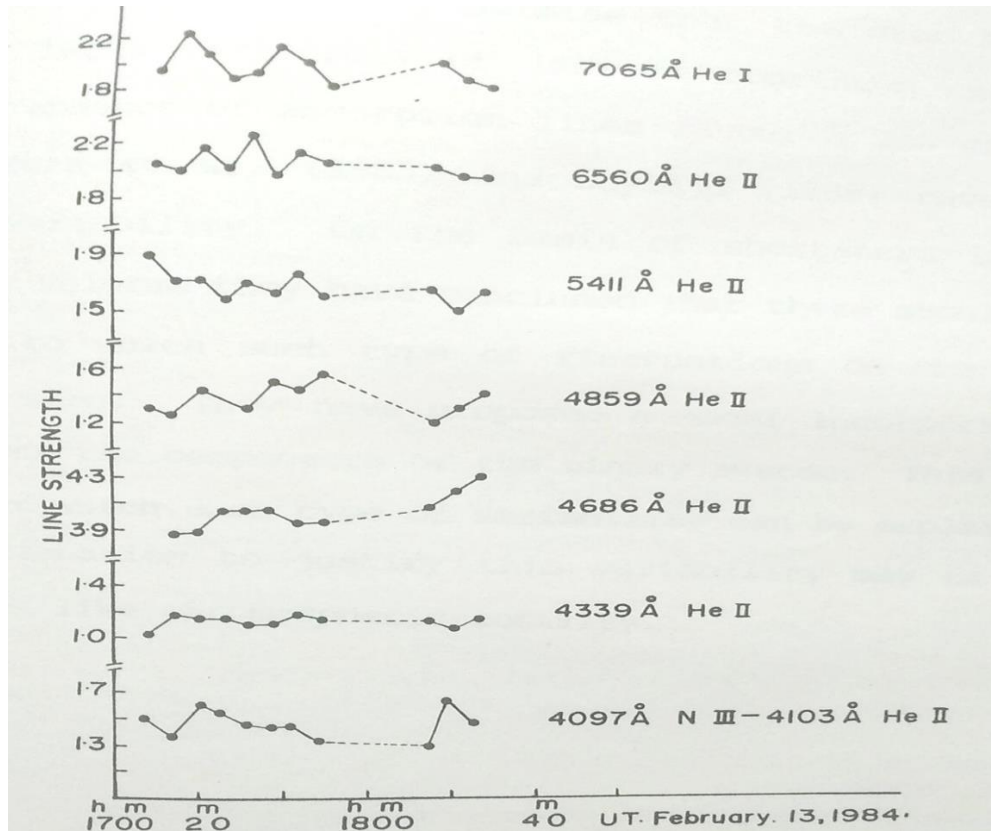
Stock 17 - Young Star Cluster



Four young clusters, namely King 21, King 12, NGC 1931 and Stock 17 were observed in UBV filters using the photomultiplier mounted on the 104 cm Sampurnanand Telescope. For these clusters no photometric data was available at that time. The observed magnitudes and colors were utilized to determine the cluster parameters, e.g., membership, reddening, distance and age. These observations along with the available photometric data for other clusters were further used to study the distribution of reddening material in the solar neighbourhood in the Galaxy. This slide shows identification chart (Left) and unreddened color-color and color-magnitude diagrams (Right) of the Stock 17.

Reference: Pandey, A. K., 1987, Ph.D. Thesis, Kumaun University.

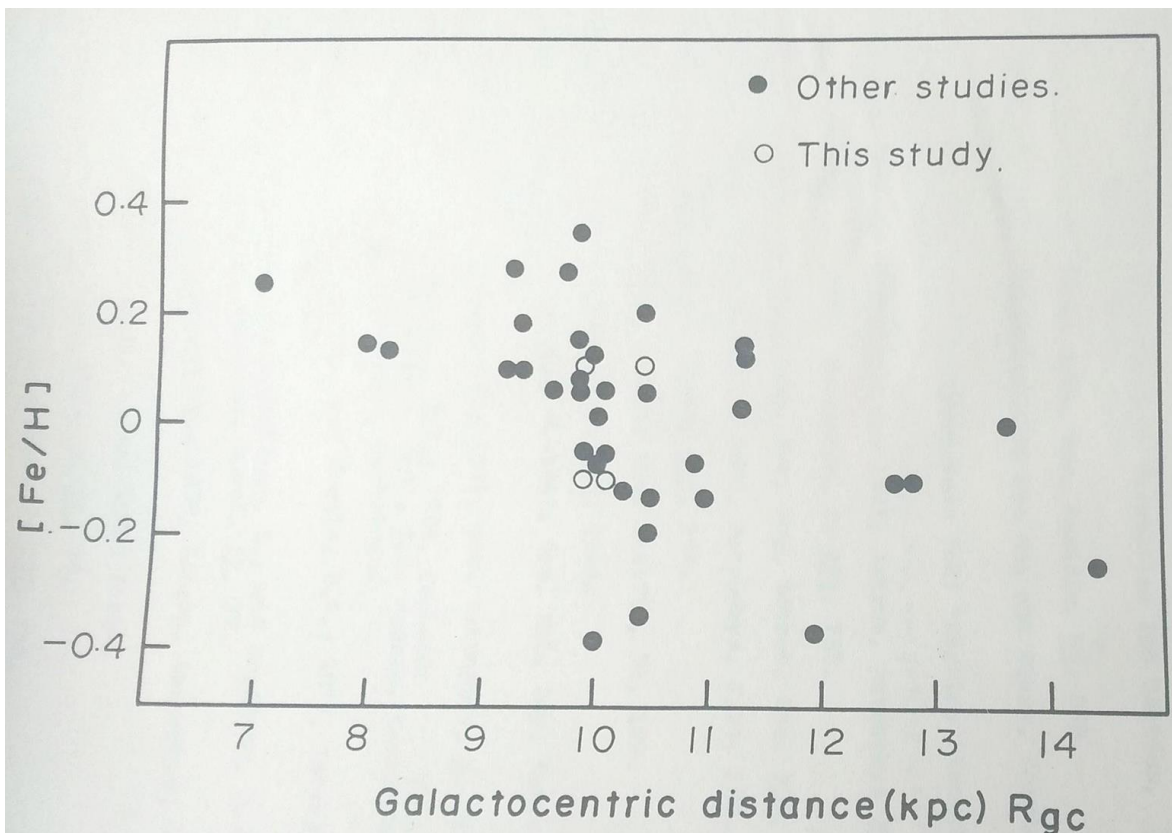
Early Type Be Stars



The salient features of the early type Be stars were explored 1.04-m telescope. On comparing the observed spectra of 20 Be stars were compared to the theoretical models, it was observed that there is excess of near infrared emission for majority of stars and for few of them the Balmer jump was seen. Estimation of the basic physical parameters and evolutionary status of the studied stars were also discussed. The large variation in the strength of Helium and Nitrogen were observed particularly in a Wolf-Rayet star HD50896. The stellar winds and mass loss phenomena in a sample of Wolf-Rayet stars were studied. The mass loss rates, star formation and initial mass function in these stars were studied and it is found that there is a large variation in their mass loss rates during their evolution.

Reference: Singh, M.; 1987, Ph.D . Thesis, Kumaun University.

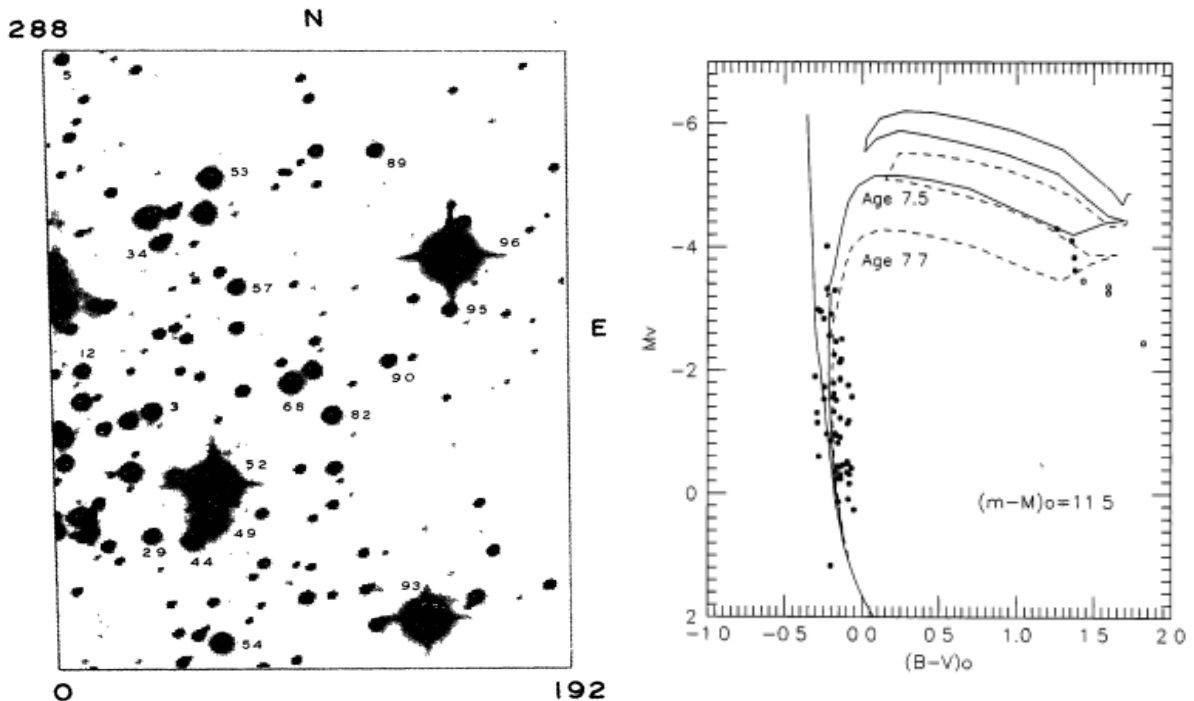
Galactic Cepheids



The fundamental parameters such as effective temperature, luminosity, mass, chemical composition of four Cepheids namely DT Cyg, SZ Tau, W Gem and X Cyg were determined using spectrum scanner on 104cm ST. A color-temperature, period-radius relations were derived for the studied stars. The radial velocity curves and visual light curves were compared and used for the estimation of stellar radius. The luminosity computed using standard relation were compared to the luminosity calculated using P-L-C relation. The mass calculated through pulsational relation were compared to the mass estimated using evolutionary method and found in consistent. This slide shows Fe/H and Galacto-centric distance plot for target objects.

Reference: Sanwal, B. B., 1988, Ph.D. Thesis, Kumaun University.

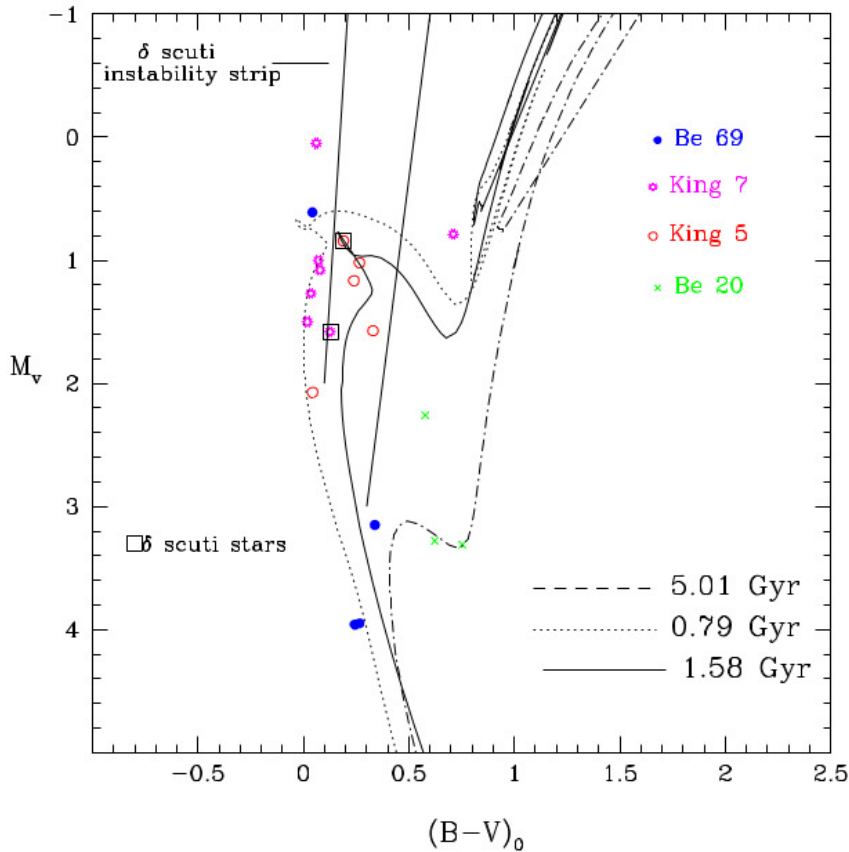
NGC 7419 - Young Star Cluster



The open star clusters, NGC7419, NGC1931 and NGC366 were studied using 104-cm Sampurnanand Telescope. The UBVRI CCD photometry have been made and various cluster parameters are obtained. This slide shows 3'x2' image covering a small part of NGC7419 taken with 104-cm telescope with 576x384 pixel Photometrics CCD system along with CMD diagrams to estimate age of NGC7419 and NGC366. A comparison of the theoretically obtained integrated parameters with the observational data of open clusters in the Milky Way and clusters in the LMC has also been made. This works also studies the large scale structure of the Milky way with help of the data of open clusters, WR stars and Supernova remnants.

Reference: Bhatt, Bhuwan, 1993, Ph.D. Thesis, Kumaun University.

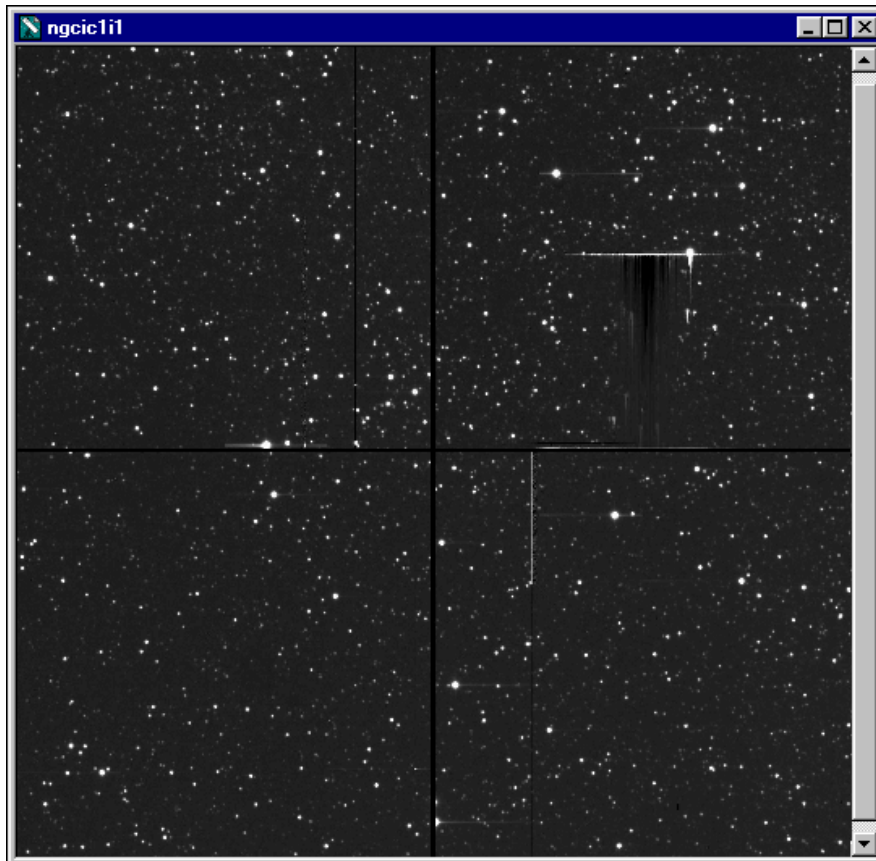
Be 69 - Open Star Cluster



The UBVRI photometric observations for the five star clusters Be64, Be69, King5, King7, and BVRI for Be 20 were carried out during 1990 to 1996 using the photometric CCD system at the f/13 Cassegrain focus of the 104-cm Sampurnanand Telescope. Spatial variation of mass function slope for these clusters were investigated. We have carried out time series photometry of the four clusters Berkeley 69, King 7, King 5 and Berkeley 20. A total of 19 variable stars are identified in these clusters.

Reference: Durgapal, Alok, 2001, Ph.D. Thesis, Kumaun University.

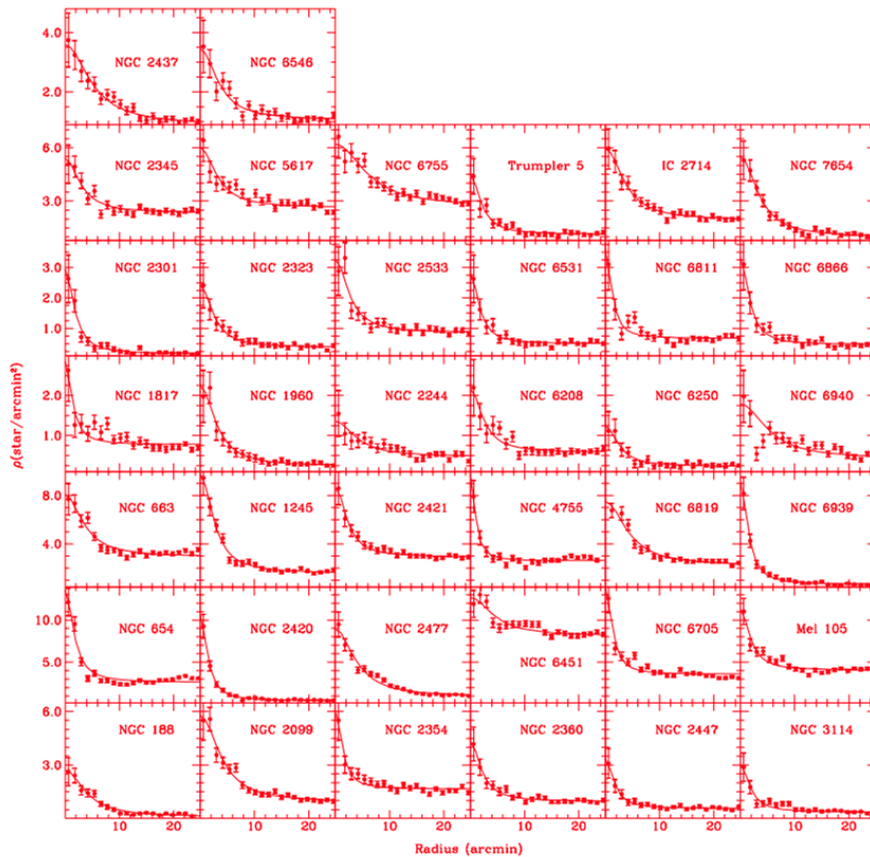
Open Cluster NGC6631



The *VI* photometric observations of NGC6631 open cluster were obtained on the 104-cm Sampurnanand telescope using a 4Kx4K mosaic CCD camera, covering 16' x 16' area on sky. For the first time, the *V* and *I* CCD photometry down to *V*=20 mag was obtained for 5,500 stars in wide region around NGC6631 open cluster. Each CCD in the mosaic was processed separately and the cluster parameters were determined and compared with previous observations using UPSO CCD camera system, validating the performance of the mosaic CCD camera as satisfactory.

Reference: Naidu, B. N., Ph.D. Thesis, 2001, Bangalore University.

Spatial Structures of Galactic Star Clusters



The thesis highlights the statistical study of the spatial distribution of stars in the forty-three rich galactic open star clusters and deep CCD photometric observations of extended regions of two clusters, NGC7654 and NGC2099, obtained using 104cm ST. The sizes and the core-corona structures of the clusters were determined by analyzing the radial density profiles of their member stars (shown in the above picture). The work concludes the dynamical evolution is not the only reason for the occurrence of corona, but the corona is an integral part of a cluster from the time of its formation. The massive stars form during the early phase whereas low mass stars form in the last phase of a cluster formation.

Reference: Nilakshi, 2001, Ph.D. Thesis, Kumaun University

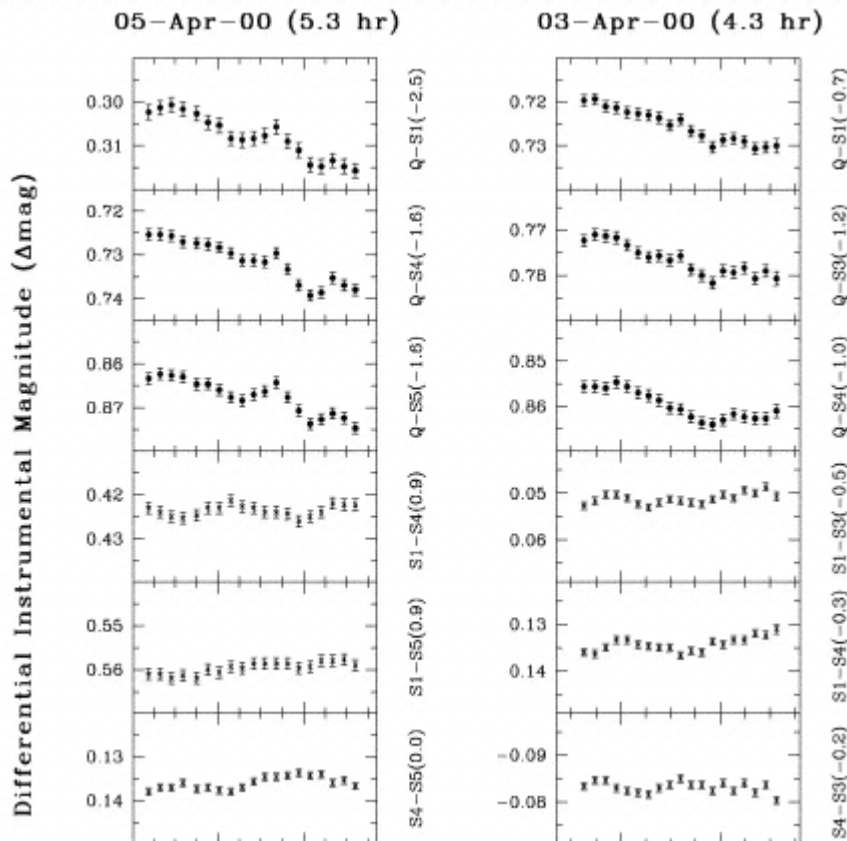
NGC 7067 - Open star cluster



The fundamental goal of the thesis was to investigate young star objects. The 104-cm Sampurnanand telescope (ST) was used to observe the six open clusters, Trumpler 1, Berkeley 11, Basel 4, NGC 7067, Bochum 1 and Bochum 6, from 1997 to 2001. The CCD image of the open cluster NGC 7067 taken with ST is shown above. The observations were made using a 2kx2k CCD camera with broad band filters. For these clusters, it was the first time that wide field CCD data had been gathered. These data sets were used to examine the clusters' structural characteristics and physical characteristics. Additionally, we investigated the mass function and mass segregation in these clusters. These data sets, coupled with the 2MASS data, were utilised to analyse the extinction law in the direction of the clusters.

