The whisper of the faintest X-ray sources and the loud influence of Riccardo Giacconi

March 13, 2001
Seeing the Unseen: Chandra Deep Fields
Space Science Update @ NASA HQ
THANKS to Sheva Moore and team at NASA TV

Ann Hornschemeier

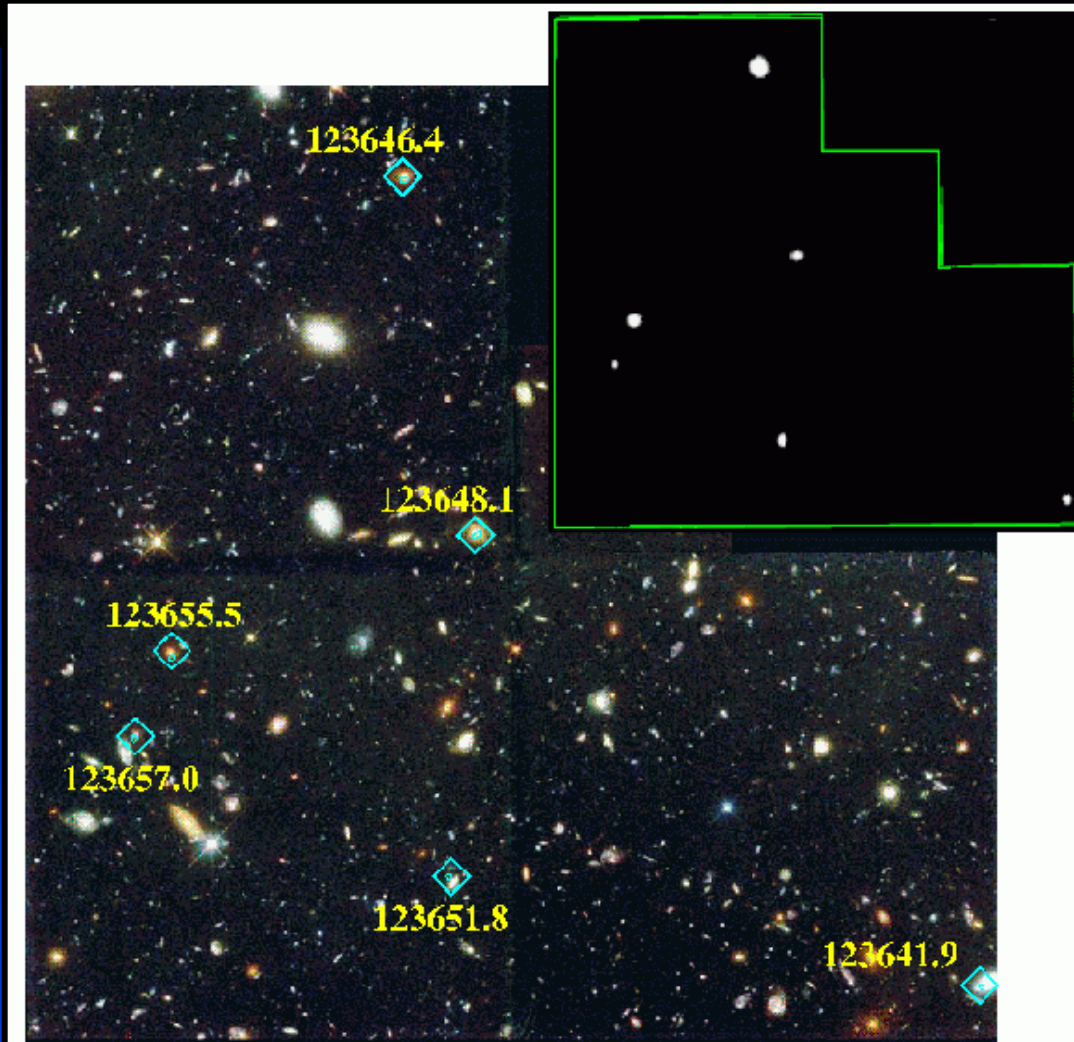Lab Chief, X-ray Astrophysics (NASA GSFC)

What was it like sitting next to Riccardo?

