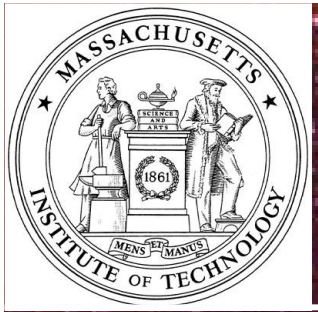

ISM Surveys with Chandra and Con-X

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Evolution and Recycling of Matter

Phases of the Interstellar Medium (ISM)

X-ray Absorption Cross Sections

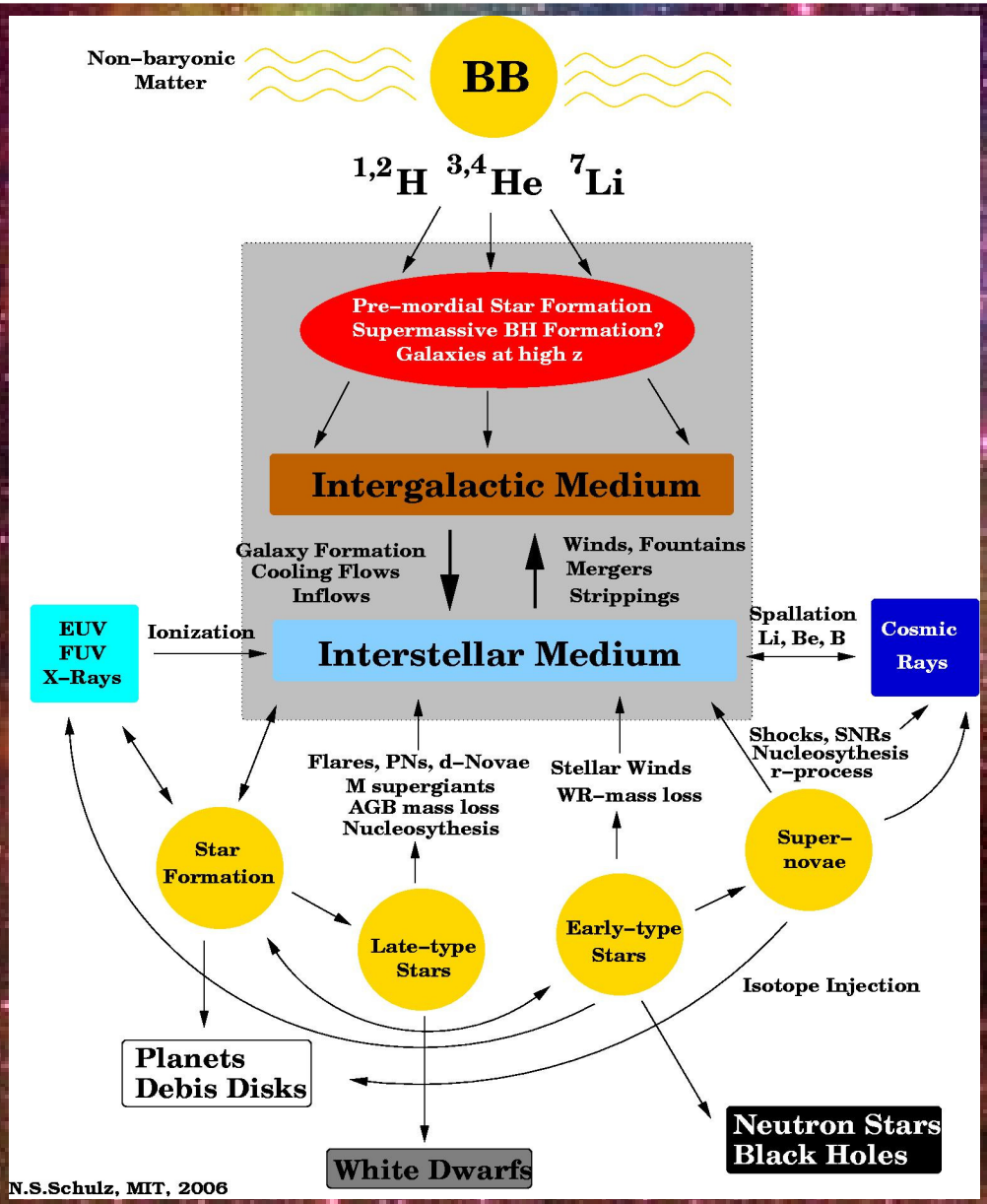
Spectral Requirements

The Chandra Survey - First Results

Con-X Specifications in Context

Proposed Survey with Con-X:

Evolution & Recycling of Matter



Chemical Abundance:

Elements: C, O, Ne, Mg, Si, S, Ar, Ca
Fe, Ni

Molecules: CO_2, CO, O_2, H_2O….
C_sH_6O, CH_2O_2,…….

