High time-resolution analysis of X-ray data from Proxima Centauri

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Abstract

The presence of a stable atmosphere is usually considered a requirement for the development of life-as-we-know on an exoplanet. X-ray and extreme ultraviolet (together, XUV) radiation from stars is for this reason a major concern for habitability, both because it strongly affects planetary atmospheres retention and because of its ionizing effects. Stellar flares represent the extreme cases as not only we see a rise of orders of magnitude in the total flux but also a strong enhancement of XUV. Proxima Centauri represents one of the best candidates for in-depth studies of XUV radiation from flares because it is the closest star to us and presents high activity. We have analyzed archival data of Proxima Centauri from the XMM-Newton and Chandra telescopes, and produced time series of its X-ray spectra. We have paid special attention to calibration, time-resolution and uncertainties. We propose a simplified pile-up correction finding that total fluxes may vary by up to 30% because of this effect. We devised a sliding-window time-binning algorithm and a model regression routine that allows to reach time resolutions of few minutes both for fluxes and plasma parameters. The quiescent and the flaring emissions from Proxima Centauri are characterized both in energies and in frequencies using nearly 6 days of observations spanning 19 years. Fluxes scenarios in the 1-100 Årange are presented with uncertainties lesser than 10% and average time-resolution of 5 minutes.