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ORIGINAL ARTICLE

The diffuse ultraviolet foreground

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Abstract Ultraviolet observations from low Earth orbit (LEO) have to deal with a foreground comprised of airglow and zodiacal light which depend on the look direction and on the date and time of the observation. We have used all-sky observations from the GALEX spacecraft to find that the airglow may be divided into a baseline dependent on the sun angle and a component dependent only on the time from local midnight. The zodiacal light is observable only in the near ultraviolet band (2321 Å) of GALEX and is proportional to the zodiacal light in the visible but with a color of 0.65 indicating that the dust grains are less reflective in the UV.

Keywords Atmospheric effects · Diffuse radiation · Ultraviolet: general · Zodiacal dust

1 Introduction

Measurements of the diffuse ultraviolet (UV) radiation field have to contend with a number of contaminating sources including atmospheric emission lines and the zodiacal light (Murthy 2009). These foreground sources are particularly important at high galactic latitudes where the Galactic contribution to the radiation field is relatively small and at longer wavelengths where the zodiacal light, which follows the solar spectrum, becomes increasingly important. It has been difficult to disentangle these components, largely because of a lack of relevant observations. Ideally, these would be spectroscopic observations with moderate resolutions over a large part of the sky with different sun angles. However, what we have is thousands of observations from the Galaxy Evolution Explorer (*GALEX*) in two bands (FUV: 1531 Å and NUV: 2321 Å) with observations far from the Sun to minimize foreground emission.

Despite these drawbacks, we have used the *GALEX* data to derive empirical formulae for the foreground sources. Although our main interest is in better understanding the galactic and extragalactic diffuse radiation, we hope that our results will also prove useful in studies of the Earth's atmosphere and of the zodiacal light. They will certainly prove useful in mission planning for other space-borne instruments such as the Ultraviolet Imaging Telescope (Kumar et al. 2012) which will observe the sky with large field of view instruments where diffuse radiation limits the observable sky.

2 Observations & data

2.1 Observations

The *GALEX* spacecraft was launched in 2003 and has since observed about 75 % of the sky in two spectral bands (FUV: 1531 Å and NUV: 2321 Å) with a spatial resolution of about 5″ over a field of view of 0.6°. The primary mission was described by Martin et al. (2005) and the software and data products by Morrissey et al. (2007). Most of the *GALEX* observations were short exposures of about 100 seconds in length (All-Sky Imaging Survey: AIS) but there were a number of longer observations of 10,000 seconds or more, either to fulfill specific mission objectives or taken as part of the Guest Investigator (GI) program. A single exposure was limited by the duration of the orbital night (about 1000 seconds) and longer observations were broken up into a series

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