Ann Hornschemeier
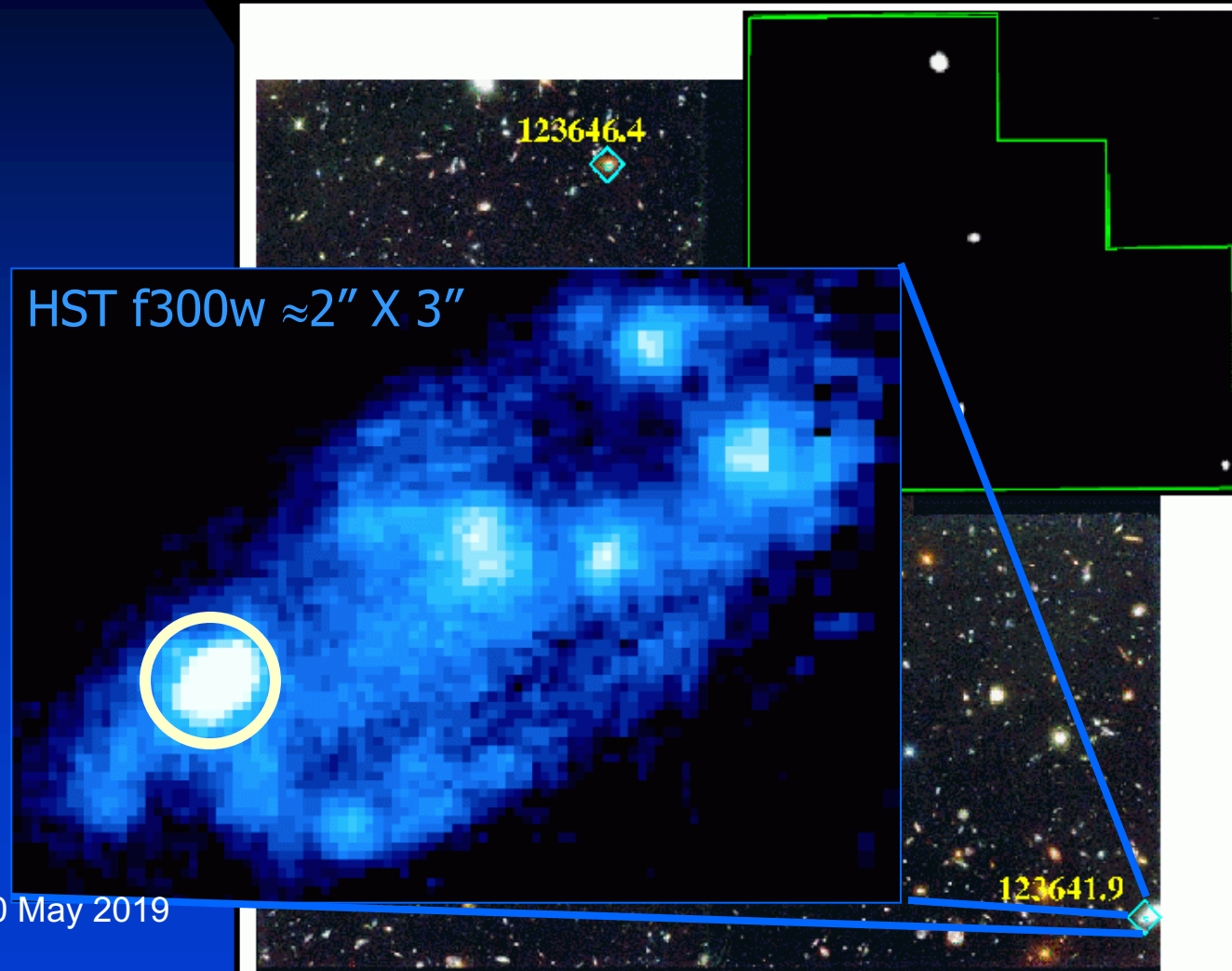Giacconi Memorial Symposium
National Academy of Sciences

