ART: Surveying the Local Universe at 2–11 keV

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Spectrum Röntgen Gamma (SRG) is a new, Russian-led x-ray astronomy mission.

ART (US; Germany; Russia)
Astronomical Röntgen Telescope

eROSTTA (Germany)
extended Röntgen Survey with an Imaging Telescope Array

XRS (Japan & US; Germany)
X-Ray Spectrometer

- In scanning mode, SRG will perform an all-sky survey of unprecedented sensitivity, with CCD energy resolution.
- In pointed mode, SRG will obtain long exposures, with microcalorimeter energy resolution.
ART is a medium-energy x-ray telescope system for SRG, proposed as a 3-nation collaboration.

**Mirror assembly**
- 2x4 modules of electroformed-Ni shells
- US (NASA/MSFC & SAO, proposed)
- Russia (VNIIEF)

**Optical bench and alignment**
- Russia (IKI)

**Focal-plane detectors**
- 2 eROSITA CCDs
- Back-illuminated pn
- 50-ms integration
- 450-μm depletion
- Germany (MPE)

- Each mirror module images onto a distinct quadrant of a CCD.
- ART modules point 3° from mean direction.
- Align 1 pair of modules to eROSITA & SRG.
ART extends the spectral coverage of eROSITA to 11 keV (15 keV for pointed observations).
This extended coverage increases detections of Fe-K lines by 3, heavily obscured AGN by 3–5.

ART will detect nearly 100,000 AGN >2 keV.

<table>
<thead>
<tr>
<th>SRG ART</th>
<th>All-sky</th>
<th>Polar</th>
<th>Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey Ω [deg²]</td>
<td>41,000</td>
<td>400</td>
<td>125</td>
</tr>
<tr>
<td>Sensitivity [erg cm⁻² s⁻¹]</td>
<td>3.1×10⁻¹³</td>
<td>3.4×10⁻¹⁴</td>
<td>8×10⁻¹⁵</td>
</tr>
<tr>
<td>Detected #</td>
<td>52,000</td>
<td>14,000</td>
<td>31,000</td>
</tr>
<tr>
<td># &gt; 100 cts</td>
<td>1,000</td>
<td>310</td>
<td>3,100</td>
</tr>
</tbody>
</table>

eROSITA will detect many more soft sources.

Expected all-sky detections of obscured AGN

<table>
<thead>
<tr>
<th>Column ( N_H ) [cm⁻²]</th>
<th>eROSITA alone</th>
<th>ART alone</th>
<th>eROSITA + ART</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1×10^{23}</td>
<td>5000</td>
<td>3000</td>
<td>12,000</td>
</tr>
<tr>
<td>&gt; 3×10^{23}</td>
<td>600</td>
<td>700</td>
<td>1,800</td>
</tr>
<tr>
<td>&gt; 1×10^{24}</td>
<td>20</td>
<td>60</td>
<td>100</td>
</tr>
</tbody>
</table>

Estimates are based upon Treister & Urry 2005.

Urry & Padovinin 1995

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ART bridges the soft- and hard-X-ray bands, complementing other missions—e.g., NuSTAR.

NGC 6240
(Seyfert 2)
z=0.0244

ART response for model spectrum
(Vignati et al. 1999)

Transparent thermal:
0.5 keV
0.7 keV

Fe-K lines:
neutral fluorescence
helium-like
hydrogen-like

Compton-reflected
power law

Heavily-absorbed
($N_H=2x10^{24} \text{ cm}^{-2}$)
power law ($\Gamma=1.8$)