

Title: Exospheric Solar Wind Charge Exchange as observed by XMM-Newton

Authors:

Jenny Carter, Steve Sembay and Andrew Read

Abstract:

The XMM-Newton observatory provides unrivalled capabilities for detecting low surface brightness emission features from extended and diffuse galactic and extragalactic sources, by virtue of the large field of view of the X-ray telescopes and the high throughput yielded by the heavily nested telescope mirrors.

One potential source of background for astronomers is locally produced X-rays from Solar Wind Charge Exchange (SWCX) interactions between solar wind ions and neutral atoms in the Earth's exosphere. This process has been detected by essentially all soft X-ray telescopes from ROSAT onwards. Studies by members of the EPIC team at Leicester have shown that around 5% of 3012 XMM-Newton observations studied unambiguously contain a diffuse, but strongly variable local SWCX signal; this signal can be the strongest diffuse soft X-ray component within an observation.

Whilst SWCX is a source of background for astrophysicists concerned with studies of diffuse Galactic and extra-galactic X-ray emission, it provides a diagnostic of the charge state distribution of the solar wind and the mass transport around the Earth's magnetosheath. We will discuss the data processing, analysis and predictive modelling of the locally produced SWCX emission undertaken by the EPIC team at Leicester. We discuss a Coronal Mass Ejection observed by XMM-Newton and the compositional and temporal information that could be gathered about the plasma pulse. In addition we show that XMM-Newton preferentially detects SWCX around the subsolar point of the Earth's magnetosheath.