First Views of the X-ray Sky with Chandra

- Normal galaxy with ULX among first six objects detected in HDF-N   **(166 ks)**
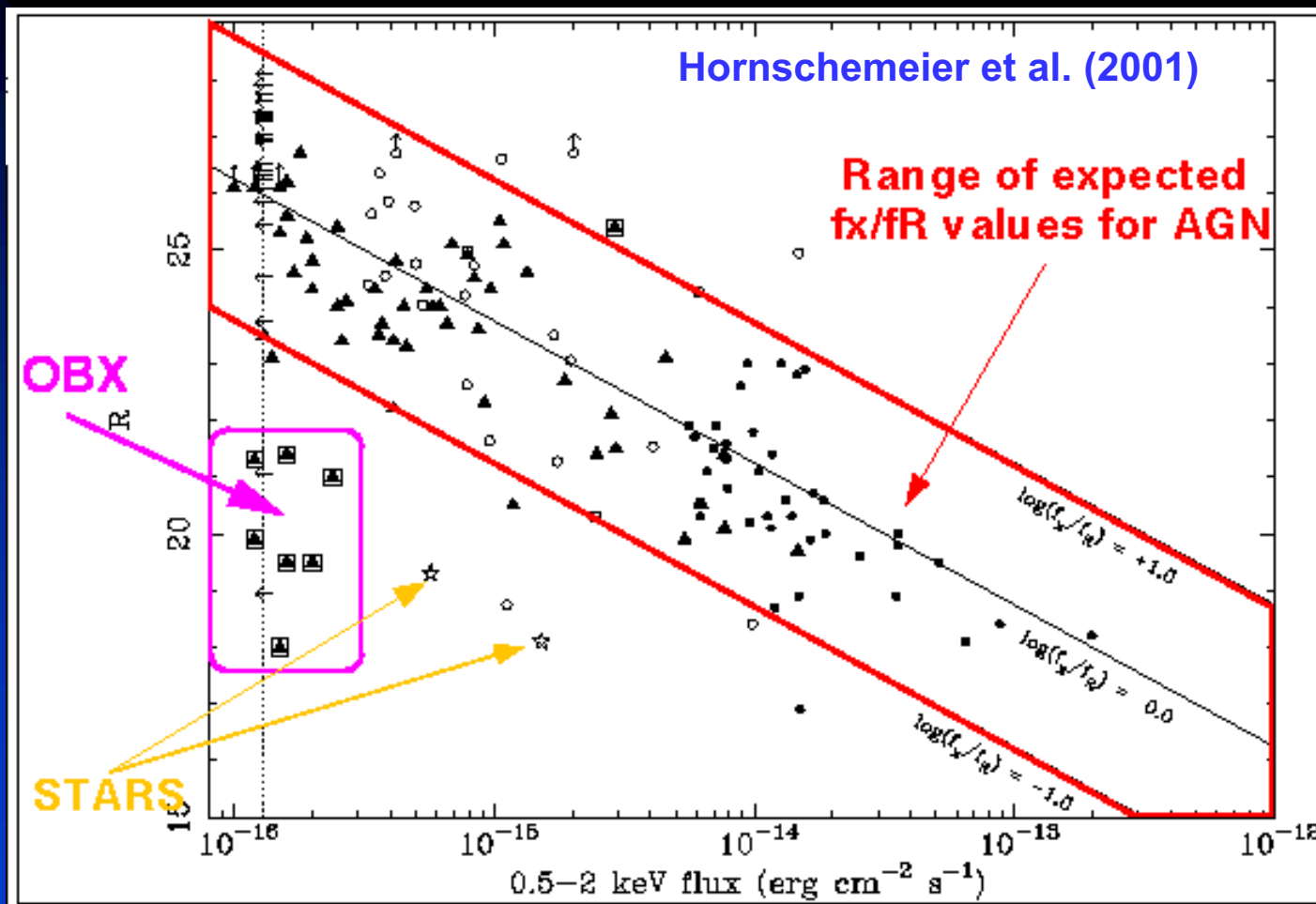
First Views of the X-ray Sky with Chandra