Reference: Yadav, R. K. S., 2002, Ph.D. Thesis, Kumaun University.

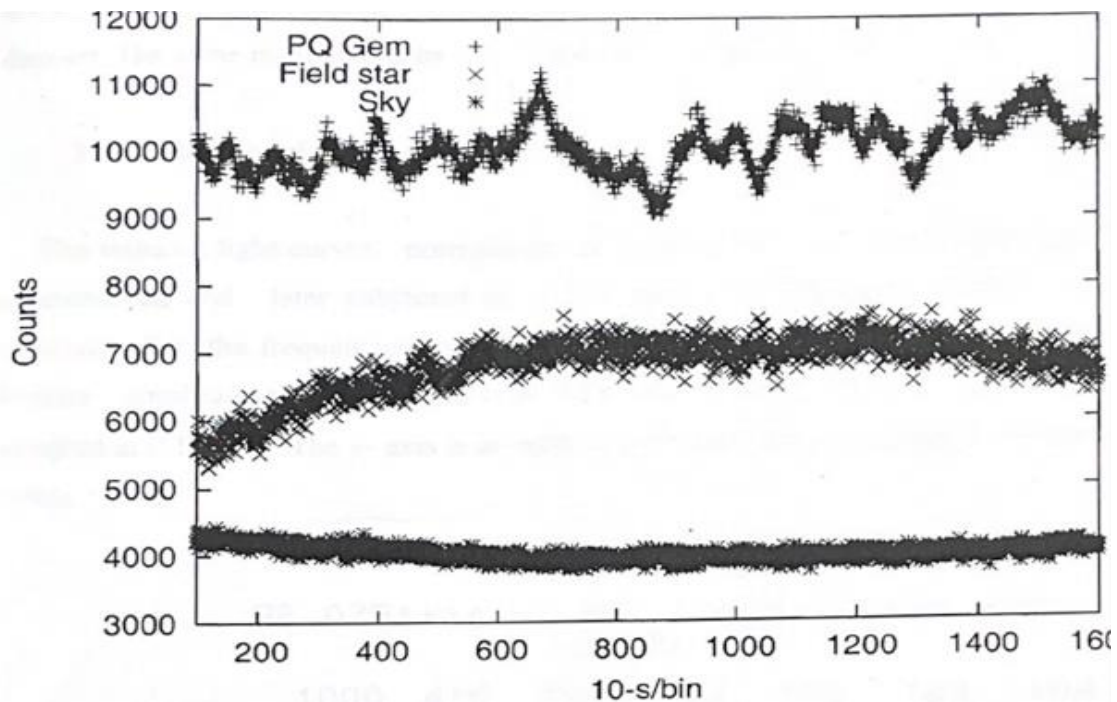
A comparative intra-night optical micro-variability of high luminosity AGN classes



Multi-epoch intra-night optical variability (INOV) observations of a set of 25 AGN were carried out over a total of 108 nights. Quality observations enabled detection of variability amplitudes of ~ 0.01 mag. These observations indicate that radio-loudness alone does not guarantee enhanced INOV in quasars. The milder and rarer INOV seen in radio-quiet quasars relative to BL Lacs can be understood in terms of them having optical synchrotron jets which are modestly misaligned from us, but are otherwise intrinsically as relativistic and active as the jets in BL Lacs.

Reference: Stalin, C. S., 2002, Ph.D. Thesis, Kumaun University.

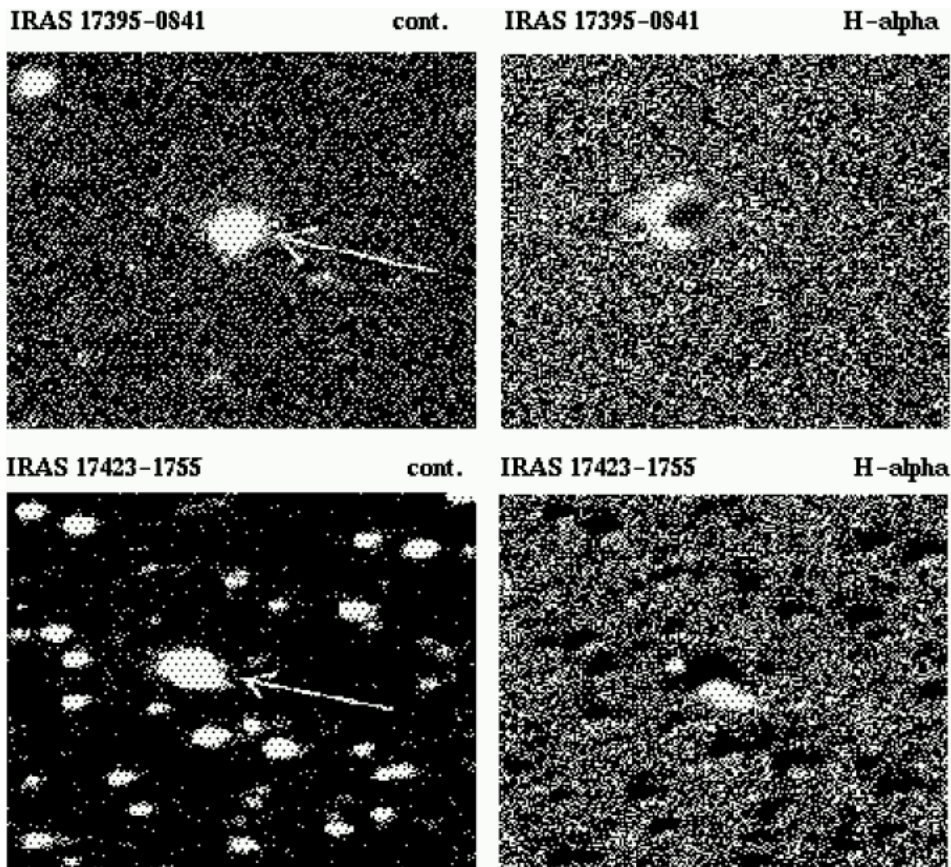
PQ Gem - Cataclysmic Variable



The exotic properties of intermediate polars were studied using fast photometric techniques. In PQ Gem, we confirmed the spin (833.39s) and orbital side band period (872.25s) and found that amplitude of both the spin and orbital period are compared. However, we could not confirm period of 1.14 hr reported previously and proposed that if such period exist then it could be due to transient features or precession of an accretion disk. In RX J0558+53, we confirmed the presence of 545s modulation period that can be explained due to visibility of both accreting poles on the white dwarf. However, our observations could not confirm the presence of orbital modulation of period 4.15 hr as reported previously.

Reference : Ashoka, B. N., 2003, Ph.D. Thesis, Kumaun University.

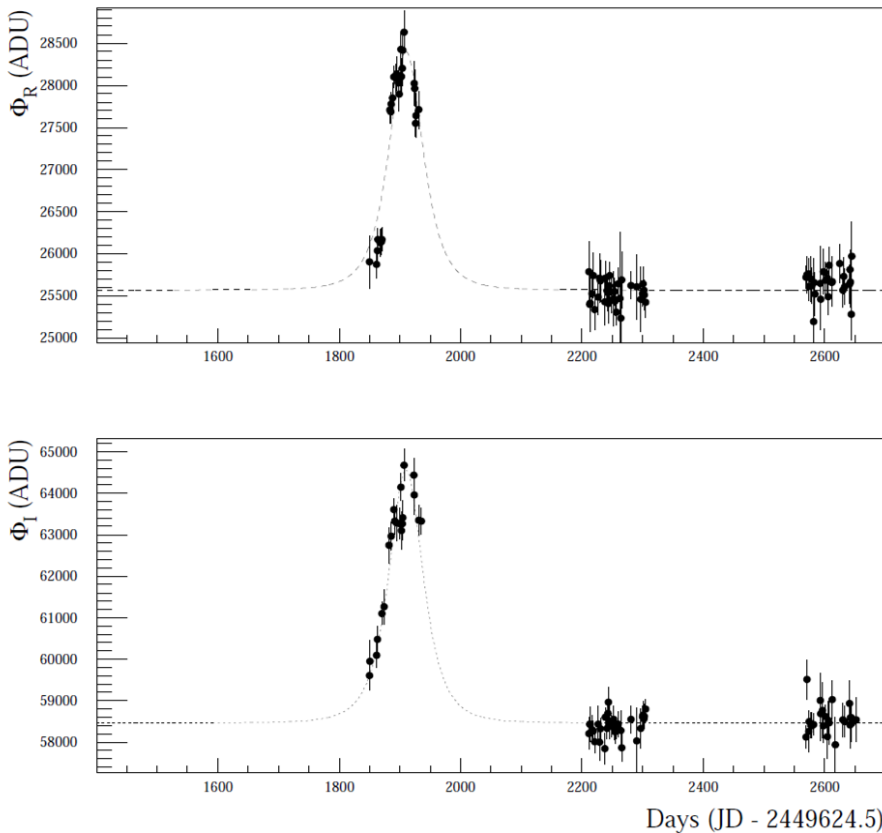
H-alpha imaging of Hot Post-AGB Stars



UBVRI and H-alpha imaging of 9 hot post AGB candidates were observed with CCD cameras mounted on 104-cm ST in 2000. These observations along with archival NIR data provided accurate SEDs to study dust envelope, mass loss rates and dynamical ages of these stars. Study finds out presence of warm dust component for 3 candidates arising due to recent mass loss process. The nebulosity around these stars were studied using H-alpha images and an angular extent of 2 to 3 arcsec was recorded for two targets. This image taken with 104cm ST shows bipolar lobes detected for the target IRAS 17423-1755.

Reference: Gauba, G., 2003, Ph.D. Thesis, Bangalore University.

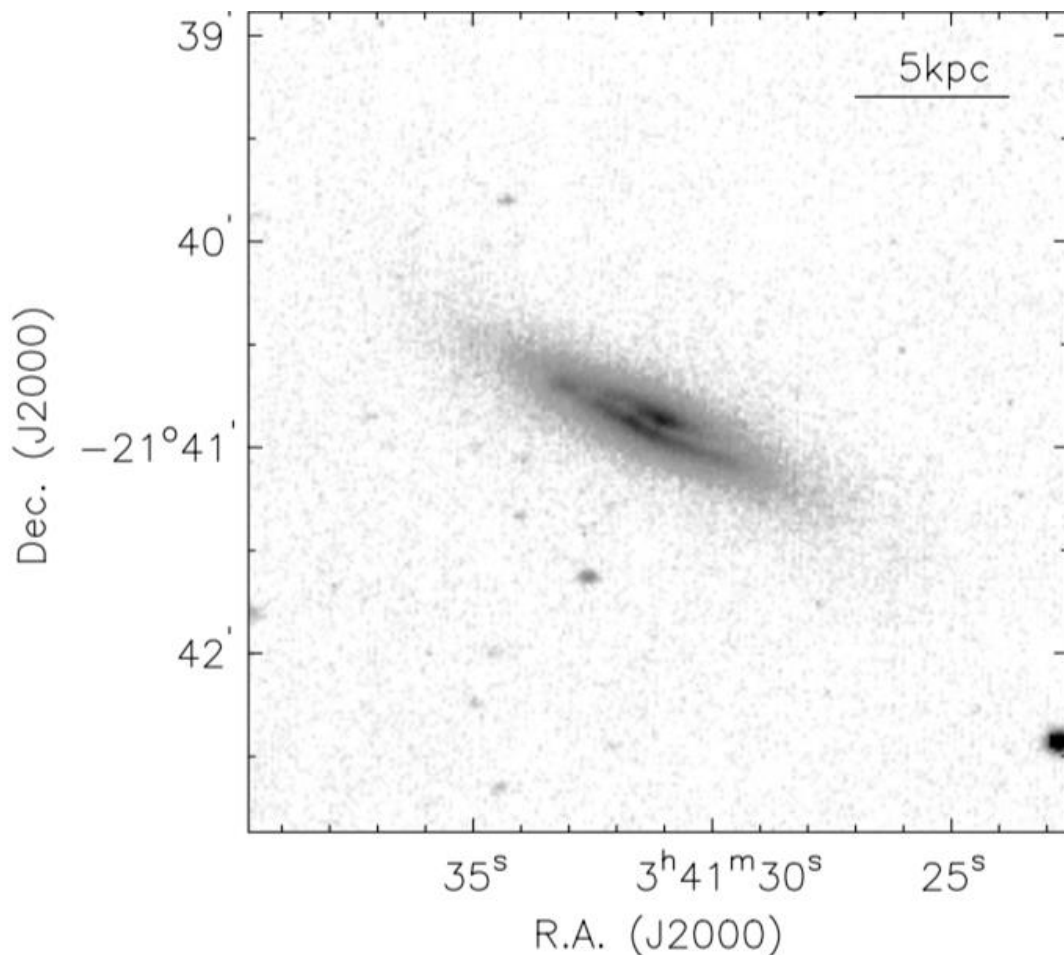
M31 Microlensing Survey



The first microlensing event from India NMS-E1 was detected towards M31 under the Nainital Microlensing Survey at ARIES, Nainital. The R and I bands photometric observations of this event were taken with the 104-cm ST during 1998-2002 and data was analysed using the pixel technique. The event was found in the disk of M31 about 15.5 arcmins to the South-East direction from galaxy center. The in-depth analysis of the event suggested that it reached $R = 20.1$ mag and $(R-I)=1.1$ mag at the time of peak brightness. The model fit gives a half-intensity duration of 59 days. The high value of half-intensity duration of NMS-E1 as well as its location on the far side of the M31 disk suggested that the event most likely occurred due to halo lensing.

Reference: Joshi, Yogesh, 2003, Ph.D. Thesis, Kumaun University.

NGC 1422 (SBab)



21 galaxies in the Eridanus group were observed using the 104-cm ST in 2002. These observations provided high sensitivity CCD r-band data, which were not available in those times. The data were used in the Ph.D. thesis for structural analysis and Tully-Fisher relations in the Eridanus group. Using the optical data and the radio data using the GMRT, the Eridanus group was identified as a rare nearby group with clear evidence for ongoing tidal interactions affecting galaxy evolution in a low density cosmological structure. This CCD frame shows NGC 1422, a member of the Eridanus group, with prominent dust lane.

Reference: Omar, Amitesh, 2004, Ph.D. Thesis, Jawaharlal Nehru University.

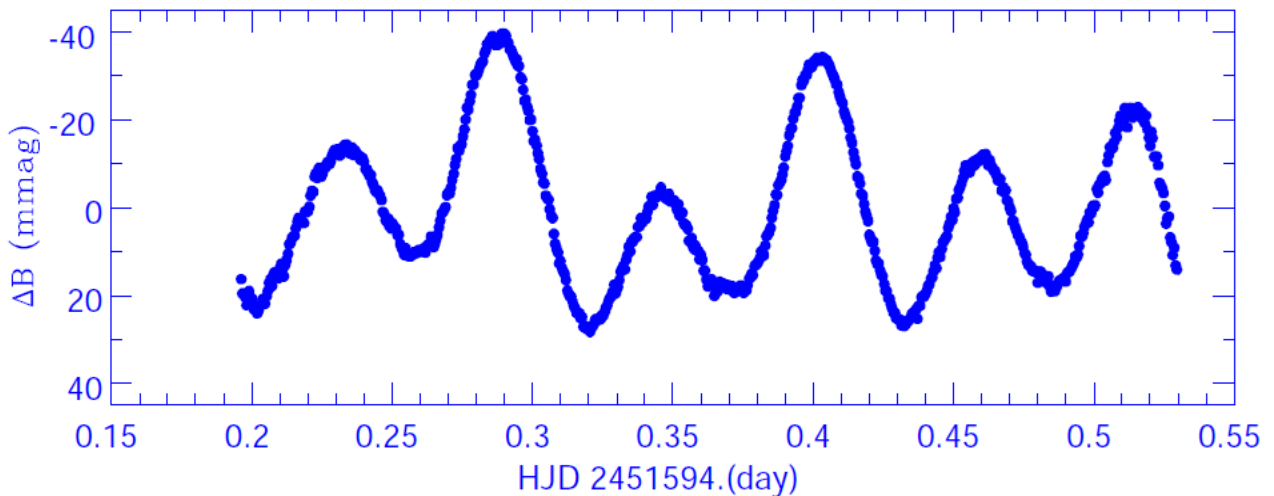
Open Star Clusters NGC 663 & NGC 654



To understand the star formation process, it is necessary to know how the star formation takes place in the star clusters. To carry out this study, we choose two young age clusters NGC 663 and NGC 654 with a mean age of 15 Myr but showing a large age spread of 15-20 Myr. Based on the UBVRI photometric study of these clusters, it is found that their star formation history seems to support the conventional picture of star formation in clusters where low-mass stars form first and higher-mass star later as star formation continues over a long period of time. The detailed study of inter-cluster reddening material in the young open clusters supports the universality of the extinction curves for longer wavelength while for short wavelength it depends upon the total-to-selective absorption in the direction of the cluster.

Reference: Upadhyay, K., 2004, Ph.D. Thesis, Gorakhpur University.

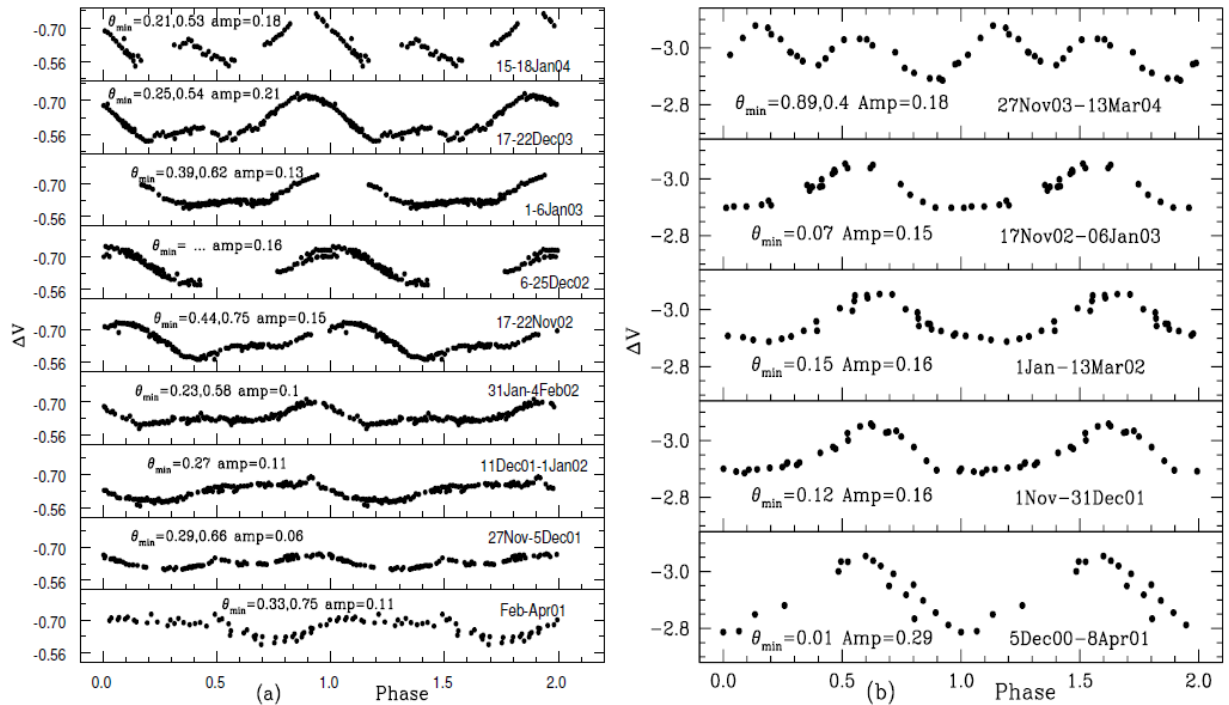
HD98851 - Chemically Peculiar Star



A ground based photometric survey to search for and study the photometric variability in chemically peculiar (CP) was initiated in 1997 using 104-cm ST and 0.5-m telescope of South African Astronomical Observatory, Cape Town, South Africa, hence the name stems the “Nainital-Cape survey”. For this legacy survey, more than 350 chemically peculiar stars were investigated making it one of the longest dedicated ground based survey where more than half of dozen exotic pulsating variables were discovered. Determination of their basic physical parameters and in-depth asteroseismic studies of the newly pulsating variables were carried out using available observations. This slide shows light curve of HD98851 using 3-channel fast photometer instrument by ISRO.

Reference: Joshi, Santosh, 2003, Ph.D. Thesis, Kumaun University.