Dust: Structure & Depletion

Ionization Fractions:

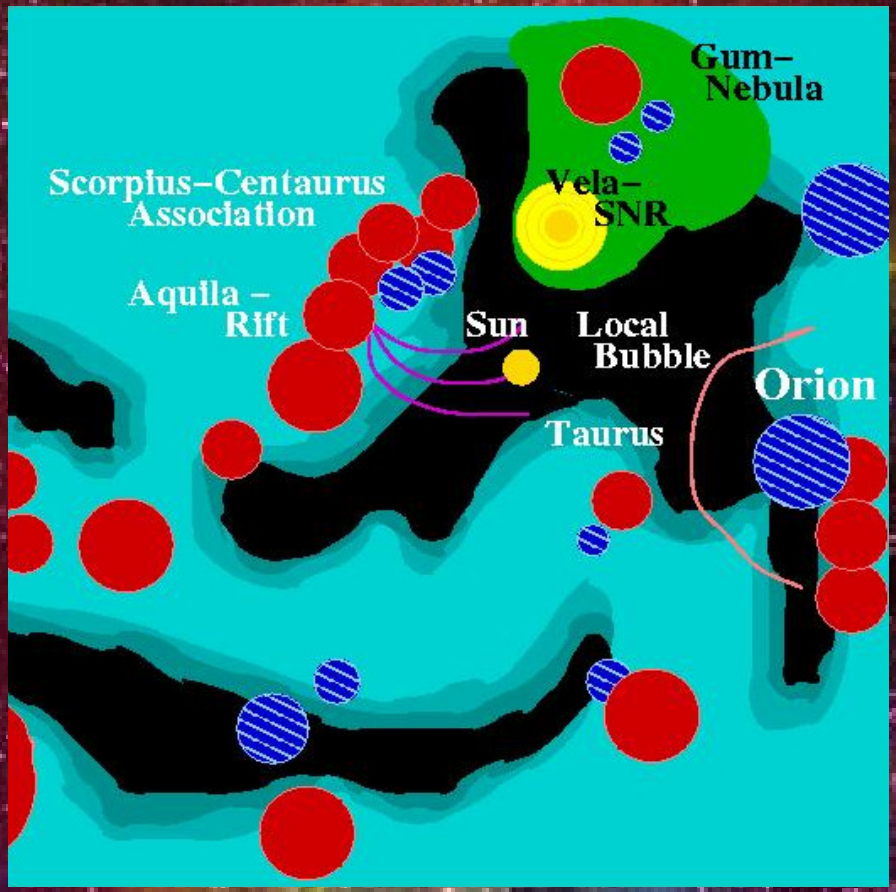
Ionized Abundances

Star Formation Rates

Missing maatter

Dynamics

Evolution & Recycling of Matter



Principle: backlighting with bright X-ray continua

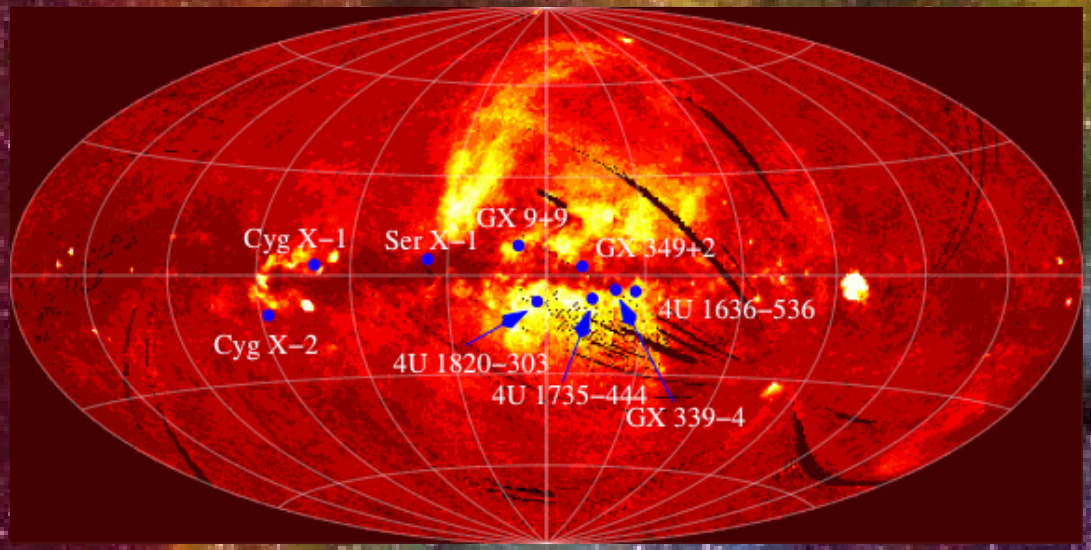
Advantage:

- Long-range analysis
- Entire Galactic plane & Halo
- Study all ISM phases
- ISM Studies in other Galaxies

Evolution & Recycling of Matter

Principle: backlighting with bright X-ray continua

Advantage:



