Summary WD/iNS Working Group
IACHEC #11, Pune, India

2016-02-29

Attendees:

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Shabnam Iyyani
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Vadim Burwitz
Observations with ASTROSAT

• Instrument Constraints
  – SXT
    • FoV 40’ diameter (jitter ~6’)
    • PSF 2’-4’ diameter (with Jitter)
  – UVIT
    • FoV 28’ diameter (40’ with drift and Jitter)
    • no bright sources in <20’ radius
WD Observations with ASTROSAT

- HZ43A (HZ43B M3.5 star 13mag, check if flaring)
  - SXT (observed, check high energy cut-off)
  - UVIT (check if observable)
- GD153
  - SXT (observed but undetected → too faint)
  - UVIT (check if observable, check if grating possible)
- Models
  - Physical models
    - Rauch, Barstow (Hubeny) NLTE Models
    - Best Fits
      - Papers Beuermann; Paper Kaastrarake
      - Thesis Menz
    - HST – absolute flux calibration
iNS Observations with ASTROSAT

• RXJ1856
  – SXT (not observed yet important for low E calibration)
  – UVIT (optically very faint: 26 mag in HAST)

• Models
  – Blackbody (well contrained from existing missions)
    • Sufficient for calibrating response shape
    • Relative calibration
  – Physical models
    • Different approaches: strongly magnetized atmospheres
      → same shape as bb model
WG Actions

- Provide KP with Rauch models for fitting ASAP (March 2016), as tables for XSPEC ✔
  → see 1st fit to ASTROSAT HZ43A data on subsequent pages

- SXT definitely requires RXJ1856 observation
  → to help improve the low energy response

- iNS provide blackbody model parameters from Drake and Burwitz papers + IACHEC efforts

- Add Models and LETGS spectra to IACHEC wiki

- Check HZ43A and HZ43B co-added spectra for high energy tail in HRC-S + LETG (Vinay, Jeremy)

- HITOMI →

<table>
<thead>
<tr>
<th>Calibration item</th>
<th>SXS/SXT-S</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Contamination</td>
<td>RXJ1856-3754, 1E0102-72</td>
<td>RXJ1856-3754, Cygnus Loop</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
### WD models from literature

Table 5.3.: Literature values of $T_{\text{eff}}$ and log $g$

<table>
<thead>
<tr>
<th>Target</th>
<th>$T_{\text{eff}}$</th>
<th>log $g$</th>
<th>$R^2/d^2 (10^{-22})$</th>
<th>$N_H (10^{19} cm^{-2})$</th>
</tr>
</thead>
<tbody>
<tr>
<td>GD153</td>
<td>$38205 \pm 1534^{1}$</td>
<td>$7.9 \pm 0.18^{1}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$38487 \pm 247^{2}$</td>
<td>$7.870 \pm 0.010^{2}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HZ43 A</td>
<td>$49435 \pm 1322^{1}$</td>
<td>$7.95 \pm 0.14^{1}$</td>
<td>$0.3011 \pm 0.018^{4}$</td>
<td>$0.0891 \pm 0.0037^{4}$</td>
</tr>
<tr>
<td></td>
<td>$50377 \pm 324^{2}$</td>
<td>$7.970 \pm 0.030^{2}$</td>
<td>$0.3037 \pm 0.013^{5}$</td>
<td>$0.085 \pm 0.004^{5}$</td>
</tr>
<tr>
<td>Sirius B</td>
<td>$24790 \pm 100^{3}$</td>
<td>$8.57 \pm 0.06^{3}$</td>
<td>$48.77 \pm 0.36^{4}$</td>
<td>$0.065 \pm 0.02^{4}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>$49.1 \pm 0.4^{5}$</td>
<td>$0.058 \pm 0.008^{5}$</td>
</tr>
</tbody>
</table>

1. Balmer line (Barstow et al. 2003)
2. Lyman line (Barstow et al. 2003)
3. Balmer line (Barstow et al. 2005)
4. Beuermann et al. (2006)
5. Kaastra et al. (2009)
H43A model from Chandra LETGS

- GD153
- HZ43A
- SiriusB

Normalized counts s$^{-1}$ Å$^{-1}$

Ratio

Wavelength (Å)

