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Study of Galactic structure using ultra-violet surveys

S. S. Todmal[1], S. K. Ghosh[1], D. K. Ojha[1*] and A. C. Robin[2]
[1] *Tata Institute of Fundamental Research, Homi Bhabha Road, Colaba, Mumbai 400005, India*
[2] *Institut Utinam, CNRS UMR6213, Université de Franche-Comté, Observatoire de Besançon, Besançon, France*

Abstract. The potential for studying the structure of our Galaxy from images in multiple Near-UV & Far-UV filters of the up-coming Ultra-Violet Imaging Telescope (UVIT) onboard ASTROSAT, has been explored. Source counts from the available GALEX data have been compared with the Besançon model of the stellar population synthesis (Robin et al. 2003). The results obtained from the raw GALEX photometric catalogue and using only the "primaries", avoiding multiple detections (Budavári et al. 2009) turn out to be identical.

1. Introduction

Studies of our Galaxy have been generally based on visible and near-infrared surveys. From these data it is generally admitted that the Galaxy can be modeled assuming four main stellar populations, viz., thin disc, thick disc, stellar halo (spheroid) and the outer bulge. Structural parameters (including stellar densities, scale height, scale length, etc.) can be estimated from observed star counts towards different directions (Galactic latitude, longitude). Here, we have initiated a programme to use star counts in the UV to extract these various parameters and compare with studies at different wavelengths. For such a study, we plan to optimize the usefulness of imaging among the five selectable filters in each of the Near-UV (NUV) & the Far-UV (FUV) channels of the Ultra-Violet Imaging Telescope (UVIT) onboard the Indian Multi-wavelength Astronomical Satellite ASTROSAT. To begin with, the available sky survey in two broad bands, NUV & FUV, by the GALEX mission has been used, whose results are presented here.

*e-mail: ojha@tifr.res.in

2. Star counts from Near-UV & Far-UV survey by GALEX

The GALEX mission images a 1.2 degree (dia) field simultaneously in two bands, NUV (227 nm) & FUV (153 nm) in one setting, leading to one "tile". Nearest available tiles from the AIS survey have been used to cover a comprehensive grid of coordinates formed by 4 longitudes (l = 0, 90, 180 & 270 deg), and 19 latitudes (b = -90, -80, ... , 0 , +10, ..., +80, +90 deg). Catalogued point sources from the central 1 square degree of each tile have been used to generate differential & integral number counts at different NUV & FUV magnitudes ($\leq$ 21, a conservative estimate of the completeness limit of AIS dataset). It was found that the numbers from raw catalogue entries (*-xd-mcat.fits) matched exactly (for all the fields considerd here) those from the more secure scheme avoiding multiple entries using "primaries" alone (Budavári et al. 2009).

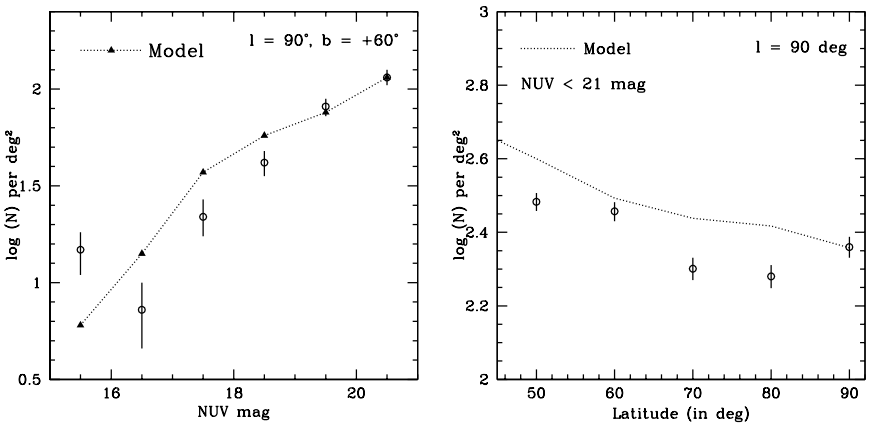

Figure 1. Comparison of differential NUV source density from GALEX-AIS with predictions of Besançon model. (*left*) The magnitude variation is displayed for l = 90 & b = +60 deg. (*right*) The latitude variation is displayed for l = 90 deg & m_{AB} = 21 mag. The open circles are observed counts with 1 σ error bars (Poisson noise only).

3. Comparison with Besançon model

Besançon model of stellar population synthesis (Robin et al. 2003) is a self-consistent model of Galactic populations and their evolution which reproduces the stellar content of the Galaxy. Recently, the model has been upgraded to include the UV bands of GALEX. In Fig. 1 (*left*), we have compared the predictions of this model (number density *versus* magnitude) with the GALEX-AIS data for the NUV band for the direction l = +90 & b = +60 deg. Fig 1.

(*right*) shows the latitude variation for $l = 90$ deg. It can been seen that the predicted NUV star counts match reasonably well with the observed counts.

4. Summary

We plan to explore the comparison between the model and GALEX data in various directions and investigate the differences in order to improve model fitting and to ensure that the model is well suited for these wavelengths and can be applied to predict counts for the UVIT-ASTROSAT.

References

Budavári T., Heinis S., Szalay A. S., et al., 2009, ApJ, 694, 1281
Robin A. C., Reylé C., Derrière S., & Picaud S., 2003, A&A, 409, 523