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Science with IUCAA telescope

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Abstract. We present a brief overview of the proposed astronomical observations using the first light instrument IFOSC for the IUCAA 2 m telescope.

1. Introduction

The first light backend instrument for IUCAA 2m telescope will be a faint object spectrometer and camera (IFOSC). The details of this instrument can be found in the article by Ranjan et al. in this volume. Here we describe the objectives and observational requirements for the first set of proposals.

2. Stars and ISM

It is proposed to undertake a moderate spectral resolution ($\sim 1-2$Å) survey of bright stars covering the wavelength range 4000-8500Å. This data will be used for (i) building a spectral library of stars with a range of metallicity, (ii) estimating T_{eff}, log g and Fe/H using synthetic spectra, (iii) spectral classification using Artificial Neural Network and (iv) realistic SEDs for evolutionary studies of star clusters and distant galaxies. This project requires a typical S/N of 50 that can be obtained in a 3 min integration for a star of 10^{th} magnitude.

The magnetic fields in the Galactic molecular clouds will be studied using the proposed polarimetic attachment to IFOSC. The main objectives of this programme are to (i) trace the geometry of magnetic fields associated with isolated, molecular clouds, (ii) understand the role of these fields in possible star-forming activities taking place in the clouds and (iii) correlate extinction with polarization to understand properties of light scattering dust in the clouds. With the IFOSC polarimeter it is expected that 0.2% polarimetric accuracy can be obtained in 30 min for a 17.5 mag star.

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3. Galaxies and AGNs

The multiband imaging capabilities of IFOSC will be used to study the surface photometry of galaxies using a bulge-disk decomposition technique. The parameters obtained from the decomposition of multi-band images will be used to (i) get insights into the formation and evolution of galaxies (ii) study the fundamental plane and photometric plane (iii) redshift evolution (iv) environmental effects etc. To achieve optimum results this programme requires good seeing conditions and dark nights.

Spectroscopic study of a well selected sample of Seyfert galaxies will be performed. This programme aims to (i) do the reverberation mapping studies of BLR in Seyfert 1s and narrow line seyfert galaxies, (ii) obtain relationship between blackhole mass, luminosity and the radius of the BLR, (iii) investigate coronal lines (such as [Fe VII]λ6086, [Fe X]λ6374, [S VIII]λ6374, [S VIII]λ9913) and its variability, (iv) relationship between systemic redshift and emission line redshift of very bright AGNs. This programme requires moderate resolution spectra (1-2Å) with a typical S/N$\sim 30-50$. This can be achieved using 20 min exposures for objects brighter than 15^{th} mag.

4. Extragalactic astronomy

It is proposed to carry out a spectroscopic monitoring of gravitationally lensed QSOs that show differential amplification for continuum and emission lines. This study aims to detect the micro-lensing events that takes place in the lensing galaxy. Typical time-scales of few months are required for the sampling. A low resolution spectroscopic survey of QSOs will be carried out for (i) studying the Broad emission line profiles of a complete sample of luminous QSOs (B$\leq$ 18 mag) and (ii) searching for Lyman limit systems and Damped Lyman alpha systems toward bright high-z QSOs (B$\leq$ 18 mag). The programme requires low resolution ($\sim 4-6$Å), moderate S/N (~ 20) spectra in the wavelength range, 4000-6500Å. For an 18^{th} magnitude QSO, with 1.5 arc sec seeing we need 30 min exposure per object. For a good statistics we need to study about $\sim$ 500 QSOs.

The telescope will also be used for observing targets of oppertunity such as Gamma-ray bursts. Such a programme will allow us to (i) identify the afterglow candidates, (ii) perform multi-band light curve monitoring of afterglows, (iii) estimate the powerlaw index for the electron energy distribution (iv) obtain intrinsic properties of the after glows from the breaks in the spectral energy distribution and (v) detecting polarization in the afterglows.