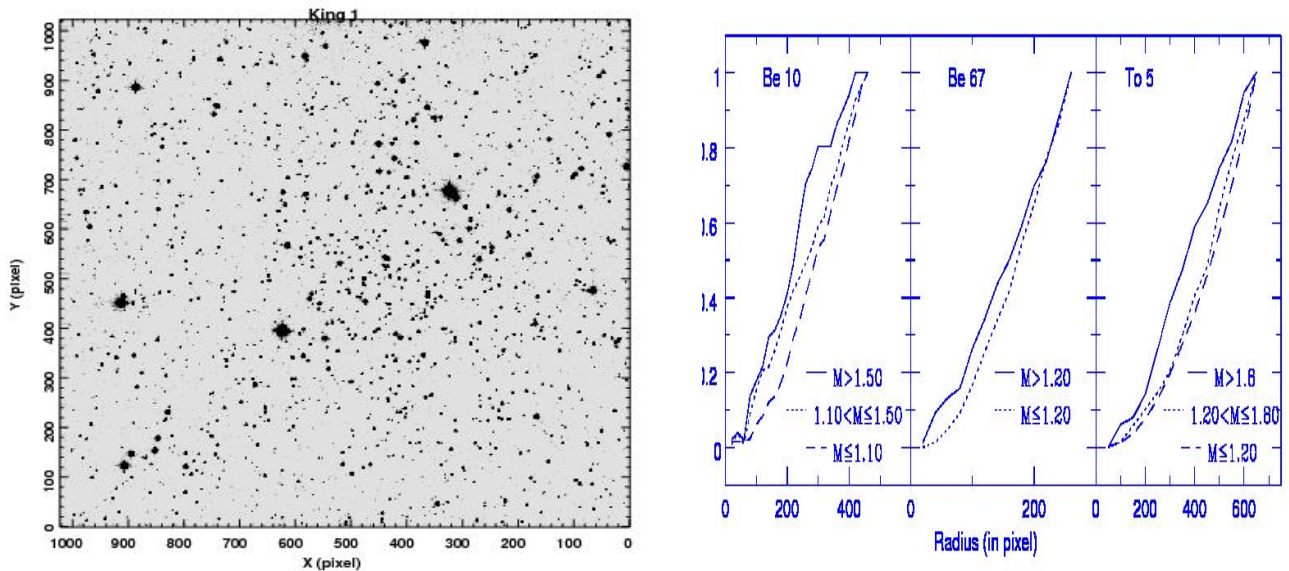
Stellar Magnetic Activity



Several magnetically active solar-type stars were observed from the 104-cm telescope of ARIES during 1999-2004. The stars FR Cnc and HD 81032 are found for the first time showing magnetic activities on diverse scales with rotation periods of 0.827 and 19. days. The long-term photometric study indicates that the star FR Cnc is an active, young star of 100 Myrs or less, whose activity levels are primarily due to its youth, whereas the star HD 81032 is evolved RS CVn-type binary. This study has reconfirmed that selecting stars by their high X-ray-to-optical flux ratio is an efficient way to identify active stars in the solar neighbourhood, but that optical studies, as presented in this thesis, are essential in order to characterise the activity class, e.g., BY Dra or RS CVn.

Reference: Pandey, J. C., 2005, Ph.D. Thesis, Kumaun University.

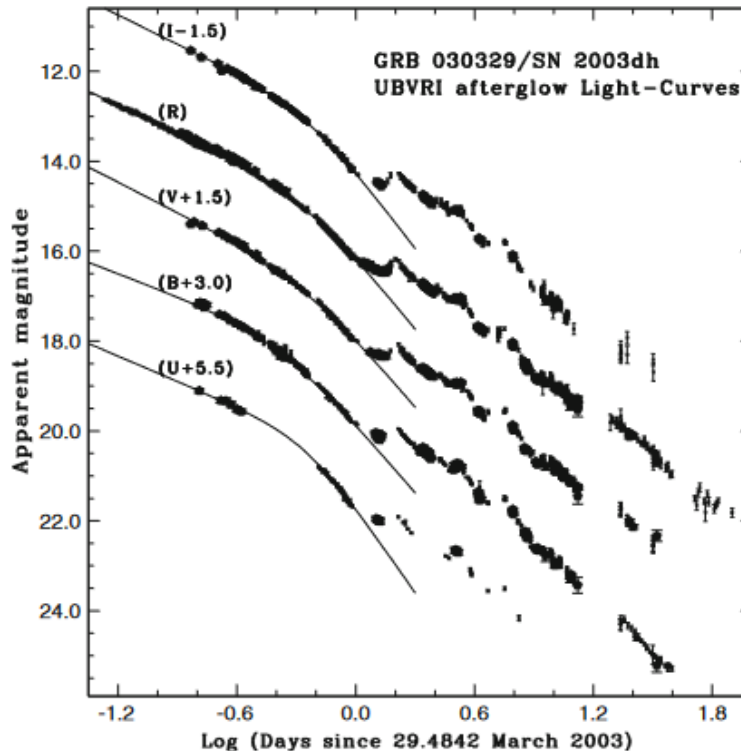
Photometric Studies of Galactic Open Star Clusters



CCD photometric observations of six open clusters named Be 10, Be 67, To 5, Be 15, Be 71 and King 1 have been carried out in UBV (Johnson) and RI(Cousin). The clusters selected for the present work are not studied so far. Observed image of open cluster King 1 in V filter and cumulative radial distribution of stars in different mass ranges are shown above. The fundamental parameters of the clusters have been obtained by fitting theoretical models to the photometric observations. The luminosity function, mass function, dynamical relaxation and mass segregation have also been studied in detail for the present cluster sample.

Reference: Lata, Sneha, 2005, Ph.D. Thesis, Kumaun University.

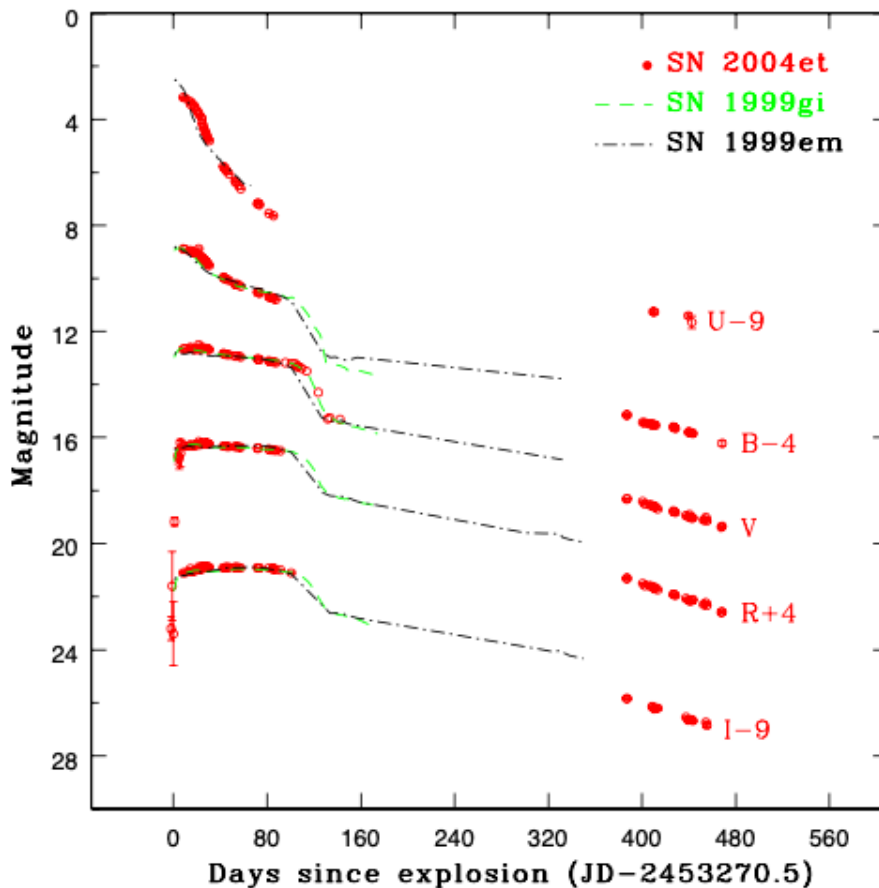
Optical studies of GRB related events



Afterglows of Gamma-ray bursts (GRBs) are powerful tools to probe stellar explosions much more energetic than typical core-collapse supernovae (SNe). Utilizing longitudinal advantage of 1.04m Sampurnanand Telescope (ST) at Manora Peak Nainital, well calibrated optical photometry of many afterglows and related SNe were studied as a part of the present thesis, the first one largely using the data obtained with the 1.04m ST. Results presented in this thesis helped to understand collimated outflow among these energetic events and constrained their physical parameters. This study also helped to understand that a subset of core-collapse SNe and GRBs are very much related and are helpful to understand evolution of massive stars and their end stages in a better way.

Reference : Pandey, S. B.; 2006, Ph.D. Thesis, Kumaun University.

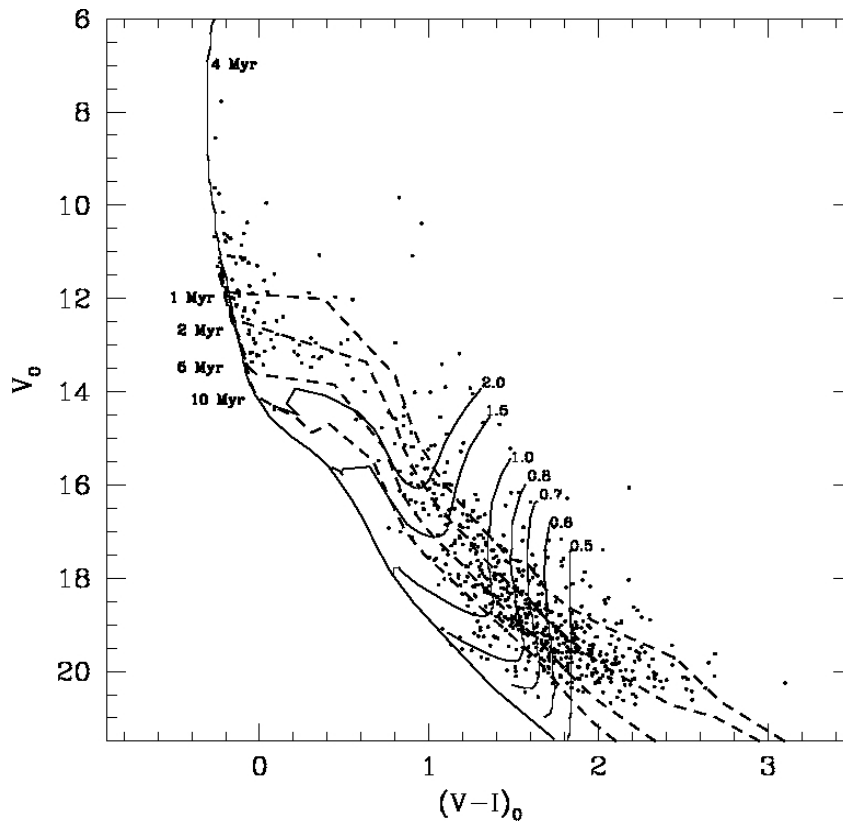
Multiband light curve of the first Type IIP SN 2004et observed with the 104-cm Sampurnanand Telescope



SN 2004et, a Type IIP supernova, located in the prolific supernova-producing galaxy NGC 6946 was the first Type IIP supernova extensively observed with the 104-cm Sampurnanand Telescope. NGC 6946 a grand design spiral galaxy has hosted several supernovae to date. Our observations cover the different phases in the multiband light curves – the rise, a pronounced plateau (~110 days) and the late nebular phase extending out to nearly 500 days after the explosion. The detection of X-ray and radio emissions in this supernova hinted toward circumstellar medium interaction.

Reference: Misra, Kuntal, 2008, Ph.D. Thesis, Kumaun University.

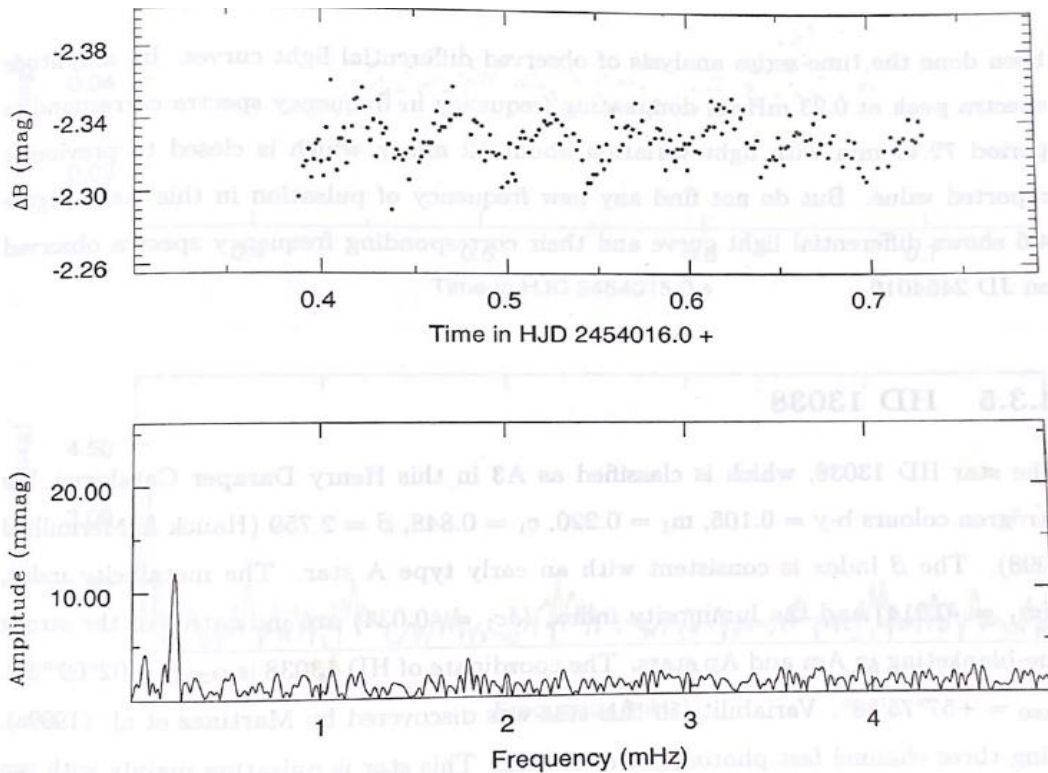
Open Cluster NGC 1893



Statistically cleaned and de-reddened optical color-magnitude for stars lying in the 1893 cluster. The isochrone for 4-Myr age by Bertelli et al. (1994) and PMS isochrones of 1, 2, 5, 10 Myr along with evolutionary tracks of different mass stars by Siess et al. (2000) are also shown. All the isochrones are corrected for a distance of 3.25 kpc. Low-mass stars upto 0.3 solar mass were detected in this study. Deep optical data taken from 1.04m telescope were used in the Ph.D. thesis for structural analysis and Initial mass function studies in the young open star clusters by the detecting stars in almost complete mass range (~ 40 -0.1 solar mass) in the star clusters.

Reference: Saurabh, 2008, Ph.D. Thesis, Kumaun University.

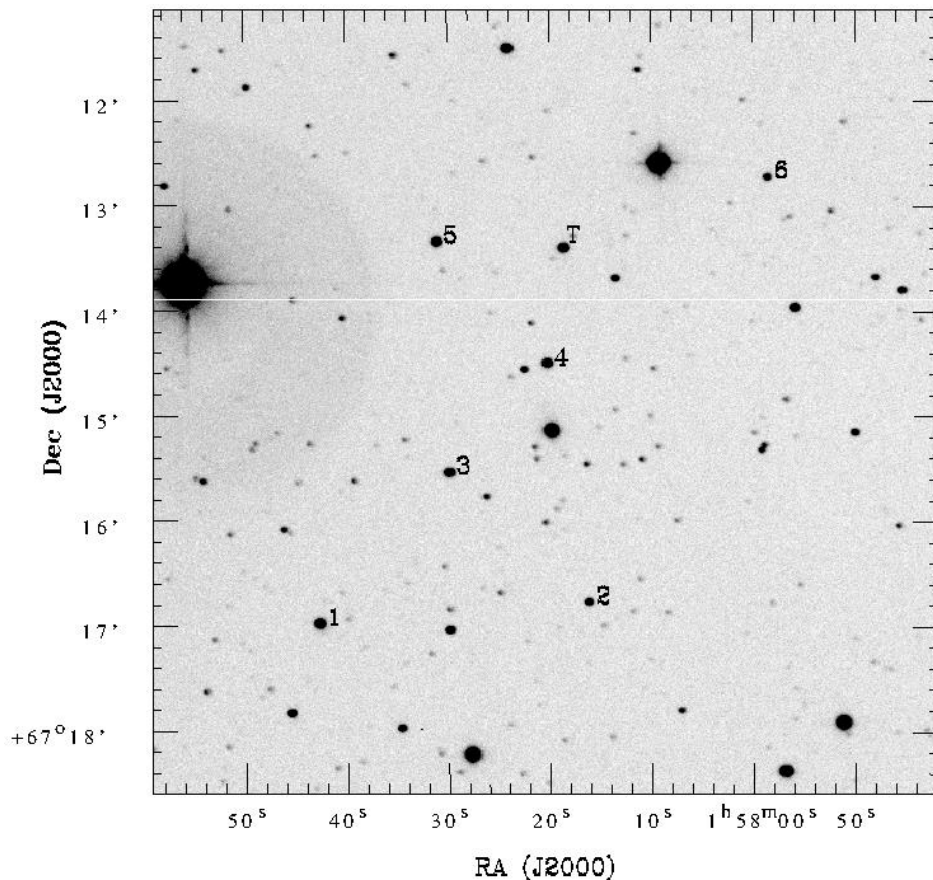
Studies of Pulsation in Chemically Peculiar Stars



Differential light curve and corresponding frequency spectrum of HD13079 are presented above. HD103498 was discovered as a variable stars in year 2007 with a period of 15 min and also exhibit amplitude modulation. HD151178 was discovered as a pulsating star with period 6 min. Seven known roAp stars were observed and confirmed their pulsational characteristics. Pulsation in Am stars HD25515, HD118660, HD13038 and HD13079 were also investigated. A total of 6 eclipsing binaries system with pulsating components were also observed.

Reference: Tiwari, S. K., 2008, Ph.D. Thesis, Gorakhpur University.

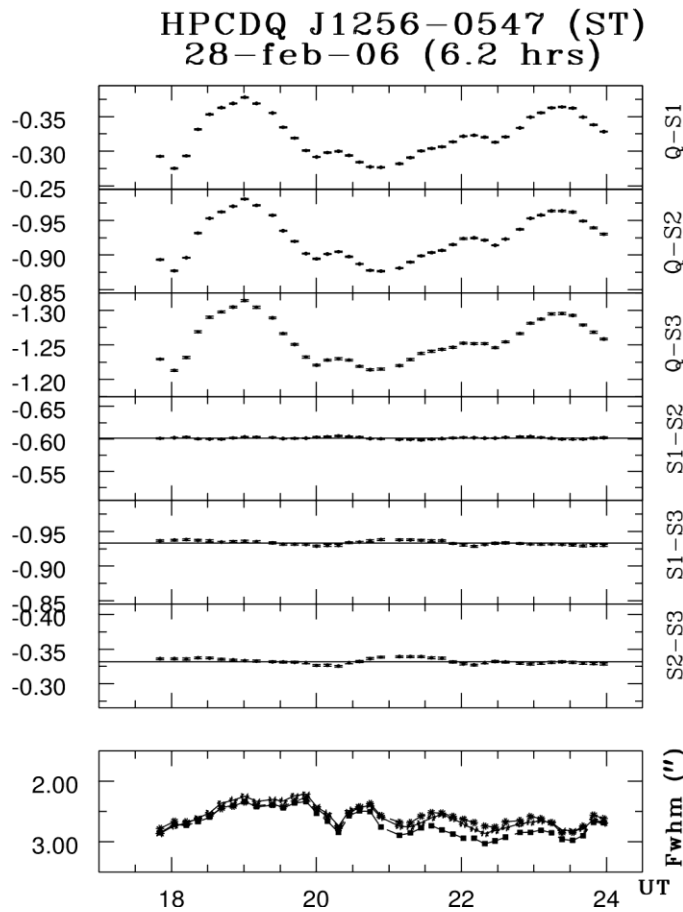
Transient X-ray Binary IGR J01583+6713



The nature of transient X-ray source IGR J01583+6713 has been investigated using optical and X-ray observations. This source was observed in UBVRI bands using 2k CCD camera mounted on 104cm ST. This slide shows the B-band images of the transient event which is marked with "T" along with comparison stars. A field of 7.5 arcmin is shown. No significant variability in V-band is seen for this source. The X-ray absorption was found to be consistent with the optical reddening estimates.

Reference: Kaur, Ramanpreet, 2009, Ph.D. Thesis, Kumaun University.

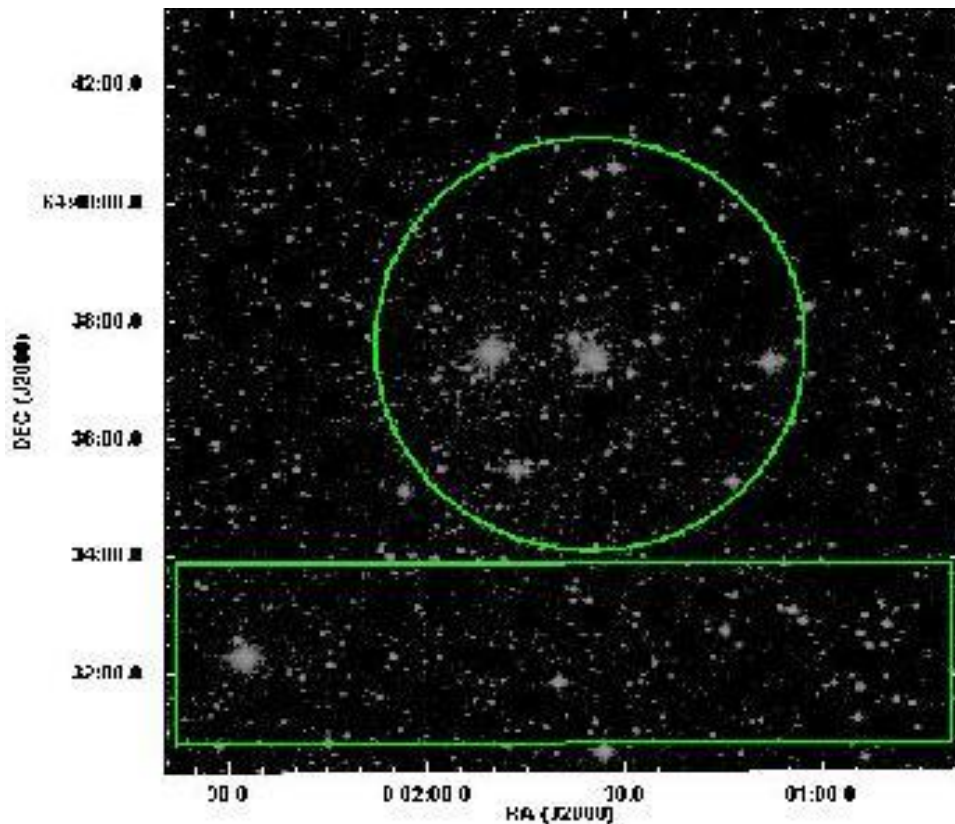
Intra-night Optical Variability in AGN



The optical microvariability in jetted AGN can be due to either intrinsic (particle acceleration, cooling, etc.) or extrinsic (changes in the direction of the jet leading to relativistic beaming of the emission) causes. We systematically monitored different AGN classes using the 104cm ST between 2004-2009. Figure shows the variation of the differential magnitude of an AGN against 3 comparison stars (top 3 panels), the variation of comparison stars' magnitudes against each other (bottom 3 panels) and the seeing during the monitoring run (last panel). As a result, we pinpointed the mechanism of production of microvariability by demonstrating that relativistic beaming of the jet emission was secondary as far as the production of optical microvariability is concerned for jetted AGN.

