Notice for the PhD Viva Voce Examination

Ms Akshaya Subbanna M S (Reg. No. 1540077), PhD scholar at CHRIST (Deemed to be University), will defend her PhD thesis at the public viva voce examination on Tuesday, 27 April, 2021 at 11.00 am. The defense will be conducted online on the Webex Meeting platform.

Title of the Thesis	**:**	**Study of the Diffuse Ultraviolet Background Radiation at High Galactic Latitudes**
Discipline	**:**	**Physics**
External Examiner (Outside Karnataka)	**:**	**Dr Ranjan Gupta** Senior Professor (Retired) Inter-University Centre for Astronomy and Astrophysics (IUCAA) Post Bag 4, Ganeshkhind Savitribai Phule Pune University Campus Pune 411007 Maharashtra
External Examiner (Within Karnataka)	**:**	**Dr Mousumi Das** Associate Professor Indian Institute of Astrophysics II Block, Koramangala Bengaluru 560034 Karnataka
Supervisor	**:**	**Dr Ravichandran S** Professor Department of Physics and Electronics School of Sciences CHRIST (Deemed to be University) Bengaluru – 560029 Karnataka
Co Supervisor	**:**	**Dr Jayant Murthy** Senior Professor Indian Institute of Astrophysics II Block, Koramangala Bengaluru – 560034 Karnataka

The faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva.

Registrar

Place: Bengaluru
Date: 23 April 2021

ABSTRACT

The diffuse background radiation is observed throughout the whole sky and across every wavelength of the electromagnetic spectrum. The study of this background is of great importance as it contains photons coming from a variety of astrophysical environments, traveling over the time scales of a few hundred light years to the age of the universe itself. After the discovery of the cosmic microwave background, the diffuse sky in all the other wavelengths was studied with great interest as they could provide useful insights into the formation history of the universe. In the work outlined in this thesis,I will be describing this diffuse background radiation observed in the ultraviolet (UV) region. Over more than three decades of observations of the diffuse sky in the UV has revealed our lack of understanding of all the components that contribute to the observed background sky in this wavelength region. Initial studies arrived at controversial conclusions with one group suggesting that most of the observed diffuse surface brightness is due to the dust scattered starlight while another group suggested contribution from an exotic component along with the dust scattered component. We will explore this background sky in detail by trying to identify individual components and quantify its contribution at various regions in the sky. We have started our analysis at the Galactic pole regions with $|b| > 80°$ using the data from Galaxy Evolution Explorer (GALEX) in the ultraviolet band. A major Galactic component of the diffuse sky in the UV is the starlight scattered by interstellar dust (also called Diffuse Galactic Light: DGL). We chose to study the Galactic poles due to the low dust environment in these regions and easier modeling of the DGL component. We found consistent offsets in the UV data at a level of 230 – 290 photons s−1 cm−2 sr−1 Å−1 (hereafter photon units) in the far-UV (FUV: 1539 Å) and 480 – 580 photon units in the near-UV (NUV: 2316 Å) when the UV surface brightness was compared with Galactic tracers like E(B-V) and the infrared surface brightness. These offsets represent the UV brightness at zero column densities. Part of this offset comes from the extragalactic background light (EBL) originating in background galaxies, QSOs, etc.

After careful estimation of this EBL component, we found a residual UV surface brightness of about 120 – 180 photon units in the FUV and 300 – 400 photon units in the NUV. The DGL component came to be about 120 photon units in these regions. We also found evidence for contribution from molecular hydrogen fluorescence at a column density of log NH > 20.2 (NH is in cm−2). We conclude that this contribution from H2 is from the cirrus features present at high Galactic latitudes. We further confirmed our findings at the north and south Galactic poles by studying the region between latitudes $70° < b < 80°$ where we found similar offsets and the fluorescence contribution from H2 at the same levels as in the NGP.We proposed a possible contribution to the observed residual surface brightness coming from Hawking evaporation of Primordial Black Holes. But the level of this radiation was not sufficient to account for the entirety of the observed excess. The failure of this explanation only further deepens the mystery of the source of the excess surface brightness of the UV sky.

Keywords: dust, extinction – local interstellar matter – surveys – ultraviolet: general – ultraviolet: ISM – ISM: clouds – diffuse radiation – radiative transfer – scattering