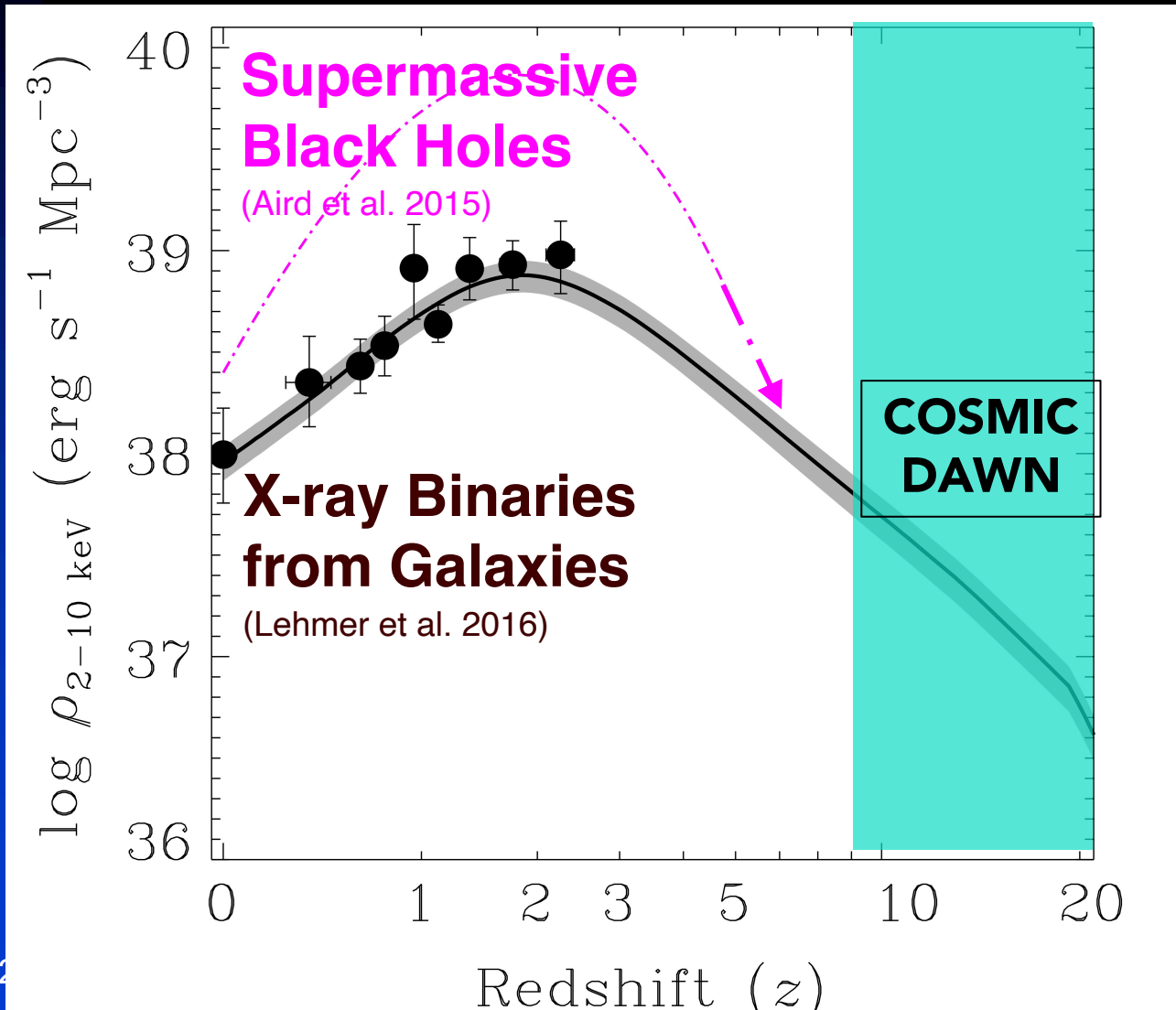- Normal galaxy with ULX among first six objects detected in HDF-N **(166 ks)**

HST f300w ≈2″ X 3″

123646.4

123641.9

30 May 2019

3

Optical properties of CDF-N Sources, 221 ks

- "New" population seen to arise (just past 166 ks)

Hornschemeier et al. (2001)

Range of expected fx/fR values for AGN

OBX

STARS

0.5–2 keV flux (erg cm^{-2} s^{-1})

$log(f_x/f_R) = +1.0$

$log(f_x/f_R) = 0.0$

$log(f_x/f_R) = -1.0$

The X-ray output of binaries exceeds that of AGN at z>6

30 May 2

X-rays from star formation affect the primordial IGM at z≈20
(courtesy A. Mesinger)