Reference: Goyal, Arti, 2010, Ph.D. Thesis, Kumaun University.

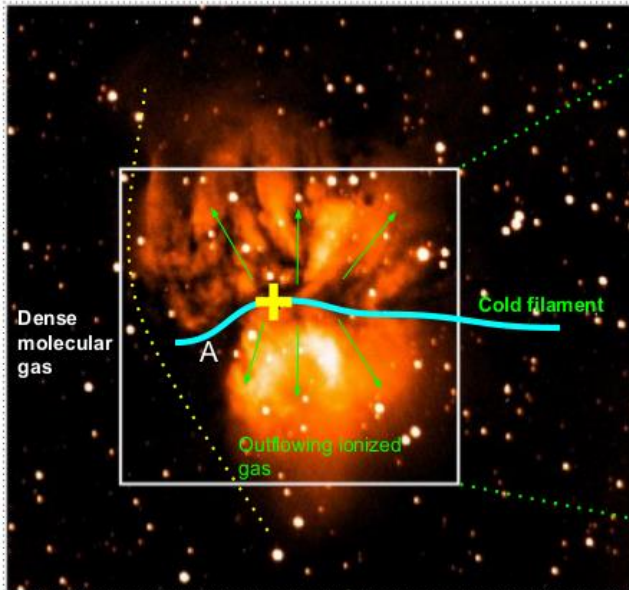
Study of Young Open Clusters at Sampurnanand Telescope



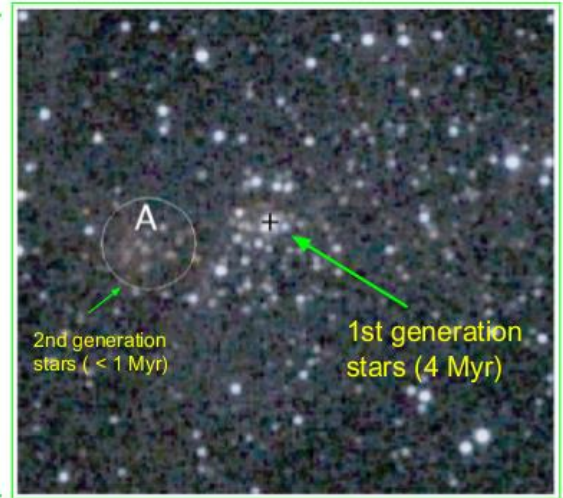
Broad-band UBVRI and h-alpha photometric observations of 2 young open stars clusters were obtained with 104cm ST to probe star formation processes in these targets. Deep imaging data ($V \sim 22$ mag) of member stars were used to derive basic parameters of clusters, such as age, reddening and distance. The NGC 7419 reveals spontaneous star formation in and around the cluster whereas Stock 18 complex is triggered by a centrally located massive star. Star formation in both clusters are found to be non-coeval and does not cease after formation of massive star. This slide show V-band image of Stock-18 obtained with SIT.

Reference: Joshi, Himali, 2011, Ph.D. Thesis, Kumaun University.

HII region Sh2-294



H α image of the HII region Sh2-294 @ 104-cm

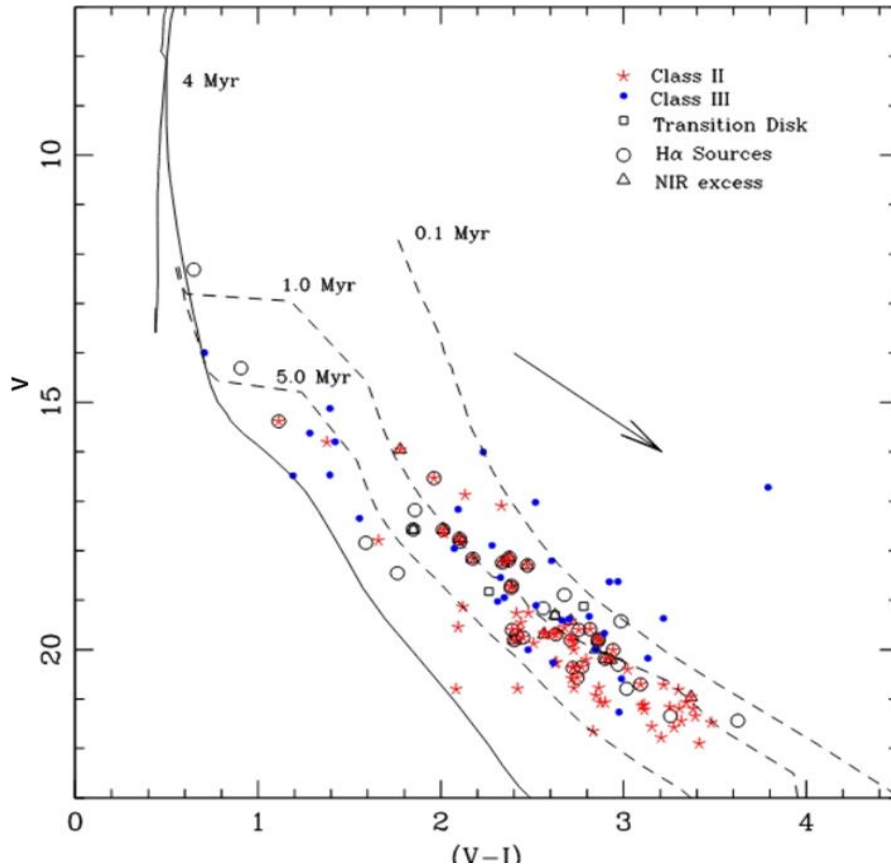


2MASS K-band image of Sh2-294

Optical images of the HII region “Sh2-294” were obtained in H α and U,B,V,I filters using 104-cm Sampurnanand Telescope during 2005-2006. The data were used in the Ph.D. thesis to study the ionized gas morphology and properties cluster that powers the HII region. These observations along with the multi-wavelength data sets, in the thesis work, we proposed that the observed bipolar morphology (shown in left panel) of the HII region is likely due to the formation and evolution of the HII region in a filamentary cloud. By virtue of these observations, we also discussed that the young (< 1 Myr) cluster seen at the western outskirts of the HII region (shown in the right panel) is the 2nd generation stars of the complex. And its formation is induced by the 1st generation stars of the complex. And its formation is induced by the 1st generation optically visible cluster of an age ~ 4 Myr that powers the HII region. This work gives a new prospective of stellar feedback on the future generation of star formation in filamentary clouds.

Reference: Samal, Manash, 2011, Ph.D. Thesis, Kumaun University.

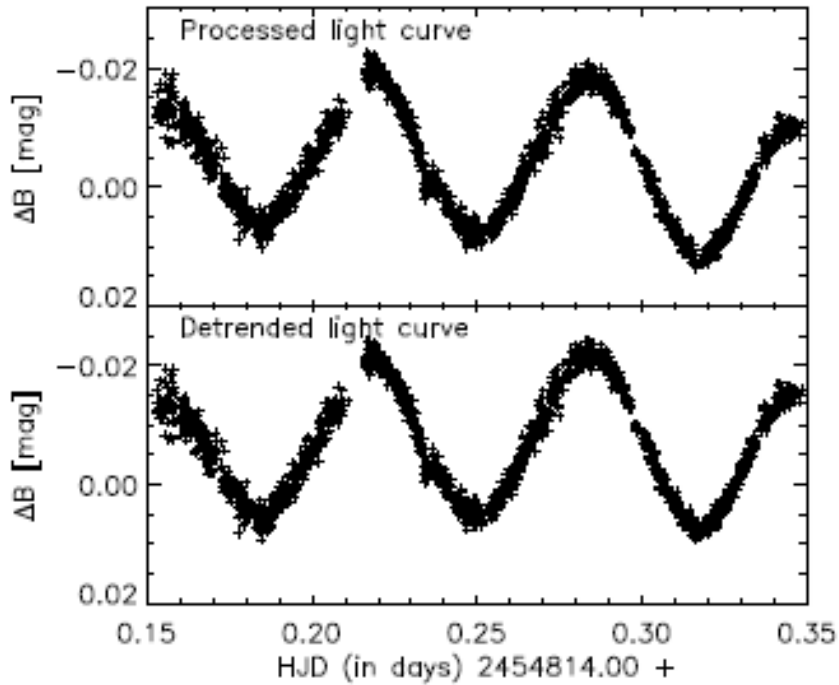
HII region W5 E



Young star cluster and bright rimmed clouds (BRCs) associated with the HII region W5 E were observed using 104-cm Sampurnanand Telescope. The data were used in the Ph.D. thesis to study the cluster parameters, such as, reddening, distance, age, initial mass function etc. and study the star formation processes in the associated BRC regions. The cumulative mass functions indicate that the cluster region and BRC NW have relatively more low-mass young stars in the mass range $0.2 \leq M/M_{\odot} \leq 0.8$. Our analyses show the quantitative evidences for the small scale sequential star formation in the BRC regions for the first time.

Reference: Neelam, 2011, Ph.D. Thesis, Kumaun University.

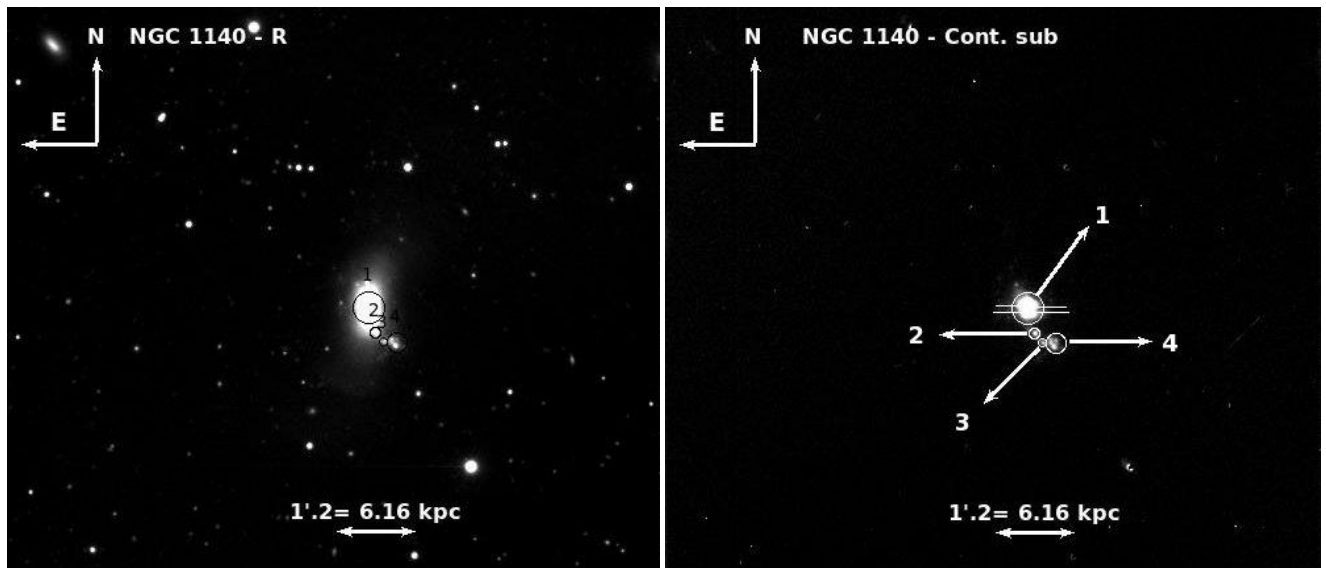
Photoelectric photometry of Delta-scuti star HD 40372



The photoelectric photometric observations of delta scuti star HD 40372 was carried out using a single channel fast photometer mounted on 104cm Telescope in the night of 13th December 2008. This slide shows the light curve obtained in B-band. The raw data is corrected for dead time count, sky background and atmospheric extinction. The detrending is done to take care of variation in sky transparency during night. A period of $0.06732\text{d} \pm 0.00095\text{d}$ was obtained using period analysis.

Reference: Deb, Sukanta, 2011, Ph.D. Thesis, University of Delhi .

Star forming regions in Wolf Rayet Galaxy

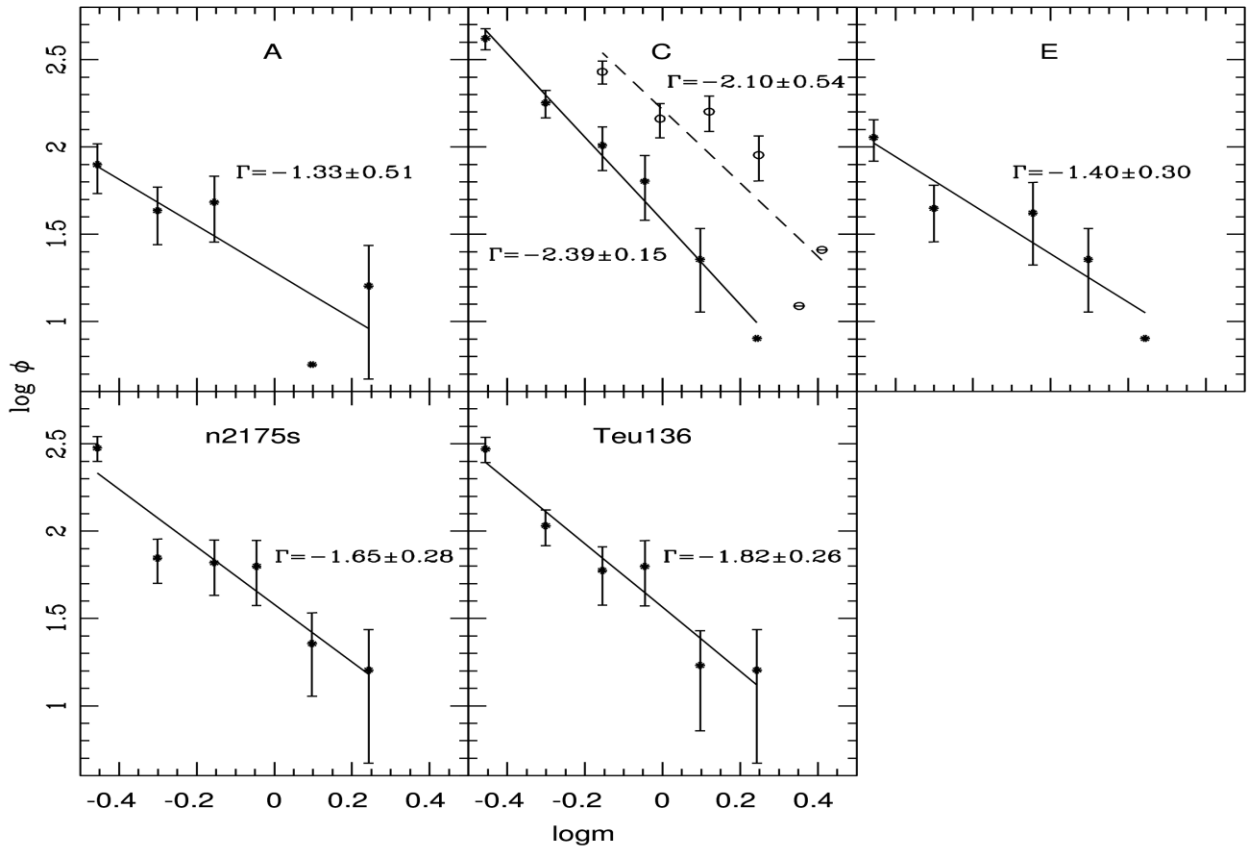


NGC 1140 is a SbPec galaxy located at a distance of 17.9 Mpc. It is an object showing blue colours, $B-V = 0.01 \pm 0.02$ mag, and intermediate metallicity, $12+\log(\text{O}/\text{H}) = 8.38 \pm 0.10$. Broadband photometric observations of NGC 1140 were obtained in the UBVRI bands using the 1-m telescope with a $2\text{k} \times 2\text{k}$ CCD. The central giant HII region, has been considered as a single star-forming region (knot 1). The other star-forming knots, numbered 2, 3 and 4, which are in the south-west part of the galaxy, also show very blue colours. Here, knots 3 and 4 are bluer than the central knot. Bluer outer body of the galaxy indicates that extensive star formation is occurring throughout this galaxy.

The age of the most recent burst decreases from the centre (~ 5.0 Myr) to the external regions (~ 3.2 Myr) of NGC 1140, suggesting that the arc-like plume where they are located originated very recently. The SFRs calculated using the $\text{H}\alpha$ flux for the four knots reveal that the central region (knot 1) is undergoing an intense starburst, while the other three star-forming knots have a moderate rate of star formation.

Reference: Karthick, C. M., 2012, Ph.D. Thesis, Kumaun University.

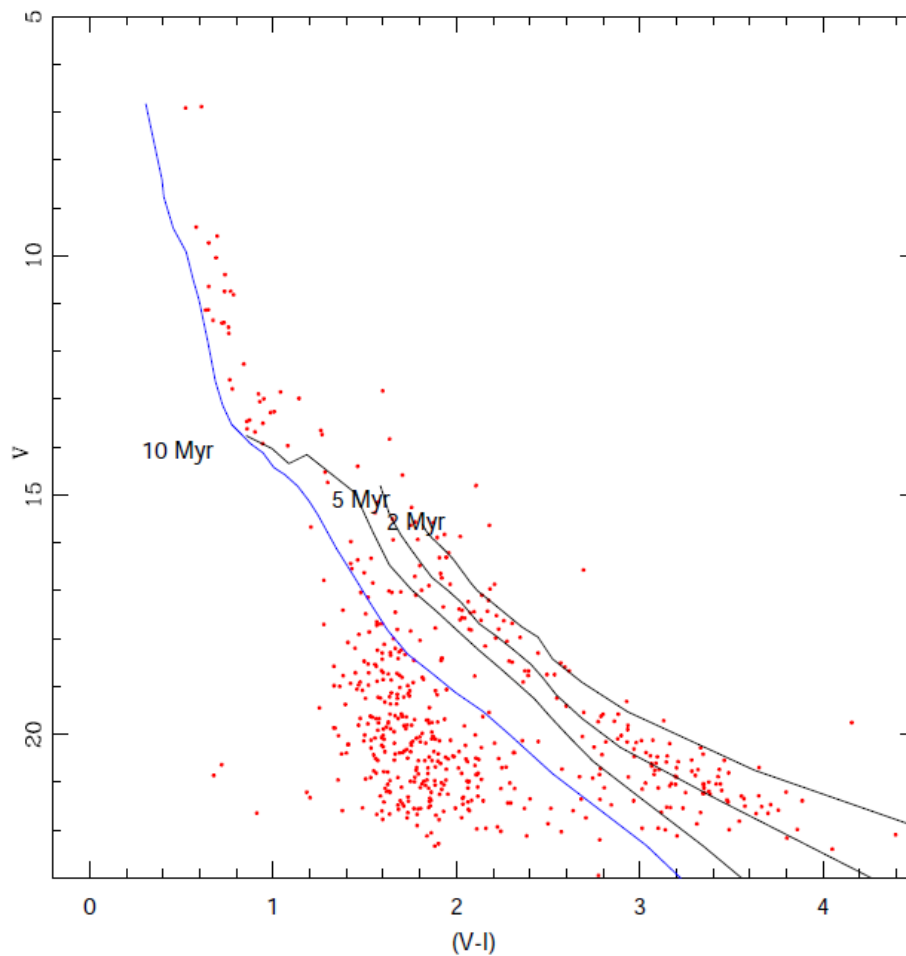
Star Forming Complex Sh2-252



Initial mass functions estimated using the 1.04m ST at ARIES in the massive star forming complex Sh2-252. Sh2-252 is an active star forming region well known for its feedback driven activity from the central massive stars, which essentially created a giant bubble in the region. There are five prominent sub-clusters, each one is associated with HII regions at the boundary of this complex. Using the deep optical photometry from ST, we obtained the Initial mass function (IMF) of these five sub-clusters. The IMFs of individual regions are comparable with the Salpeter Slope within uncertainty. Though the sub-clusters are formed out of feedback activity, we obtain a uniform IMF within them.

Reference: Jose, Jessy, 2012, Ph.D. Thesis, Kumaun University.