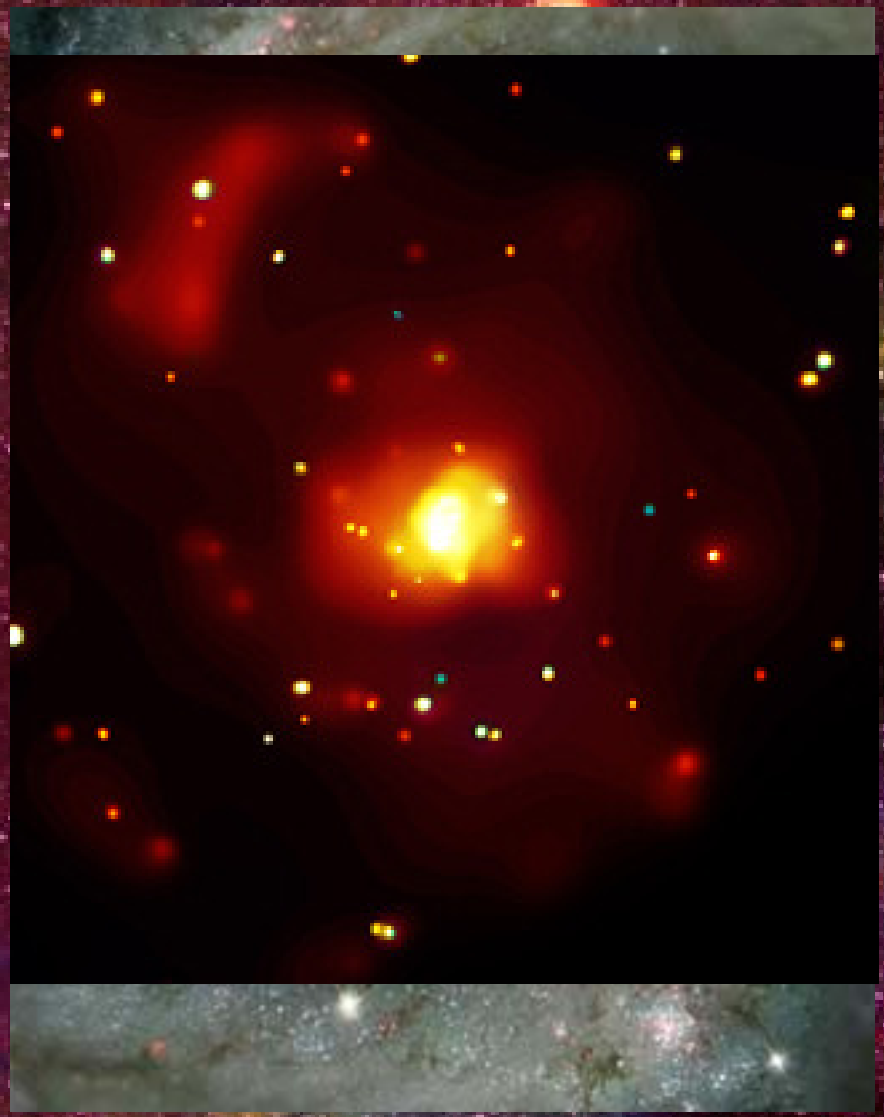
Long-range analysis

Entire Galactic plane & Halo

Study all ISM phases

ISM Studies in other Galaxies

Evolution & Recycling of Matter



Principle: backlighting with bright X-ray continua

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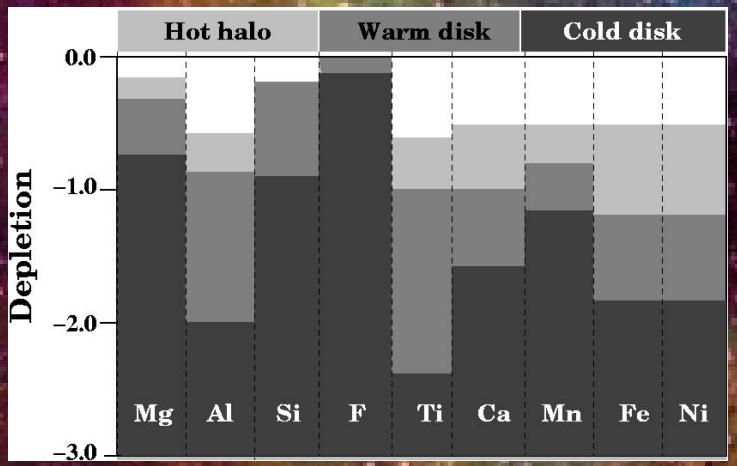