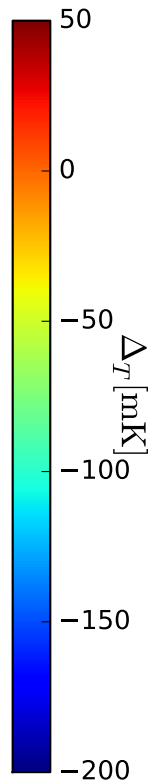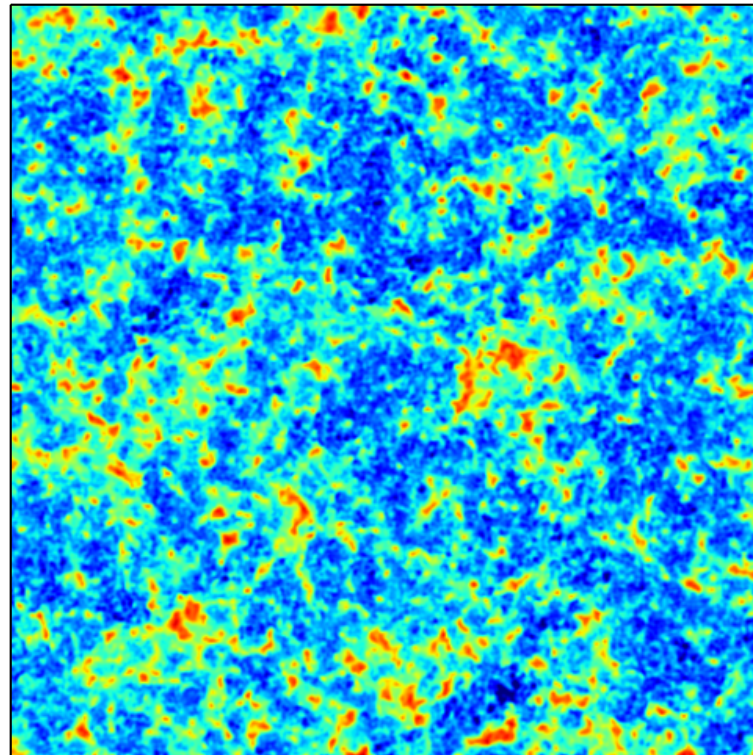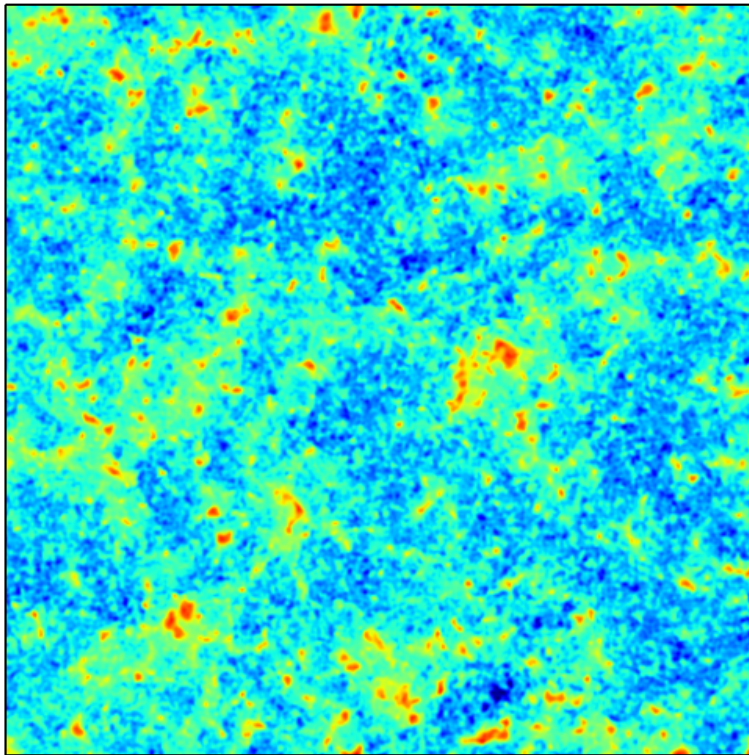The X-ray mean free path through the IGM is very sensitive to E_x:

thus the ***patchiness*** of the heating tells us about the X-ray SED

Ann Hornschemeier
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High-z 21 cm observations (HERA, SKA, etc.): Softer SEDs result in more inhomogenous IGM heating

'hard' SED ~ HMXBs

'soft' SED ~ hot ISM

750 Mpc

$\Delta_T[\text{mK}]$

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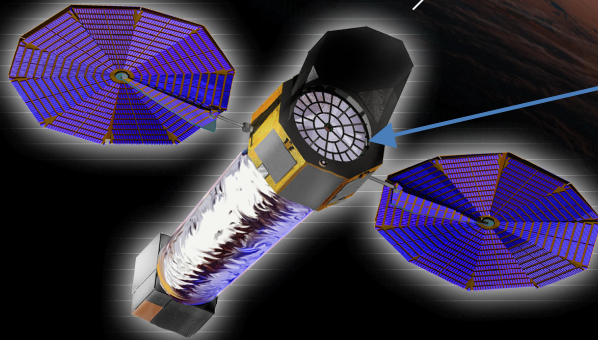
Pacucci, AM+ 2014