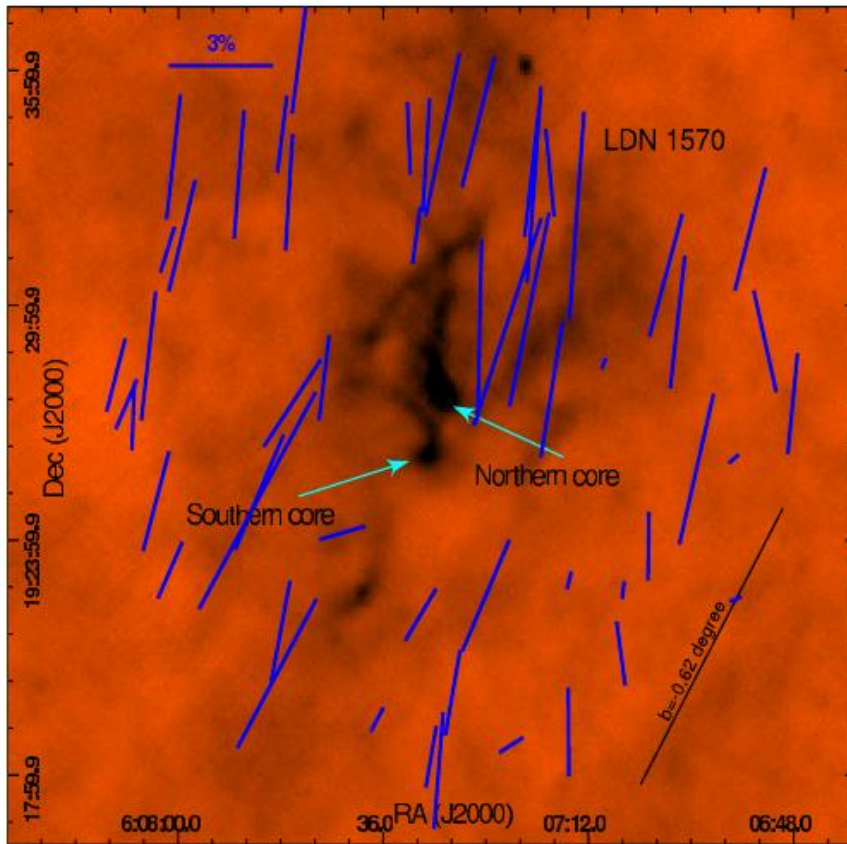
Young star cluster NGC 1502



The UBVRI photometry of three young star clusters NGC 2129, NGC 1502 and King 12 were observed using a 2kx2k CCD camera mounted on the 104-cm ST in 2004. These observations provided a wide field of 13 arcmin and accurate photometric data for these poorly studied clusters. The data were used in the Ph.D. thesis for determination of fundamental parameters such as distance, reddening and age of the clusters. The structural and dynamical parameters of these targets were also investigated. This figure shows color magnitude diagram of NGC 1502 which has an age of 10 Myr and possess several pre-main sequence stars.

Reference: Tripathi, Aparna, 2013, Ph.D. Thesis, Gorakhpur University.

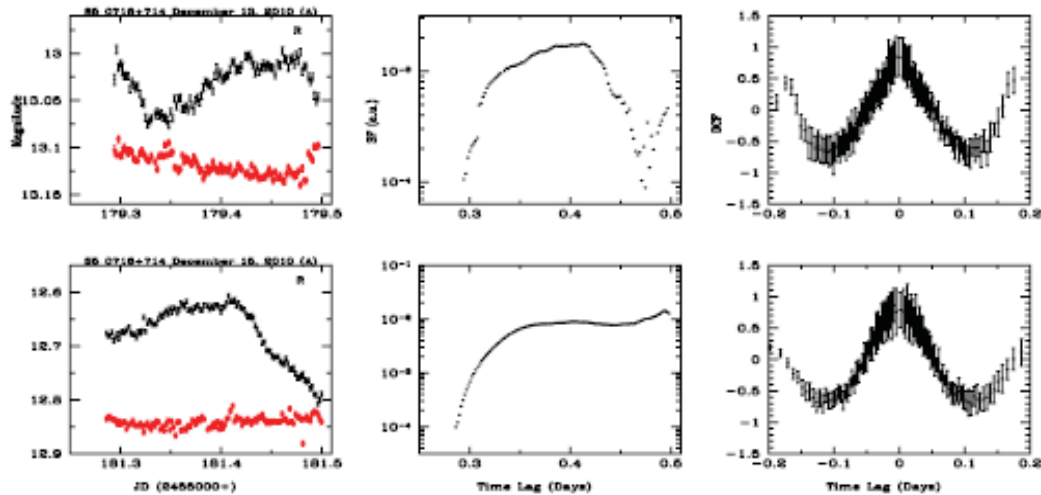
AIMPOL helps understand the importance of magnetic fields in the formation and evolution of dark clouds



Dark globules are the potential sites for forming Sun-like stars. These clouds are isolated and host pristine physical conditions of turbulence and magnetic fields, providing an ideal laboratory for understanding magnetic fields' role. ARIES Imaging POLarimeter (AIMPOL) has been a very productive instrument giving valuable data on magnetic fields. The above figure depicts the magnetic field geometry (blue segments) threading parallel to the long axis of Barnard 227 (background is Herschel 250 micron map). Magnetic field lines were found to assist cloud formation by aiding the gas flows. A recent study confirms that this cloud is on the verge of formation.

Reference: Chakali, Eswaraiah, 2014, Ph.D. Thesis, Kumaun University.

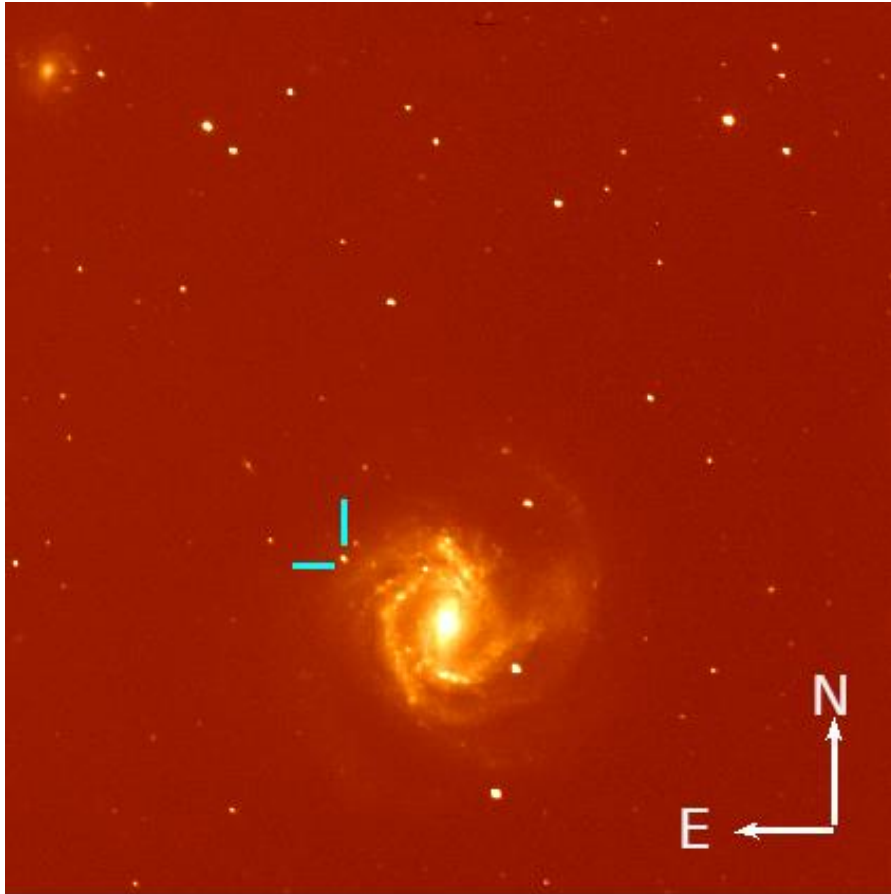
Estimation of variability timescales and color variations of blazars



We investigated intra-day variability of a sample of blazars using 104 cm Sampurnanand Telescope in order to constrain the size of the emitting region of optical bands in blazar jets. In the above plots, left panel shows an example of a blazar differential magnitude (in black points) and differential magnitudes of comparison stars (in red points); middle panel shows Structure Function (SF) and right panel shows their respective Discrete Correlation Function (DCF) to discern the variability timescales. However, we could not find any significant variability timescales in our observations. Color variations are also investigated which indicates mostly blue-when-brighter trends. This result supports the basic shock-in-jet scenario in blazars where higher frequency photons are produced sooner and closer to the shock front. One example of color magnitude relation for the blazar S5 0176+714 is shown above.

Reference: Gaur, Haritma, 2013, Ph.D. Thesis, Gorakhpur University.

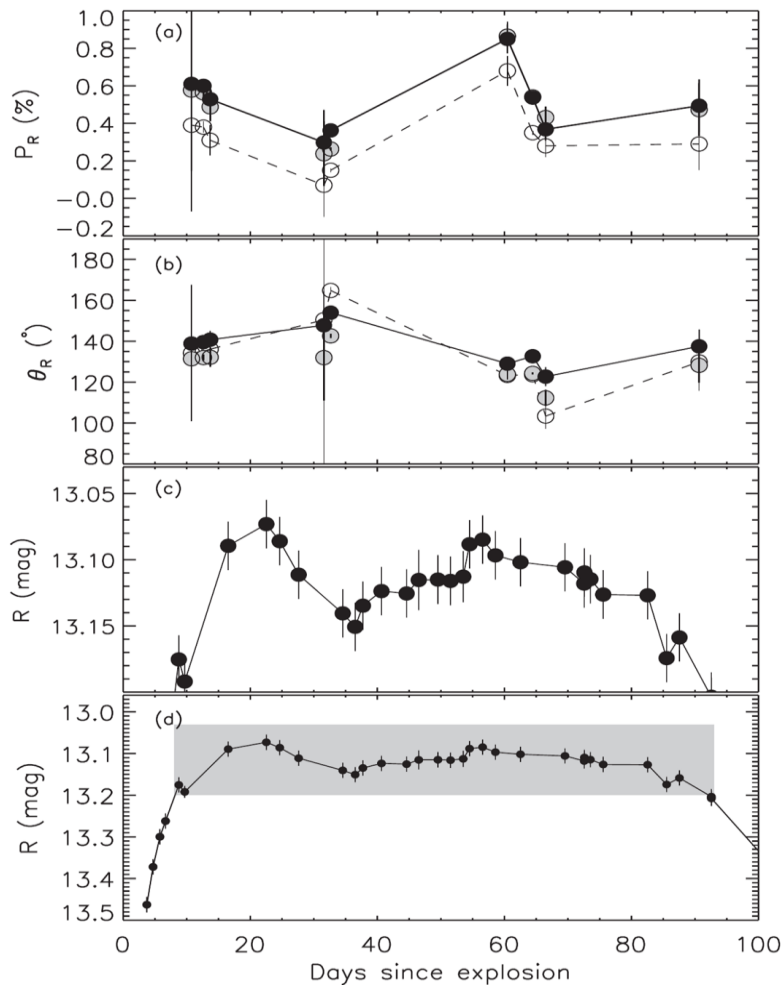
SN2008in – in M61



The above *R-band* image shows the supernova SN2008in in the nearby spiral galaxy M61. The SN was observed from ST in 35 different epochs covering a timespan of 400 days. The photometric and spectroscopic characteristics of SN2008in were in between those of normal and low-luminous Type-IIP supernovae. SN2008in was the first discovered event of this kind, and later, more events with similar characteristics were found. These events, in general, demonstrate that the progenitors of luminous and faint Type-IIP explosions have a common origin – Low-mass progenitors produce faint events while Luminous events are produced by relatively massive (in mass) progenitors.

Reference: Roy, Rupak, 2013, Ph.D. Thesis, Kumaun University.

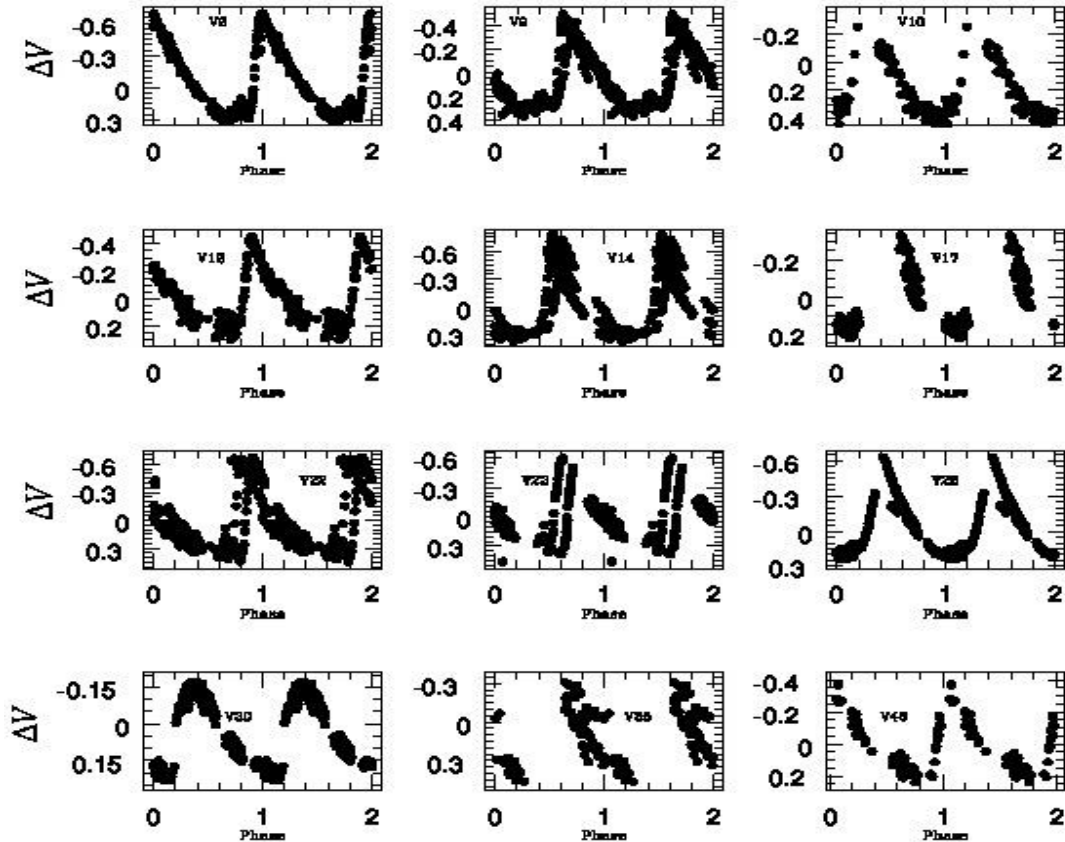
Polarimetry of Supernovae



The R-band imaging polarimetric investigation of the nearby (~ 10 Mpc) Type II-plateau supernova 2012aw was performed using the AIMPOL instrument mounted at the 104-cm Sampurnanand Telescope. This slide represents the temporal evolution of the polarization parameters of the SN (observed: gray dots, intrinsic: black and open dots). The R-band photometric LC is also shown in the bottom panels. The polarization light curve indicates small-scale variations in the SN atmosphere or interaction of the SN shocks with the ambient medium.

Reference: Brajesh Kumar, 2014, Ph.D. thesis, University of Liège.

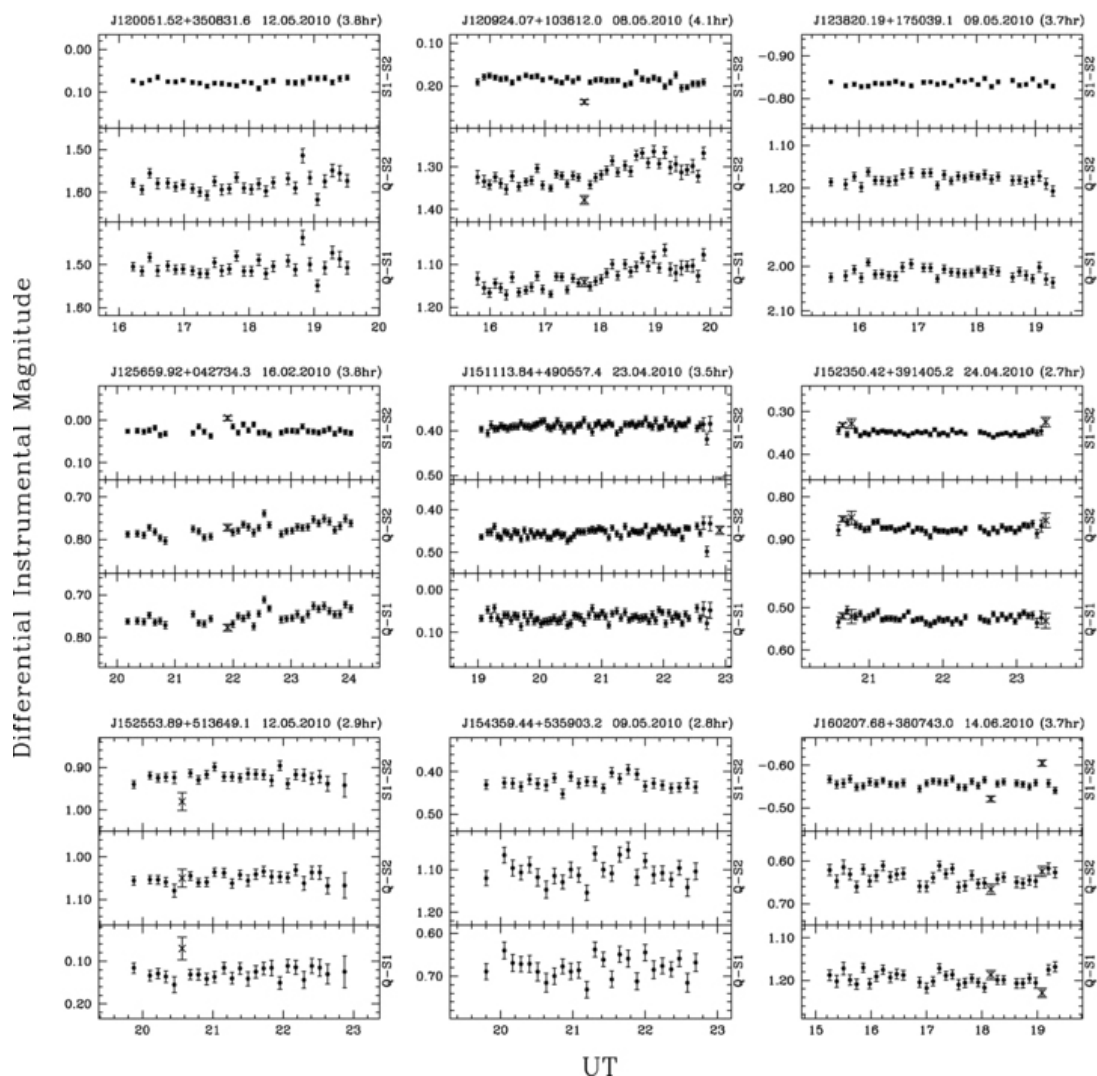
Globular Star Cluster NGC 4590



Using 104-cm Sampurnanand telescope (f/13), the observations of globular star cluster NGC 4590 were carried out in Johnson V filter. The telescope is located at ARIES, Manora Peak, Nainital, India. The cluster was observed for 10 nights during January–March, 2011. The Phased light curves and periods for 40 known variables were revised. We did not find any significant change in the periods or in the variability type. RR Lyrae stars of the type RRab, RRc and RRd were detected. The figure above presents the light curves of RRab stars. Some of these stars show change in the Blazhko effect. Variable V25 has distinguishable change as compared to the previous studies. Variable stars V10, V21, V50, V51 were found to be cluster members.

Reference: Sariya, Devesh P., 2015, Ph.D. Thesis, Pt. Ravishankar Shukla University.

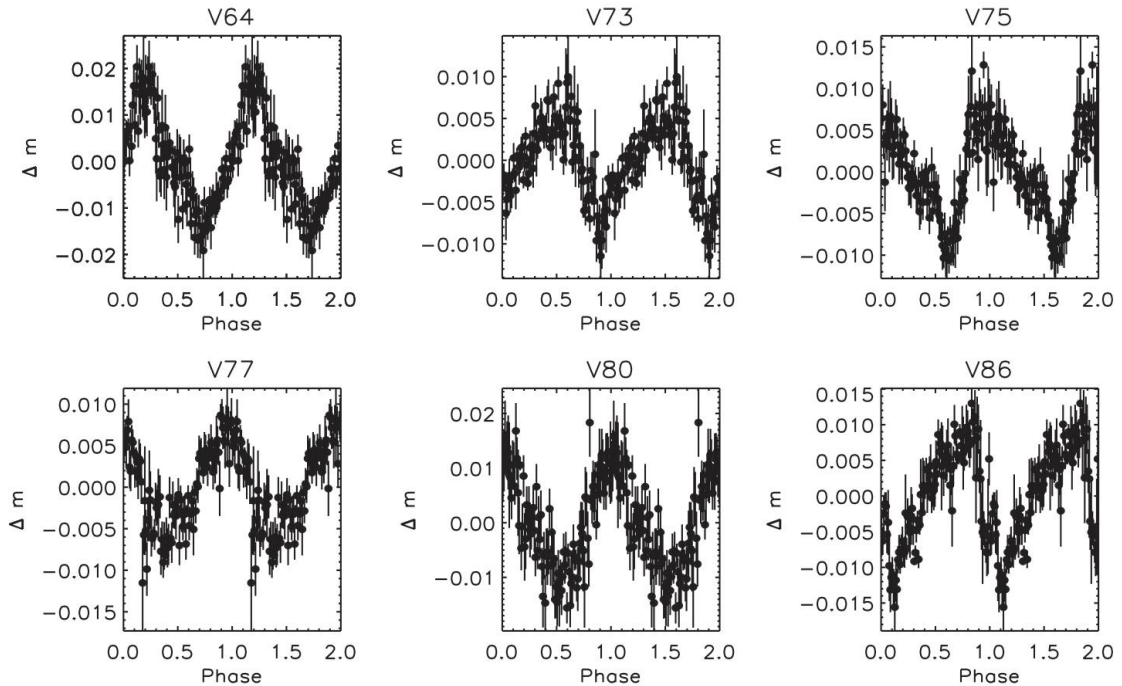
Optical microvariability properties of Broad Absorption Line Quasars



A rapid variability characteristics of 19 radio-quiet broad absorption line (RQBAL) quasi-stellar objects is investigated with the 1m Sampurnanand Telescope. The intra-night variability duty cycle of RQBAL quasars is found to be 11 per cent, which is similar to the normal radio quiet quasar population. This result provides support for models where RQBAL quasars do not appear to be a special case of the general population of radio quiet quasars in terms of their microvariability properties.

Reference: Joshi, Ravi, 2014, Ph.D. Thesis, Pt. Ravishankar Shukla University.