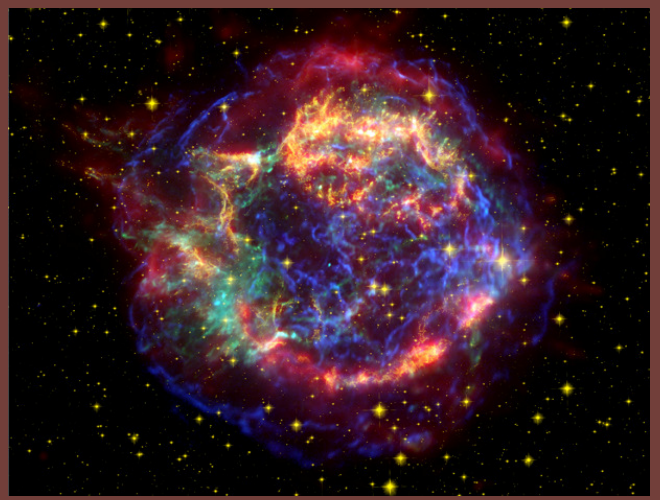
Phases of Interstellar Media



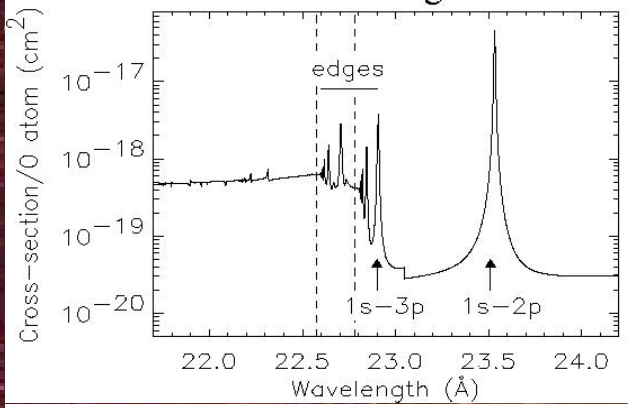
Phase	n/[ccm]	T/[K]	Media
Cold	30-3000	10-100	MCs, H I
Warm	0.03 -0.1	< 10000	H I, H II
Hot	<0.005	< 10 MK	SNR
- (Very hot)			Diffuse