Sharing a laugh with Riccardo

Ann Hornschemeier
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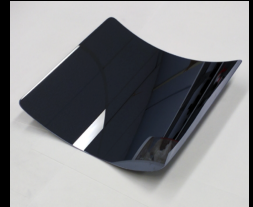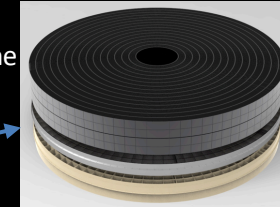National Academy of Sciences

Lynx: a new great observatory for X-ray astronomy

A NEW GREAT OBSERVATORY

X-RAY MIRROR ASSEMBLY

0.5'' Point-Spread Function, stable over a 20 arcminute FoV

Reference mission baseline optics technology:
GSFC silicon metashells

HIGH DEFINITION X-RAY IMAGER

Designed for exquisite imaging and wide surveys, the HDXI is an active pixel array covering a 20' x 20' field of view with subarcsecond imaging.
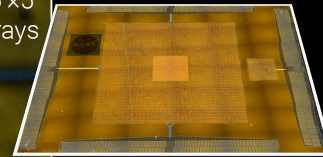
HIGH DEFINITION X-RAY IMAGER

LYNX X-RAY MICROCALORIMETER

X-RAY GRATINGS SPECTROMETER
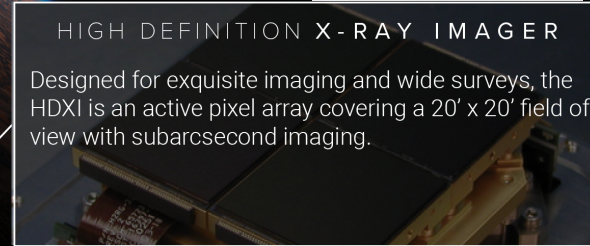
LYNX X-RAY MICROCALORIMETER

Spatially resolved 3 eV spectroscopy across a 5'×5' field of view, sampled with 1" pixels. Two subarrays optimized for finer imaging and higher spectral resolution.
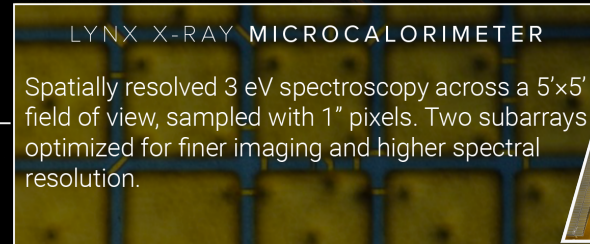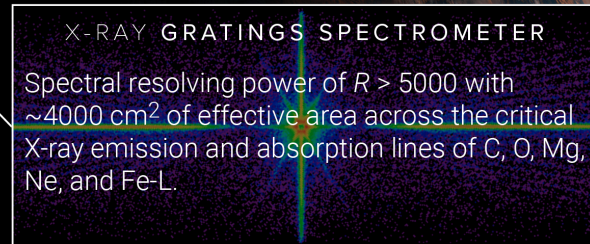
Microcalorimeter arrays developed at GSFC:

X-RAY GRATINGS SPECTROMETER

Spectral resolving power of $R > 5000$ with ~4000 cm^2 of effective area across the critical X-ray emission and absorption lines of C, O, Mg, Ne, and Fe-L.

EINSTEIN

CHANDRA

X-ray astronomy owes a huge debt of gratitude to Riccardo Giacconi.

Thank you!

Ann.Hornschemeier@nasa.gov

But we can learn more!

The X-ray mean free path through the IGM is very sensitive to E_x:

$$\lambda_{\mathrm{X}} \approx 34 \, \bar{x}_{\mathrm{HI}}^{-1} \left(\frac{E_{\mathrm{X}}}{0.5 \text{ keV}} \right)^{2.6} \left(\frac{1+z}{15} \right)^{-2} \text{ comoving Mpc} ,$$

thus the *patchiness* of the heating tells us about the X-ray SED