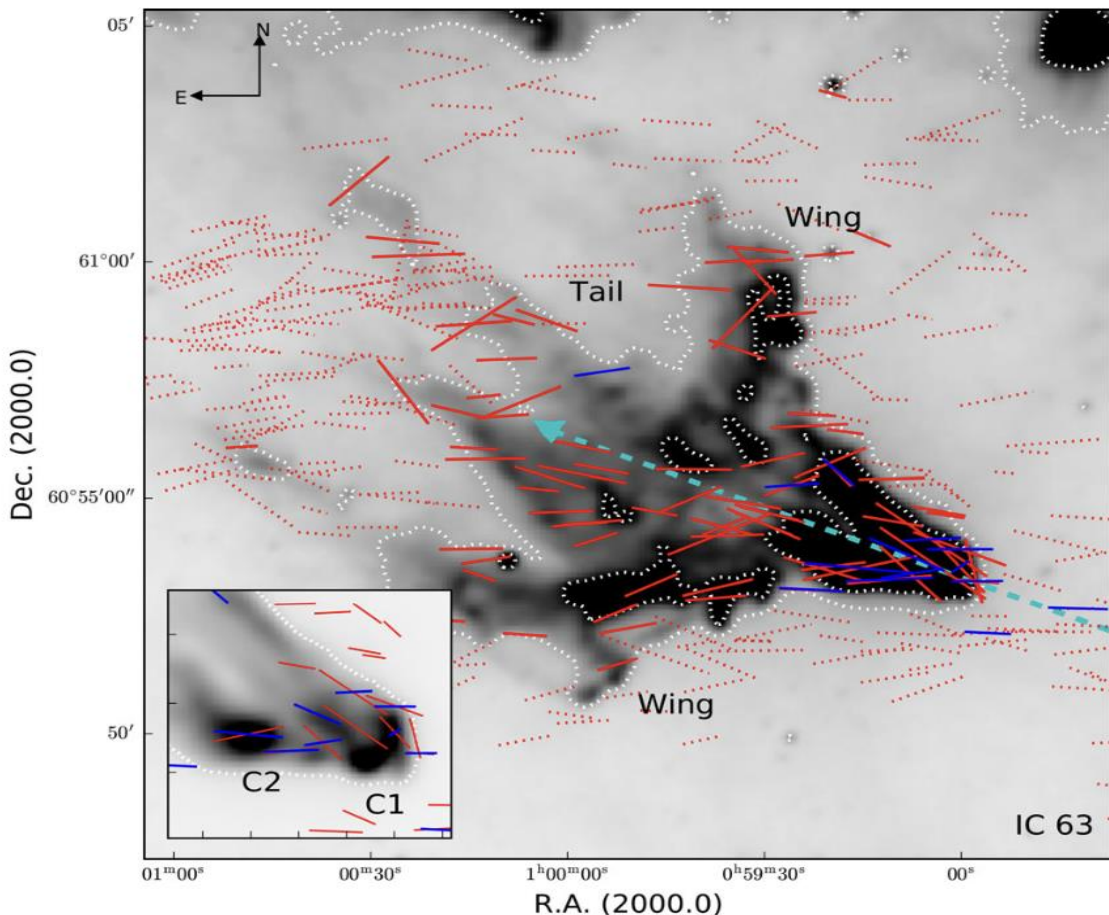
Open Cluster NGC 1893



Times-series photometry of the young cluster NGC 1893 was obtained in V-band using 2Kx2K CCD mounted on ARIES 104-cm Sampurnanad telescope during 2007-2013. These observations were complemented with *I*-band photometry with 2Kx2K CCD at 104-cm telescope, V-band time-series photometry with 130-cm Devasthal telescope, and multiwavelength archival data. We analysed the light curves of 104 variables stars that included MS, and PMS variables. The plots show the phased light curves of 6 PMS variables identified in our time series observations of the open cluster NGC 1893. We also presented the discovery of 17 variables belonging to a new class of variables reported in Mowlavi et al. 2013.

Reference: Yadav, R. K., 2014, Ph.D. Thesis, Kumaun University.

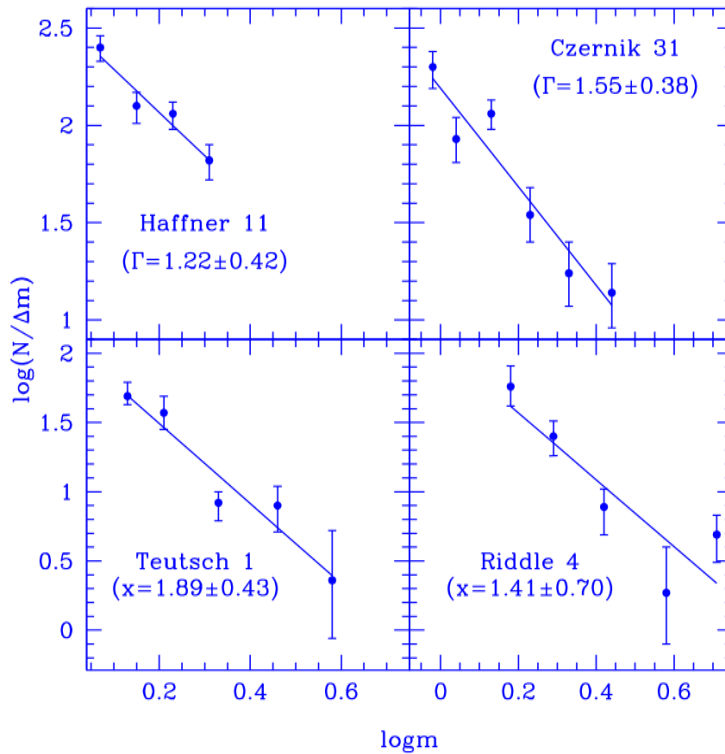
Important role of AIMPOL at 104cm Sampurnanand Telescope in investigating interstellar magnetic fields



When a massive star is born in a clumpy molecular cloud, the clumps that become exposed to the ionizing radiation from the massive star will begin to photoevaporate. The ionization heating generates a shock, and creates cometary shaped clouds in the vicinity. Now the question is whether B-fields plays some role in the formation and evolution of these clouds? The answer is YES. We have studied B-fields in many expanding HII regions where the cloud morphologies are hugely affected by B-fields. One such example of IC63 is shown in the figure.

Reference: Soam, Archana, 2015, Ph.D. Thesis, Pt. Ravishankar Shukla University.

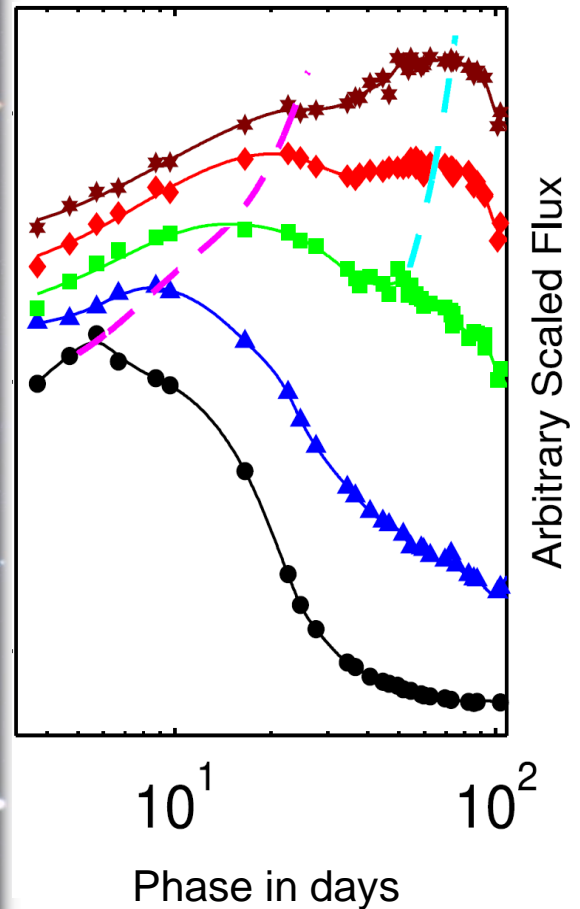
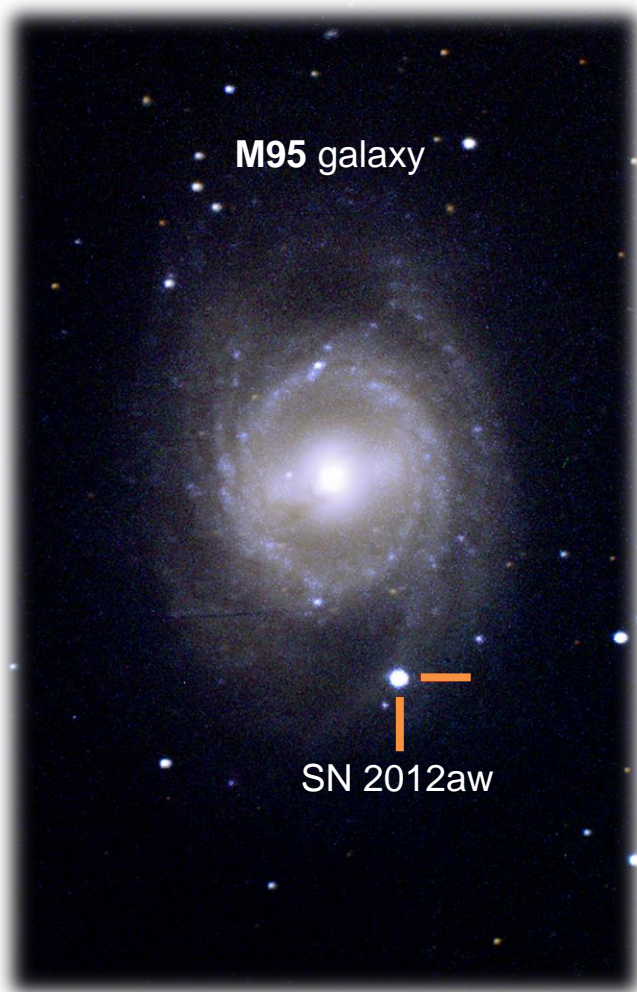
Photometric Studies of Open Star Clusters



The CCD broad band UBVI images for clusters Haffner 11, Czernik 31, Teutsch 1, Riddle 4 were collected from 2010 to 2014 using a 2K×2K CCD system at the f/13 Cassegrain focus of the 104 cm Sampurnanand telescope located at ARIES, Manora Peak, Nainital, India. We have estimated these clusters' main fundamental parameters and performed a mass function (MF) study. MF slopes were obtained by applying the data incompleteness and field star contamination. Total mass was estimated as $\sim 150 M_{\odot}$ for Cz 31, $\sim 220 M_{\odot}$ for Ha 11, $\sim 110 M_{\odot}$ for Teu 1, and $\sim 102 M_{\odot}$ for Ri 4. Mass segregation effect was observed in the clusters. The dynamical relaxation time indicates that all these clusters are dynamically relaxed because the dynamical relaxation time is less than the cluster's age.

Reference: Bisht, Devendra, 2015, Ph.D. Thesis, Kumaun University.

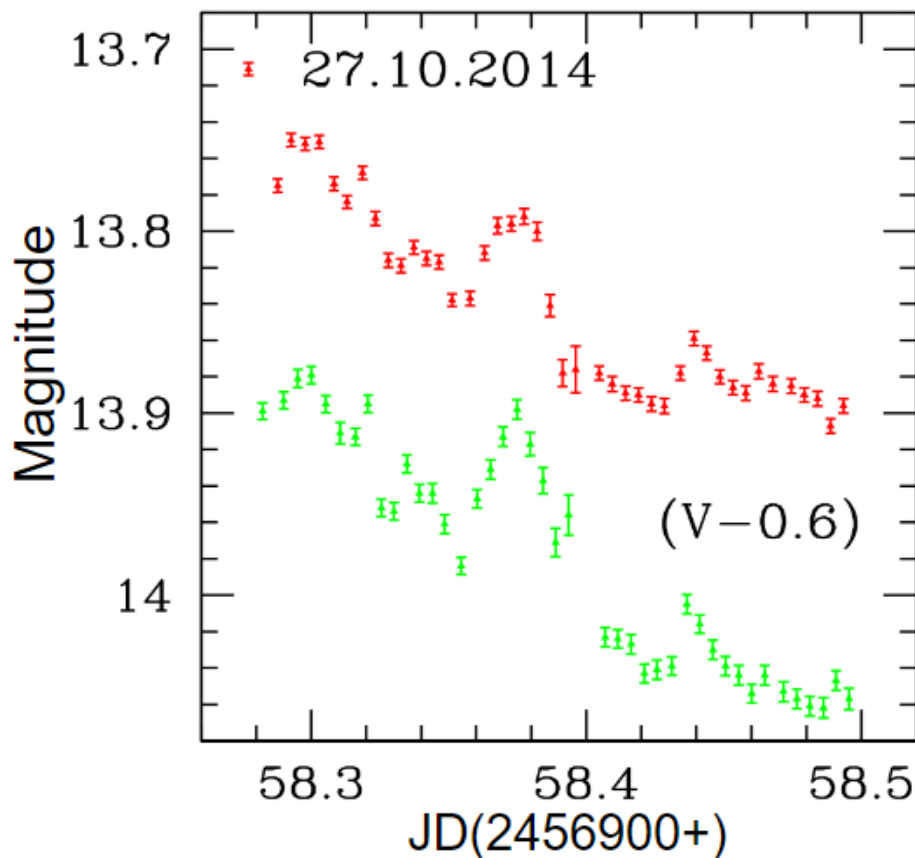
SN 2012aw in M95



Our observations of the supernova 2012aw from 1.04m Sampurnanand telescope belong to the golden sample of normal hydrogen-rich supernovae with one of the most detailed observations. With the help of the high-quality and homogeneous photometric data obtained from the Sampurnanand telescope, we detected the first clear signature of the emergence of recombination phase in the optical bands as indicated by the secondary bump in the UBVRI-band light-curves. During this phase, post-shock ionized ejecta starts to recombine and thereby controlling the rate of energy release.

Reference: Bose, Subhash, 2015, Ph.D. Thesis, Kumaun University.

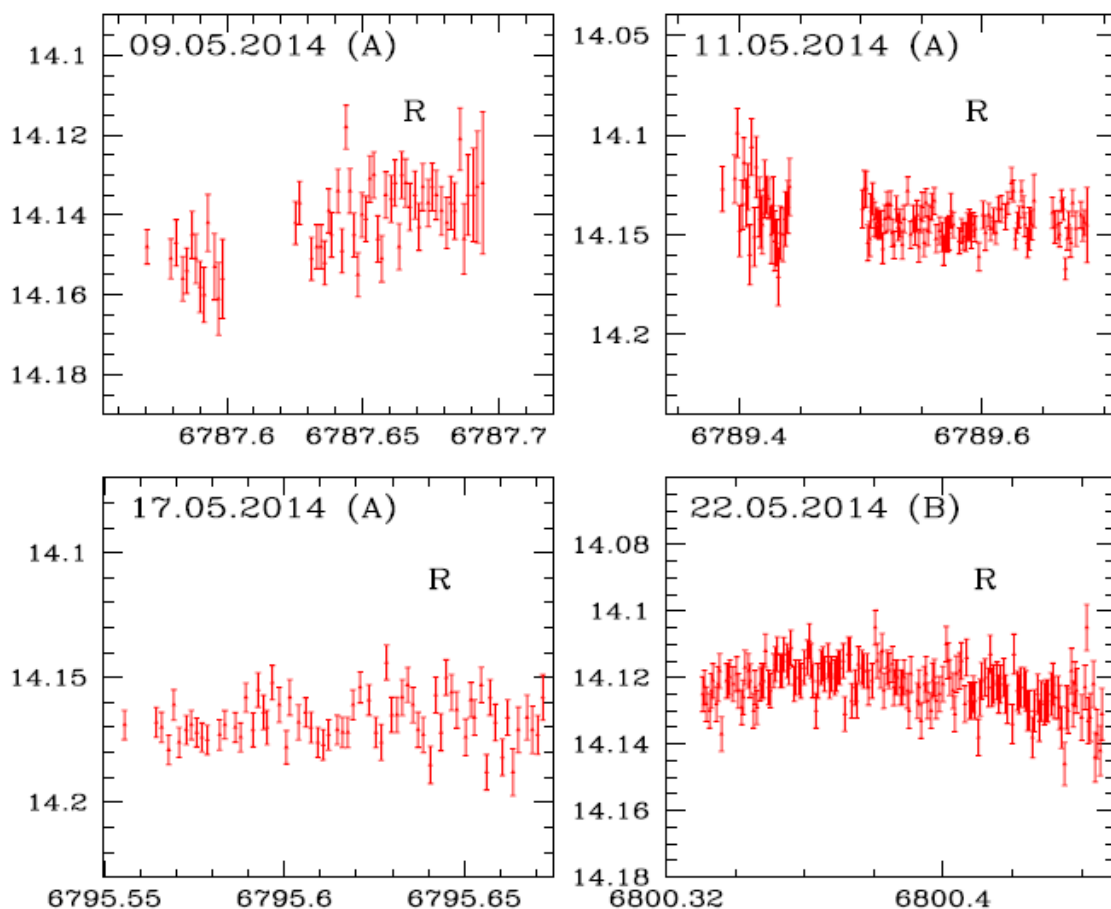
Optical view of blazars using 104-cm Sampurnanand Telescope



Variability in blazars on diverse timescales is a ubiquitous observed property; however, the source of rapid changes is not well understood. 104-cm Sampurnanand Telescope, played a significant role in exploring it further. The above image is one example of a quasi-simultaneous VR light curve of a blazar BL Lacertae observed using Sampurnanand Telescope for ~ 4 hours.. We see a prominent variation (with amplitude ~ 0.05 mag) around JD 245658.35 followed by another short flaring event around JD 245658.43 of ~ 0.04 mag in both V and R passbands on hourly timescale. Further analysis of the same light curve along with those of other blazars, as presented in the thesis, helped us identify changing parameters and emission mechanisms in blazars.

Reference: Agarwal, Aditi, 2016, Ph.D. Thesis, Gorakhpur University.

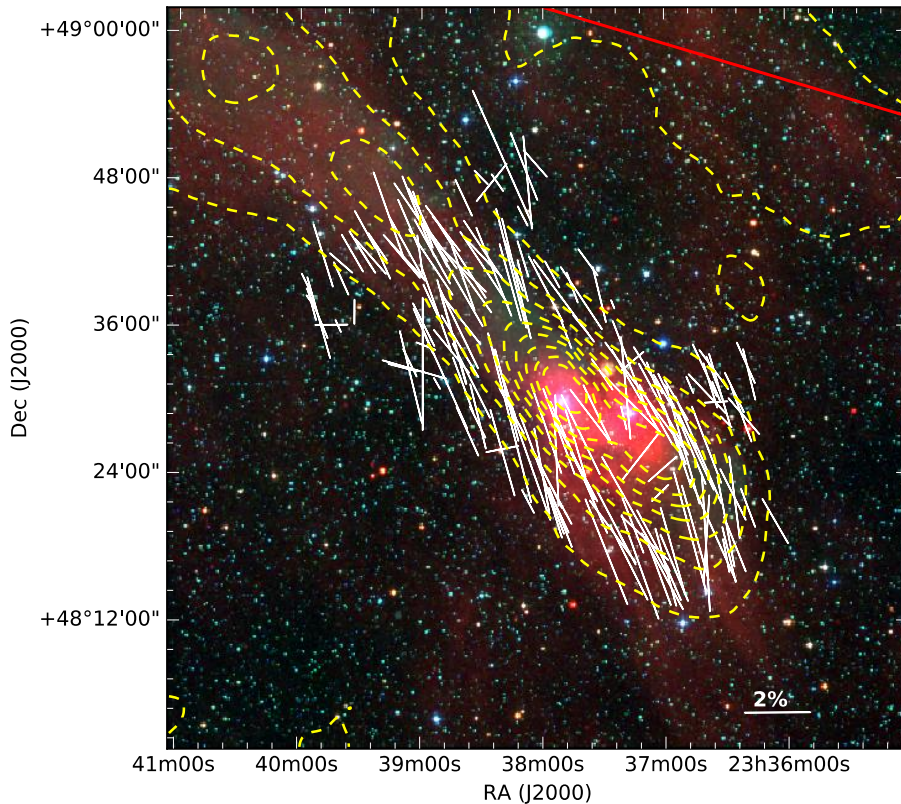
Optical study of TeV Blazars



Multi-epoch intra-night optical variability (INOV) observations of three TeV Blazars (PKS 1510-089, PG 1553+113 and Mrk 501). were carried out with BVRI filters using CCD camera on 104cm ST during June 2012 to September 2014. This slide shows R-band variation for PKS1553 for four nights and F-tests on data reveals a clear detection of intra-night variability.

Reference: Bhagwan, Jai, 2016, Ph.D. Thesias, Kumaun University.