Menz 2011

0.3 keV
WD model values from combined Chandra LETGS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>literature values</th>
<th>Chandra effective area</th>
<th>combined fit</th>
<th>new effective area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GD153</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log g (cgs)</td>
<td>7.870 ± 0.010</td>
<td>7.66 ±0.05</td>
<td>7.87</td>
<td>7.92 ±0.1</td>
</tr>
<tr>
<td>$T_{\text{eff}}$ (kK)</td>
<td>38.487 ± 0.247</td>
<td>42.15 ±2.1</td>
<td>38.487</td>
<td>38.15 ±3.9</td>
</tr>
<tr>
<td>$R^2/d^2 (10^{-22})$</td>
<td>0.25</td>
<td>0.48 ±0.16</td>
<td>0.95 ±0.69</td>
<td>1.0 ±0.1</td>
</tr>
<tr>
<td>nH ($10^{19}$ cm$^{-2}$)</td>
<td>0.14 ±0.04</td>
<td>&lt; 0.01</td>
<td>&lt; 0.2</td>
<td></td>
</tr>
<tr>
<td>reduced $\chi^2$</td>
<td>1.22</td>
<td></td>
<td></td>
<td>0.96</td>
</tr>
<tr>
<td><strong>HZ43 A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>log g (cgs)</td>
<td>7.970 ± 0.030</td>
<td>7.7 ±0.2</td>
<td>7.97</td>
<td>7.92 ±0.2</td>
</tr>
<tr>
<td>$T_{\text{eff}}$ (kK)</td>
<td>50.377 ± 324</td>
<td>50.98 ±2.7</td>
<td>50.377</td>
<td>51.25 ±3.5</td>
</tr>
<tr>
<td>$R^2/d^2 (10^{-22})$</td>
<td>0.3037 ± 0.013</td>
<td>1.2 ±0.5</td>
<td>1.10 ±0.9</td>
<td>1.0 ±0.1</td>
</tr>
<tr>
<td>nH ($10^{19}$ cm$^{-2}$)</td>
<td>0.085 ± 0.004</td>
<td>0.27 ±0.07</td>
<td>0.085</td>
<td>0.082 ±0.03</td>
</tr>
<tr>
<td>reduced $\chi^2$</td>
<td>2.36</td>
<td></td>
<td></td>
<td>1.04</td>
</tr>
<tr>
<td><strong>Sirius B</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>log g (cgs)</td>
<td>8.57 ± 0.06</td>
<td>8.40 ±0.05</td>
<td>8.57</td>
<td>8.49 ±0.2</td>
</tr>
<tr>
<td>$T_{\text{eff}}$ (kK)</td>
<td>24.790 ± 0.100</td>
<td>24.83 ±0.2</td>
<td>24.79</td>
<td>25.01 ±0.4</td>
</tr>
<tr>
<td>$R^2/d^2 (10^{-22})$</td>
<td>48.77 ± 0.36</td>
<td>170 ±10</td>
<td>179 ±129</td>
<td>152 ±5</td>
</tr>
<tr>
<td>nH ($10^{19}$ cm$^{-2}$)</td>
<td>0.065 ± 0.02</td>
<td>0.02 ±0.1</td>
<td>0.065</td>
<td>&lt; 0.09</td>
</tr>
<tr>
<td>reduced $\chi^2$</td>
<td>0.96</td>
<td></td>
<td>0.76</td>
<td>1.05</td>
</tr>
<tr>
<td>reduced $\chi^2$ combined fit</td>
<td></td>
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$^1 R^2/d^2$ value calculated with $M = 0.60M_\odot$, $d = 67.9$ pc, and $\log g = 7.86$ and $g = GM/R^2$. Values are taken from Lajoie & Bergeron (2007). An error cannot be calculated since all values are tabulated without errors.

Note: there is a factor of 3 difference between the Rauch and literature normalization constants Menz 2011
HZ43A ASTROSAT SXT 14ksec: Overview

Background level to be determined more precisely
Using default SXT
- ARF (simulated)
- RMF (ground calibration) Model
- Thomas Rauch NLTE
- Parameters from fit

Rauch NLTE model
Log $g = 7.9$
$T = 51.250$ KK
norm $= 1.4$ (free)
LETGS norm $\sim 1.0$

- RMF needs checking at this low energy range
  $\rightarrow$ only calibrated down to 0.3 keV on ground
- Background subtraction not yet ideal to be checked
WG Actions

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