Unveiling long-term variability in XMM-Newton surveys (the EXTras project)

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(on behalf of the EXTras project)

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The 3XMM-DR4 catalogue, the XMM-Newton Slew Survey (XSS) and the associated XMM-Newton EPIC data, are extensive resources for exploring high energy, time-domain astrophysics. Amongst these data are potential, hitherto unidentified variable sources, ranging from short duration (~seconds) transients through to objects varying on timescales of years. Variability signatures can be key to understanding the energetics and physical processes in a diverse range of astrophysical settings. The EU FP7-Cooperation Space framework project, Exploring the X-ray transient and variable sky (EXTras), aims to exploit these XMM-Newton resources to explore, as fully as possible, the range of X-ray variability present and provide the results to the community through a public database. Here we outline one of the project's core aims, i.e. identifying and characterising long-term (days to years) variability. The 3XMM-DR4 catalogue contains ~57000 sources comprising at least 2 detections, with some objects observed up to 44 times. In conjunction with the XSS, which has now covered ~68% of the sky, often with multiple slews, there is excellent scope for identifying new variable objects that manifest themselves through changes in luminosity between XMM-Newton observations. We discuss the plans for the EXTras long-term variability catalogue and highlight some examples of the detection of long-term variability in 3XMM-DR4 data.

Statistics of the XMM-Newton catalogues

|                  | 3XMM-DR4 | Cleaned Slew Survey (xmms1D6) *
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Number of detections</td>
<td>531261</td>
<td>20106</td>
</tr>
<tr>
<td>Number of unique sources</td>
<td>373726</td>
<td>-18400</td>
</tr>
<tr>
<td>Unique sources with &gt; 1 detection</td>
<td>606729</td>
<td>&gt; 950</td>
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<tr>
<td>Non overlapping sky coverage</td>
<td>~88%</td>
<td></td>
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* The slew survey catalogue will be improved and augmented as part of the EXTras project.

The EXTraS long-term variability work aims to:

1. Enhance the processing of XMM-Newton slew data e.g. limiting the use of a slew-specific PSF, exploiting improved attitude reconstructions using the latest XMM-Newton SAS software and optimising the rejection of high background intervals.
2. Create a catalogue of detections, combining the 3XMM-DR4 and Sloan survey catalogues.
3. Add upper limits from any XMM-Newton pointed or slew survey fields, where a combined-exposure position source is covered but not detected.
4. Create and apply optimum methodologies to search for variability amongst the detections and upper limits of such multiply-observed unique sources.

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- Create a catalogue of detections, combining the 3XMM-DR4 and Sloan survey catalogues.
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- Create and apply optimum methodologies to search for variability amongst the detections and upper limits of such multiply-observed unique sources.
- Examine and exploit approaches to characterise the amplitude and duration of the variability, while present. Characterising long-term variability in XMM-Newton data is complicated by the presence of highly-nonuniform sampling that is dictated by the observing strategy of the observation proposal for each unique source. TheChangeListener monitors the EXTraS long-term variability project.

References:


X-ray and Observational Astronomy & Space Research Centre

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