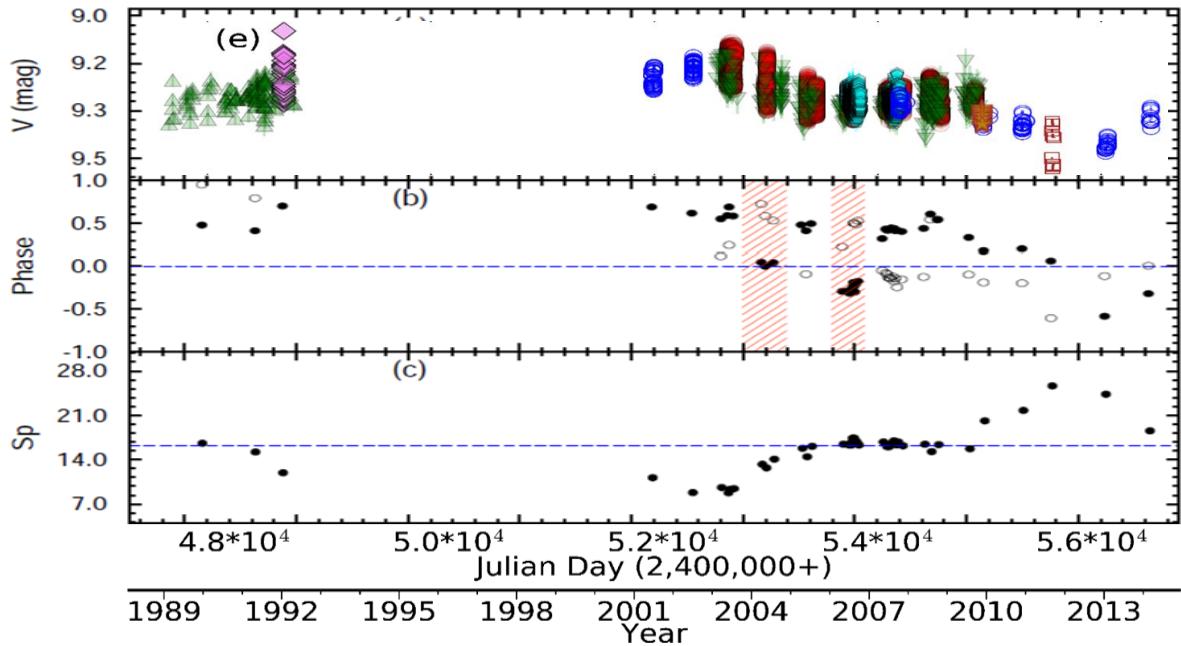
Investigation of radiation driven implosion in triggered star forming regions using AIMPOL at 104-cm ST



Gal 110-13 cloud is an isolated, unusually elongated, comet-shaped molecular cloud located at the Galactic coordinate, $l = 110^\circ$ & $b = -13^\circ$. This molecular cloud was considered to be formed by cloud-cloud collision scenario. But the most likely mechanism responsible for cometary structure of Gal 110-13 and ongoing star formation activity is found to be the RDI mode of triggered star formation as suggested by magnetic field direction inferred from our AIMPOL observations in R-band. Polarization vectors showing plane-of-sky component of the magnetic field geometry towards Gal 110-13 are shown in the figure.

Reference: Sharma, Neha, 2017, Ph.D. Thesis, Pt. Ravishankar Shukla University.

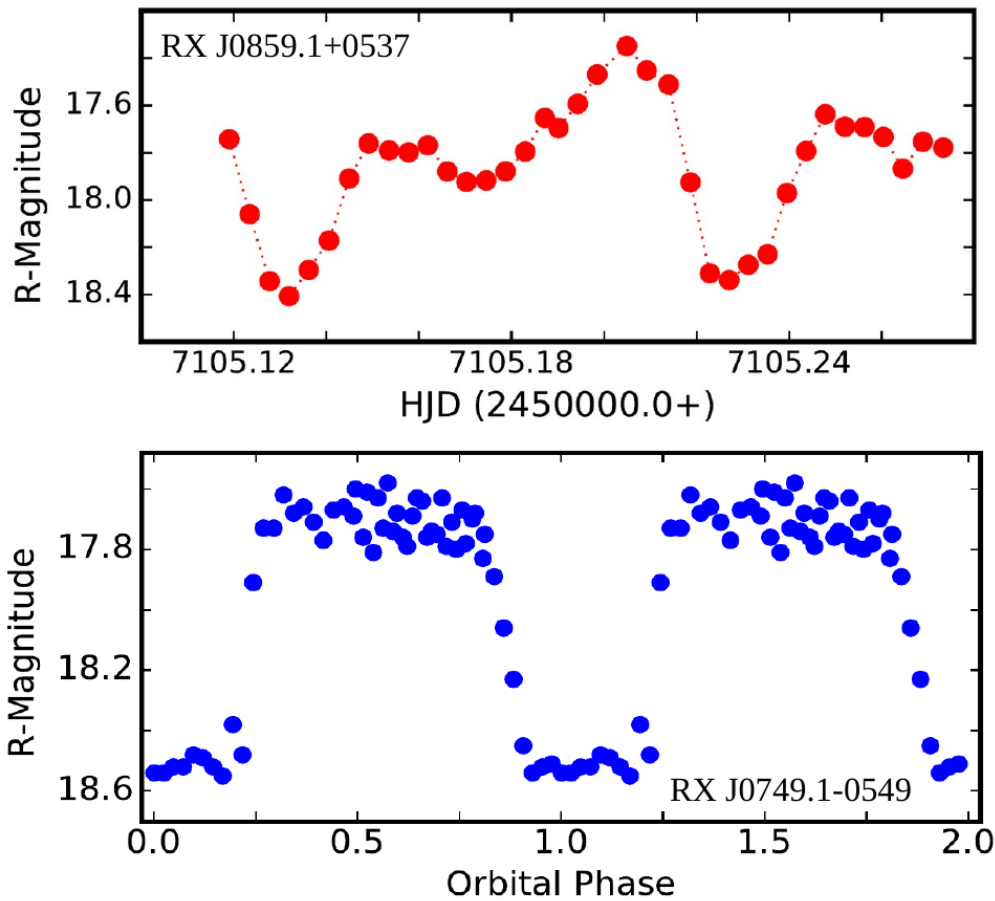
Starspot Evolution from Long-Term Monitoring



The 1.04-m Sampurnanand Telescope (ST) has been very useful in the long-term monitoring of many active stars. One such single, main-sequence, K5–8 type, ultrafast rotator LO Peg was observed by several observers from ARIES over a decade. During my Ph.D., compiling ~24 years of photometric observations, we studied the evolution of starspots, variation in spot cycles, surface differential rotation, and flaring events. The top panel of the figure shows the light curve between 1989 to 2013. Utilizing the light curve inversion technique, we modeled the stellar surface using the grid of $6^\circ \times 6^\circ$ pixels. The middle panel shows the stellar active region (solid black circle) and non-active region (open black circle). The bottom panel shows the variations in Spottedness.

Reference: Karmakar, Subhajeet, 2018, Ph.D. Thesis, Pt. Ravishankar Shukla University.

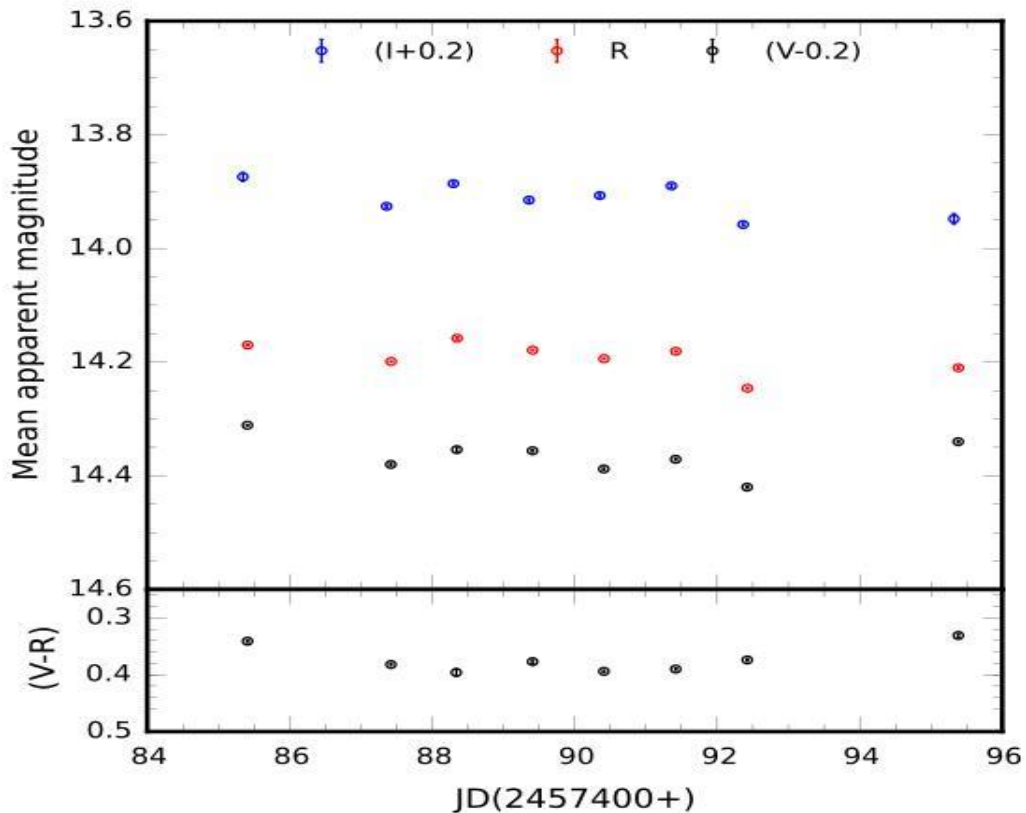
Optical Characterization of Magnetic Cataclysmic Variables using 104-cm Sampurnanand Telescope



Many magnetic Cataclysmic Variable (CV) candidates were observed using 104-cm Sampurnanand Telescope with the aim to investigate their light curve features, periodicities, proper class and other binary parameters. Among them, for the first time, two poorly studied magnetic CVs, RX J0859.1+0537 and RX J0749.1-0549 were classified as polars showing eclipse-like features that were deep, total, and variable in shape. Most accurate determination of their orbital periods provides an important addition to the distribution of eclipsing-polars. Based on the light curve morphologies and true periodicities, all their basic defining characteristics were investigated.

Reference: Joshi, Arti, 2018, Ph.D. Thesis, University of Delhi .

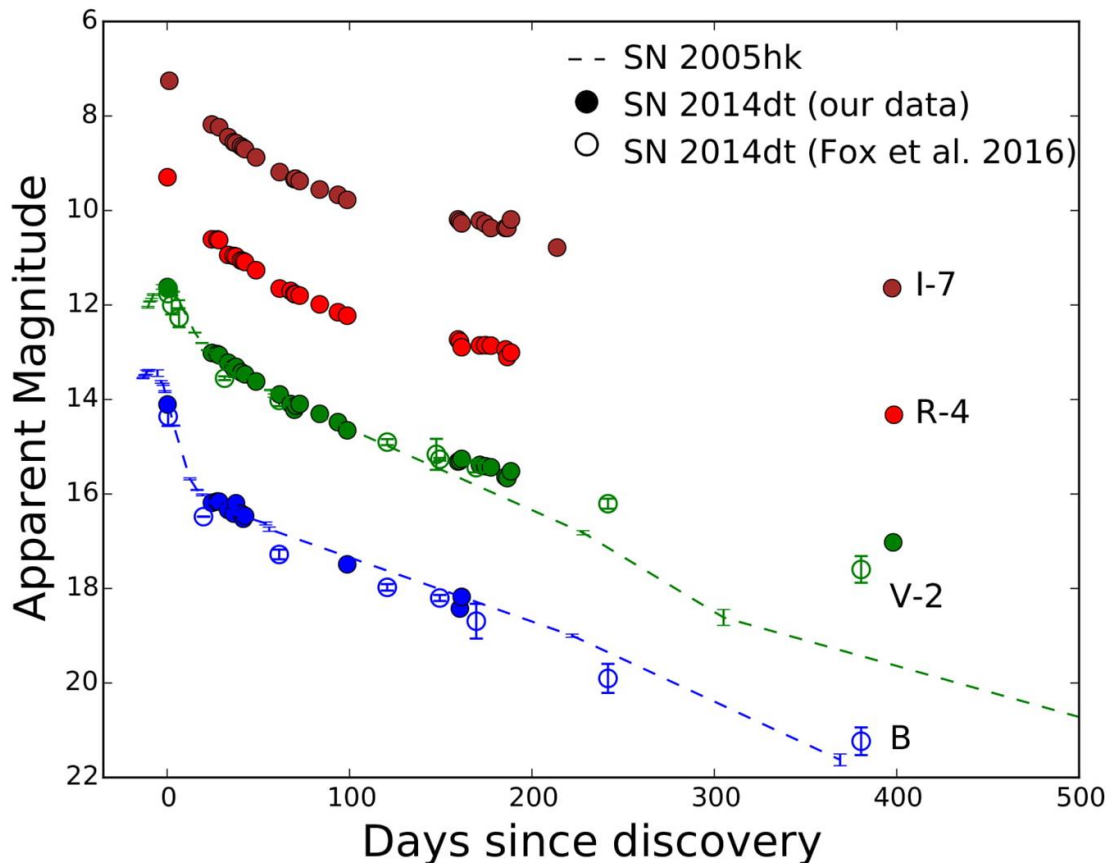
Optical variability of active galactic nuclei with 104-cm Sampurnanand Telescope



Study of optical variability of active galactic nuclei (AGN) provides insights into their unresolved inner regions. The 1-m class telescopes such as 104-cm Sampurnanand Telescope (ST) play a crucial role in such studies. A large sample of blazars, an extreme subclass of AGN, were observed with ST in B, V, R and I filters to examine their optical variability properties. Optical light curves of one such blazar, namely PG 1553+113 are shown in the above figure. Clear variations are seen in all three (VRI) optical bands as well as in the (V-R) color. Further investigations of their optical data provide important information about their inner structure and the emission processes.

Reference: Pandey, Ashwani, 2019, Ph.D. Thesis, Gorakhpur University.

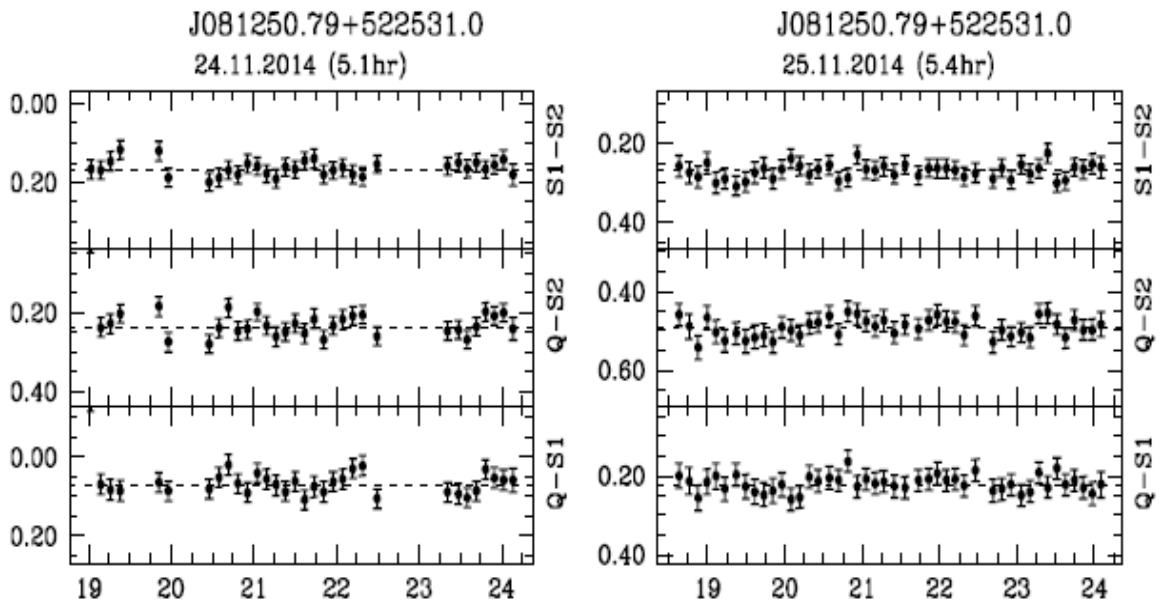
A rare bright type Iax supernova (SN) 2014dt



SN 2014dt is one of the brightest and nearest type Iax SN discovered to date using 104-cm Sampurnanand Telescope (ST). We have observed this SN for about 8 months in BVRI bands. We were able to capture the plateau phase in the light curves of SN 2014dt which is a peculiar behaviour of this kind of SNe and indicates significant positron trapping because of the presence of strong and tangled magnetic field.

Reference: Singh, Mridweeka, 2019, Ph.D. Thesis, Pt. Ravishankar Shukla University.

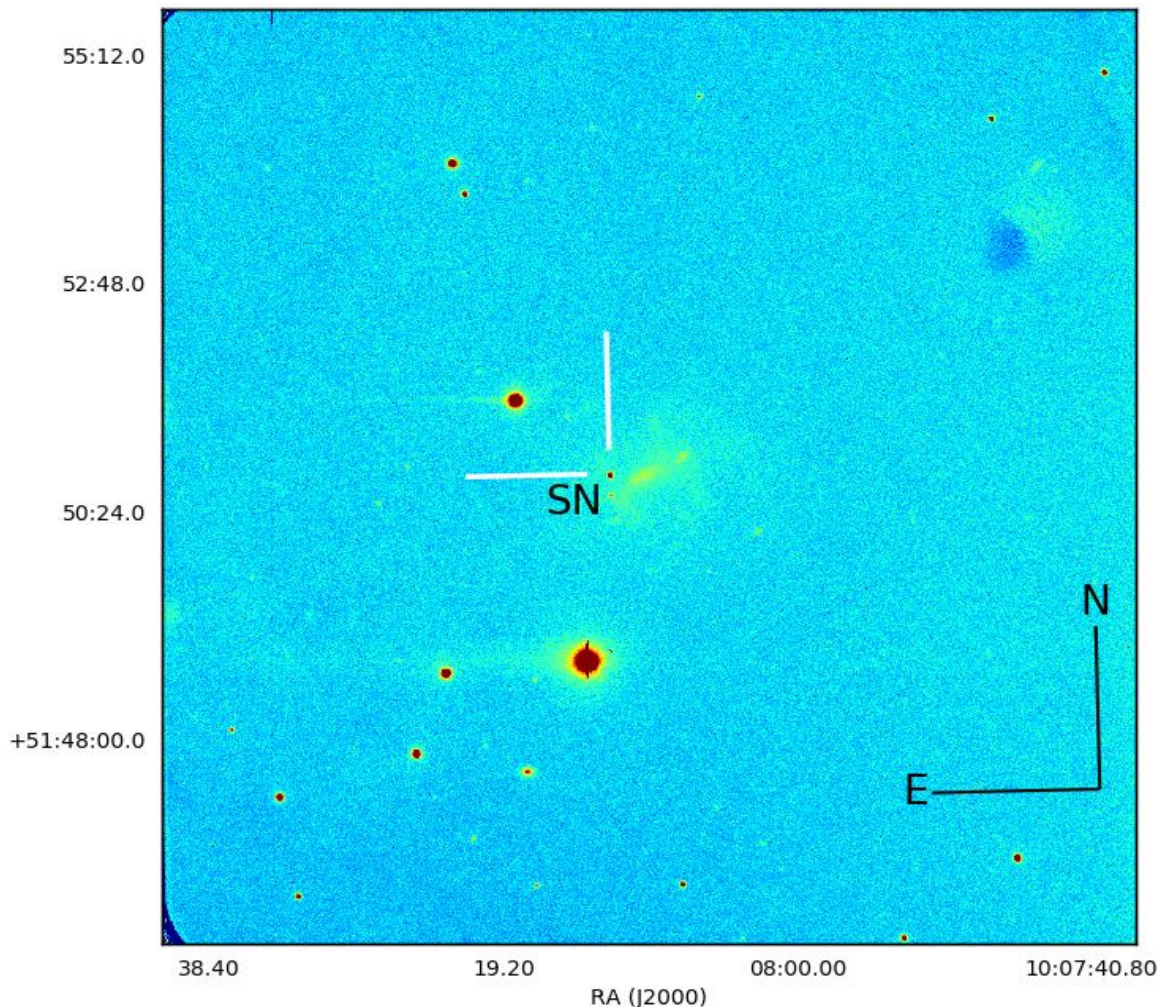
Optical microvariability of Quasars



Multi-epoch intra-night optical variability observations of ten Radio Quiet Emission Line Quasars (RQELQ) were carried out with R-band using CCD camera on 104cm ST during 2016-18. This slide shows R-band variation for J081250 for two nights and F-tests on data does not find any detection of intra-night variability. The R-band observations of RQELQ were made using other meter-class optical telescopes.

Reference: Parveen Kumar, 2019, Ph.D. Thesis, Pt. Ravishankar Shukla University.

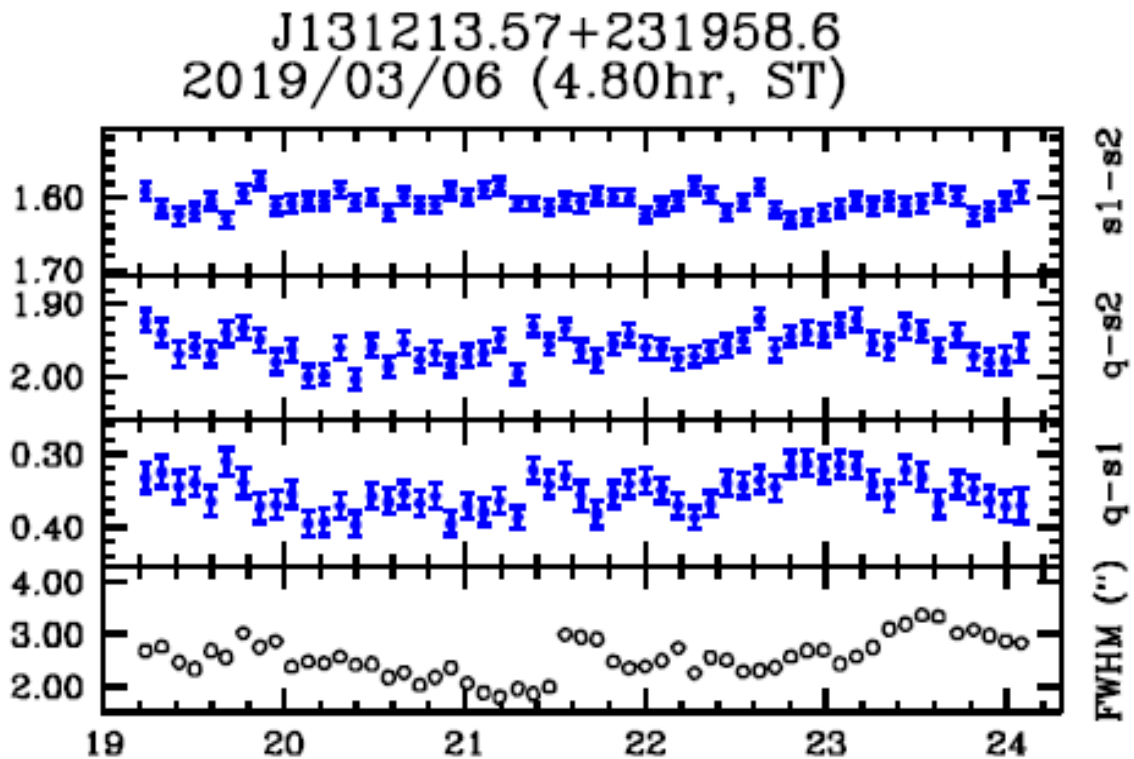
Supernovae Studies Using 104-cm Sampurnanand Telescope



The image shows a R-band 300 sec image of a type IIb SN 2015as taken with the 104-cm Sampurnanand Telescope, ARIES, India. SN 2015as is a supernova which initially showed Hydrogen lines in its spectrum but later on becomes dominated by the Helium lines. It is also one of the unique type IIb SN which lacked a primary peak due to low density outer H shell. Such explosions are very unique to deduce the properties of the progenitor star.

Reference: Gangopadhyay, Anjasha, 2021, Ph.D. Thesis, Pt. Ravishankar Shukla University.

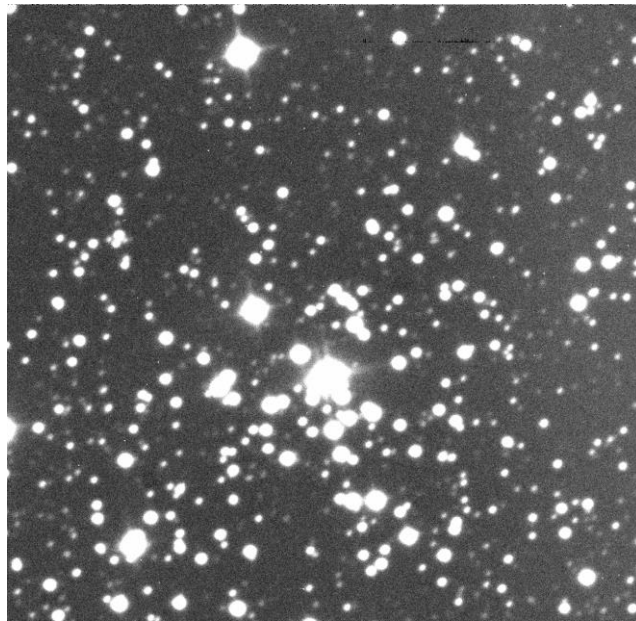
Optical microvariability of BAL Quasars



Multi-epoch intra-night optical variability observations of a BAL-Blazar candidates were carried out with R-band using 2k CCD camera on 104cm ST during 2019 for three nights.. This slide shows R-band variation for J131213 for one night. The last panel shows variation of FWHM seeing during the night. The F-tests on data do not find any detection of intra-night variability. The R-band observations of BAL-quasar samples were also made using other meter-class optical telescopes.

Reference: Mishra, Sapna, 2021, Ph.D. Thesis, University of Delhi.

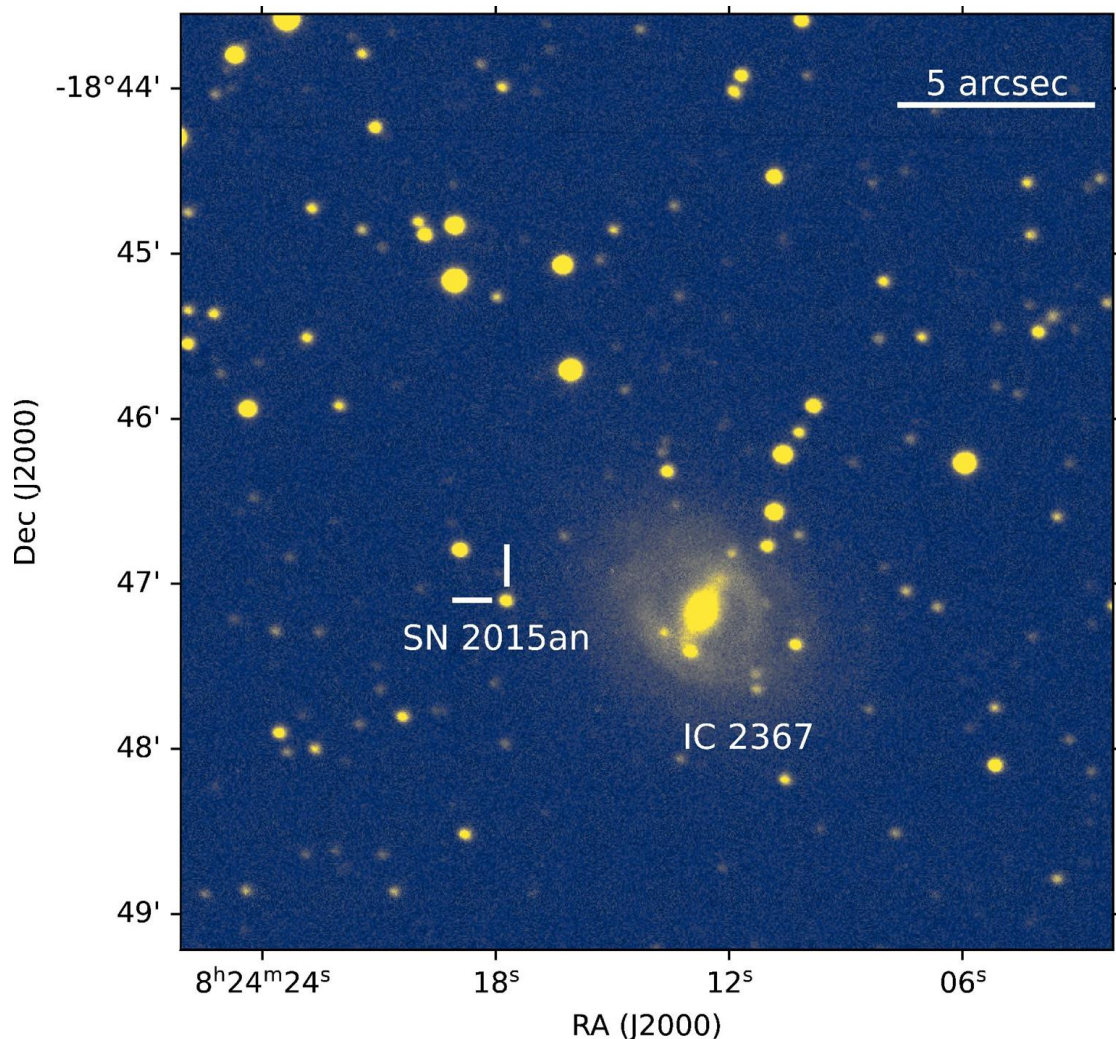
King 12 and NGC 2355 Clusters



We used PyLON 1kx1k CCD mounted on 104-cm Sampurnanand telescope to acquire broad band images for clusters King 12 (shown above) and NGC 2355 in BVRI filters to find their fundamental and dynamical properties. After correcting the data for field star contamination and completeness, luminosity function and mass segregation of the clusters were studied. We found that the luminosity function is increasing towards the fainter magnitude for King 12 and for NGC 2355 it is increasing initially but after $V_0 \sim 4$ mag it started decreasing, indicating that King 12 have its fainter members due to very young age while NGC 2355 have lost few of them. From the cumulative radial density profiles, it is evident that the more massive stars in the clusters are located toward the centre, but the mass segregation is not so clear for less massive stars. We complimented our ground based observations with space based kinematical data from Gaia mission and calculated the orbits of the clusters. We found that both the clusters are following a boxy pattern and moving in circular orbits around the Galactic centre. King 12 was born very close to the Galactic disc as compared to NGC 2355 hence moving in the close proximity of the disc.

Reference: Rangwal, Geeta, 2021, Ph.D. Thesis, Kumaun University.

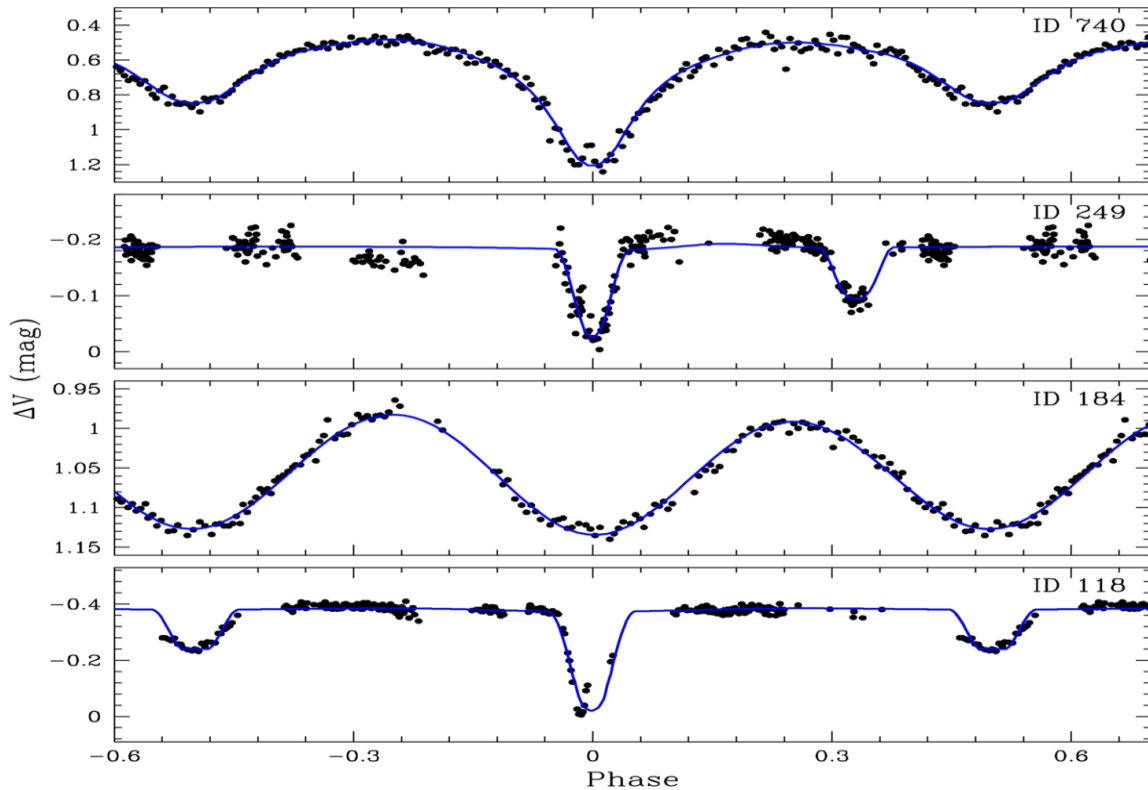
Role of 104-cm Sampurnanand Telescope in Core-Collapse Supernovae Studies



A 300-s R-band image of SN 2015an, a Type II Supernova, hosted in the galaxy IC 2367 located 30 Mpc away. This image was obtained using 1Kx1K CCD mounted on 104-cm Sampurnanand Telescope. This event is one of the bluer and brighter SNe II. The striking feature of SN 2015an was its low expansion velocity in the early phases as compared to its brightness. Indirect evidences from light curve modelling suggested interaction of SN ejecta with circumstellar-medium.

Reference: Dastidar, Raya, 2021, Ph.D. Thesis, University of Delhi.

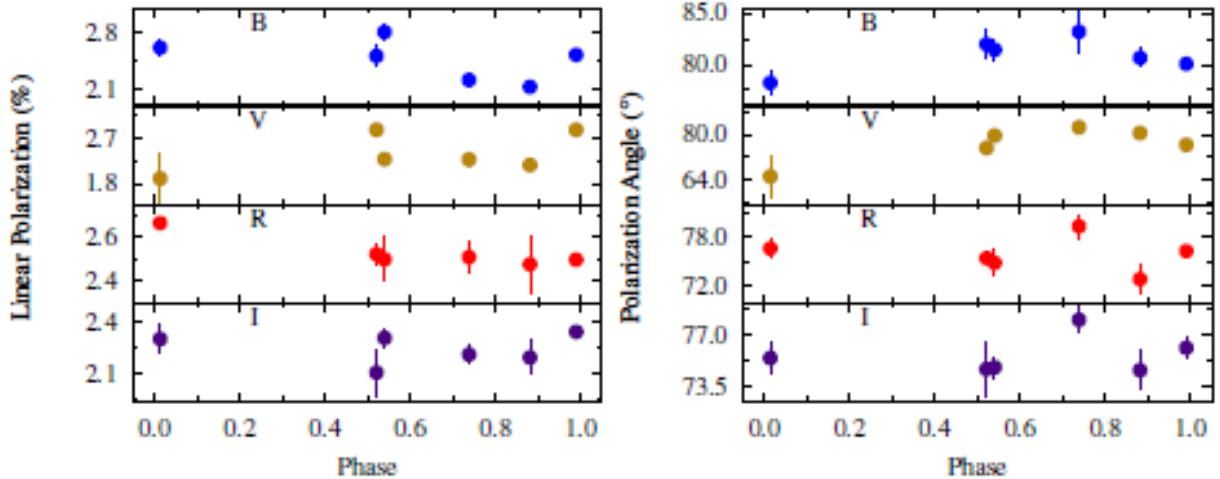
Photometric and Variability study of open star clusters



We observed open clusters NGC 1960 and NGC 559 on 43 and 32 nights spanning over few years using 1.04-m Sampurnanand telescope. We identified 76 and 70 variable stars in the clusters NGC 1960 and NGC 559. We were able to identify and characterize a rich variety of variable stars including δ -Scuti, γ -Dor, slowly pulsating B stars, non-pulsating B stars, blue straggler star, rotational variables, FKCOM variable, and eclipsing binaries. We estimated the physical parameters of the four eclipsing binaries found in the cluster region NGC 559 through model fitting on light curves using PHOEBE package (Joshi et al. 2020). The presented work also used data from 2-m IGO telescope in Pune and 2-m HCT telescope situated at Hanle, India.

Reference: Maurya, Jayanand, 2021, Ph.D. Thesis, Pt. Ravishankar Shukla University.

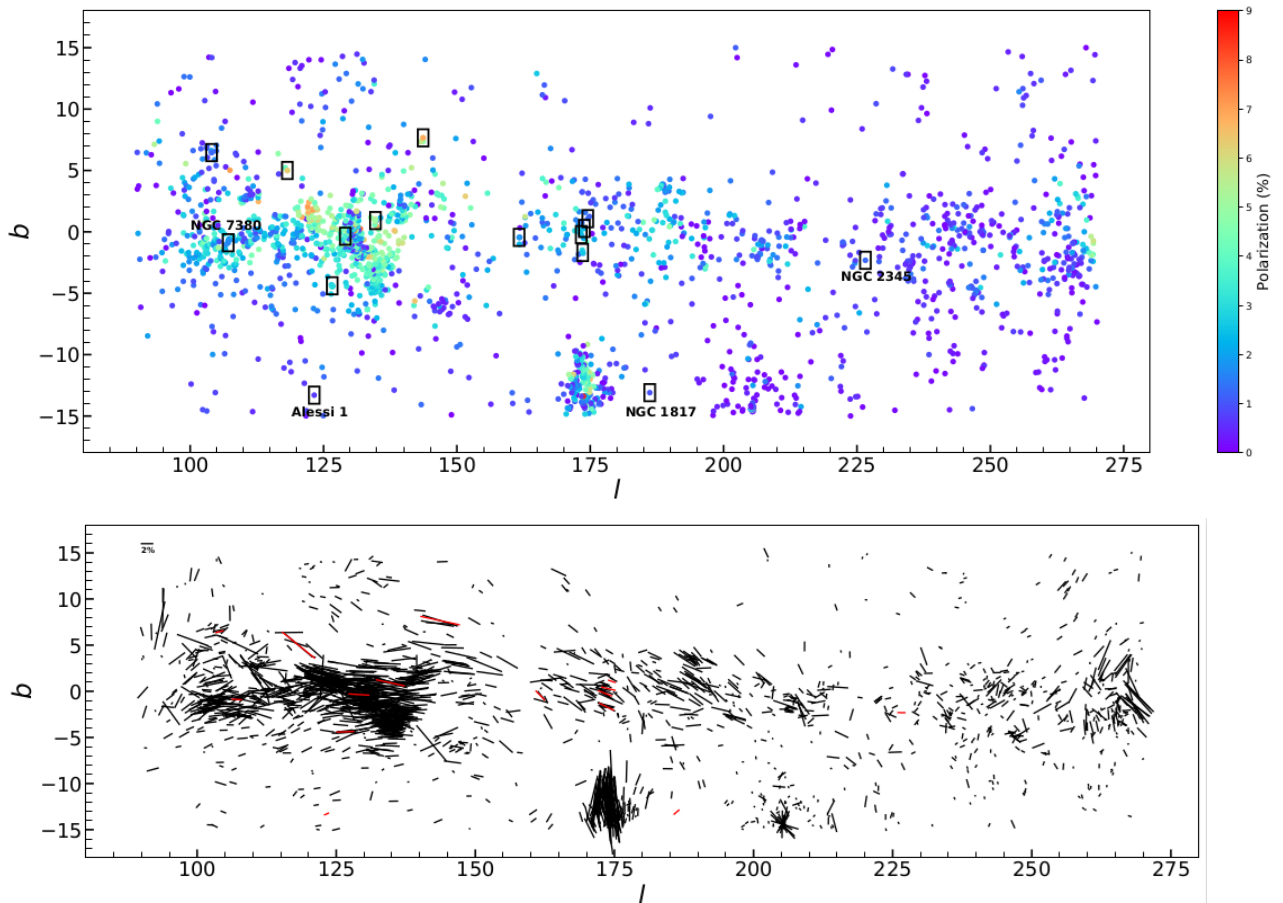
Stellar wind from massive stars



Massive stars winds are dense and extremely ionized consisting of free electrons and ions abundantly. The linear polarization of light occurs through single Thomson scattering by free electrons present in the plasma envelope rotating with the star which is ionized as well as optically thin. The polarization study of starlight from the hot objects proves to be promising manner to systematically probe their wind structure. In this project we have studied the polarization property of O+O binary DH Cep. The polarization in DH Cep was found to be variable indicating that it is intrinsic in nature. The intrinsic polarization of DH Cep may be arising due to any of the reasons: asymmetric and extended circumstellar binary envelopes, the presence of instabilities causing inhomogeneities in the massive-star winds (e.g. blobs), the rotation of spots or non-radial stellar pulsations and modulations because of the binary motion.

Reference: Arora, Bharti, 2021, Ph.D. Thesis, Pt. Ravishankar Shukla University.

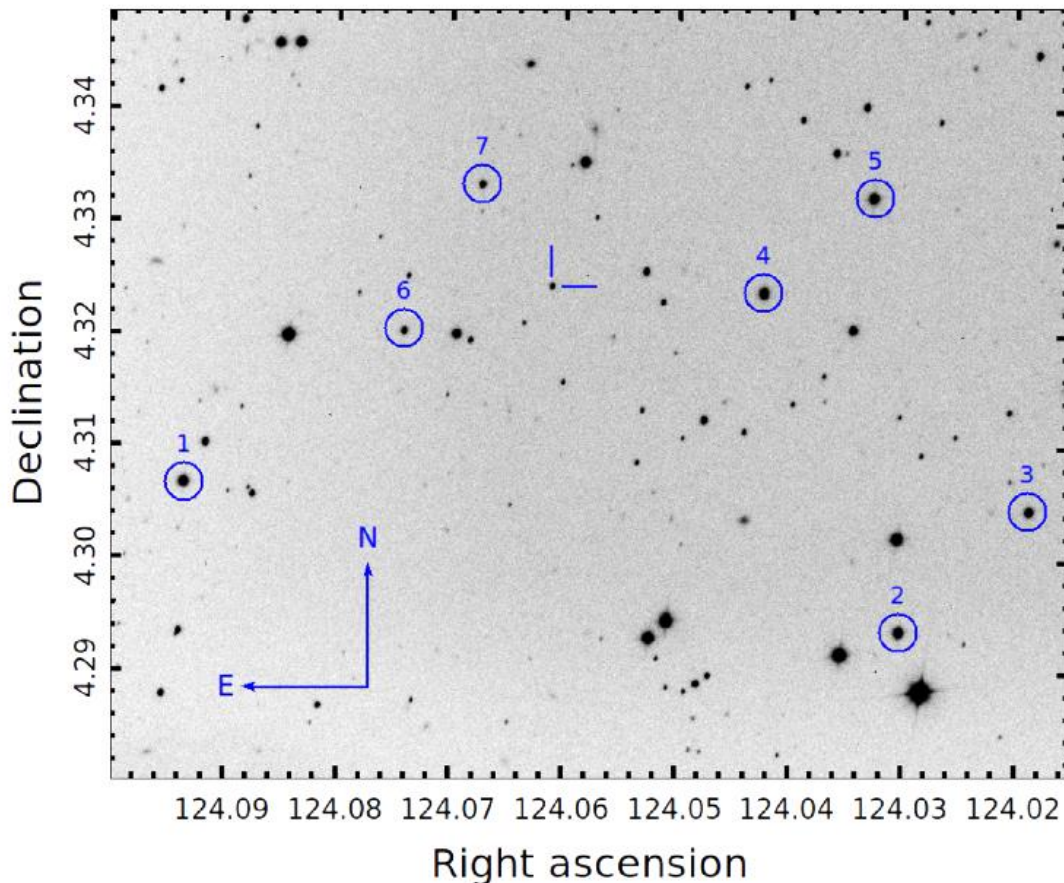
Distribution of Polarization and Position Angle towards Galactic Anti-center Direction



The polarimetric observation of four open star clusters (Alessi 1, NGC 1817, NGC 2345, and NGC 7380) was performed from the 104-cm telescope using the instrument AIMPOL in order to study the interstellar dust properties. The distribution of the degree of polarization and polarization vector plot are shown in the top and bottom panel, respectively. The observed open star clusters in my thesis are marked by boxes along with the name and other studied clusters in this direction are marked by boxes. Data are taken from Heiles (2000) also and other cluster data are taken from their respective papers.

Reference: Singh, Sadhana, 2022, Ph.D. Thesis, Pt. Ravishankar Shukla University.

Superluminous Supernova 2020ank



Broad-band VRI photometric observations of Supernova SN 2020an was carried out at one epoch using 4K CCD camera mounted on 104cm ST during 2020. This slide shows Finding chart for supernova along with local standard stars in circle. The multi-band follow-up observations of SNe are used to investigate the explosion mechanism for such events.

Reference: Kumar, Amit, 2022, Ph.D. Thesis, Pt. Ravishankar Shukla University.