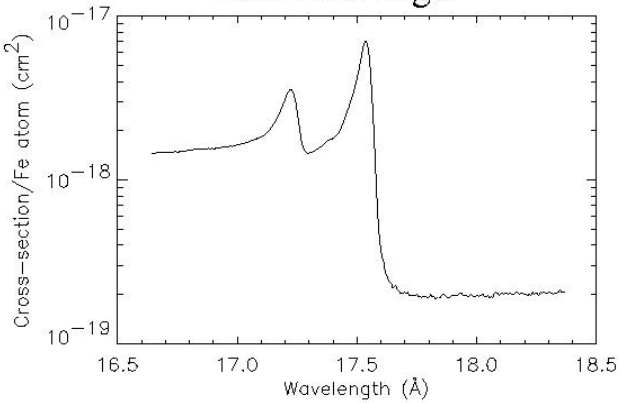
Atomic Cross Sections: Theory & Experiments

Gorczyca 2000, 2005 ; Behar & Netzer 2002 ; Prigoshin et al. 1998 ; Hitchcock2001-2003

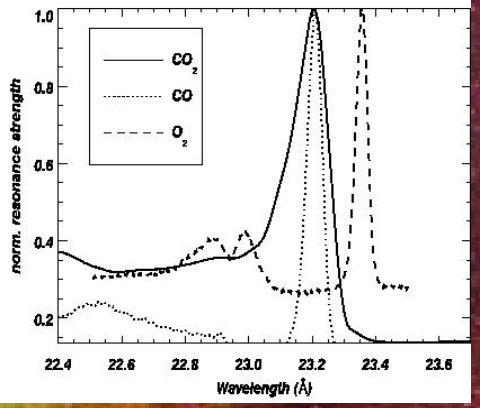
O–K edge

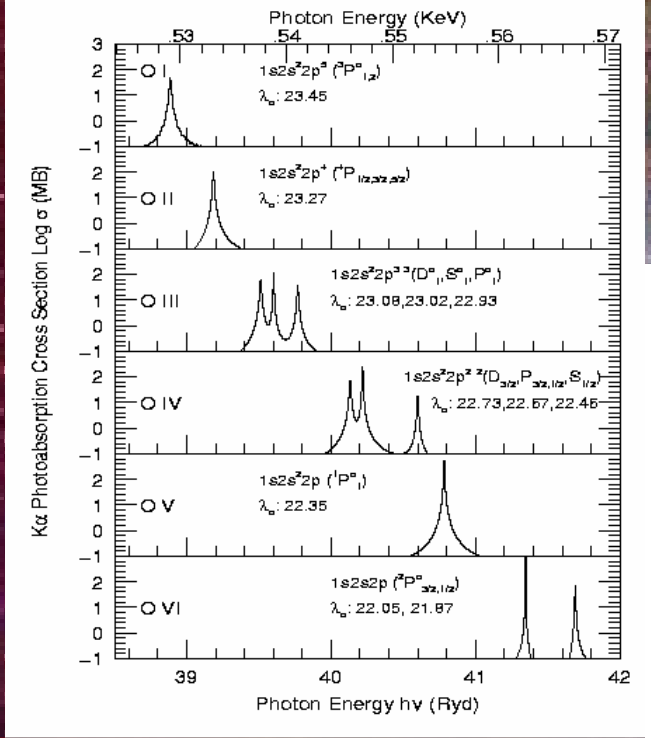


Fe L 2&3 edge



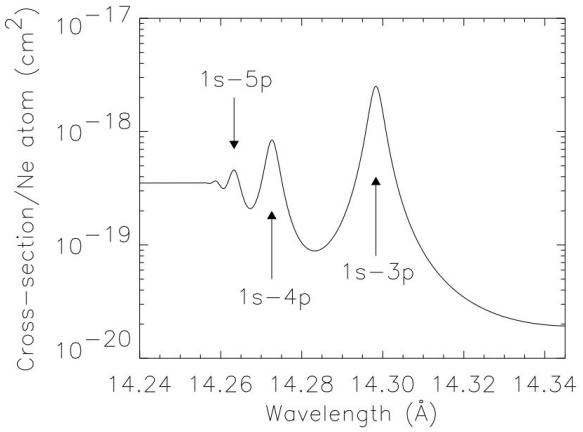
Molecules

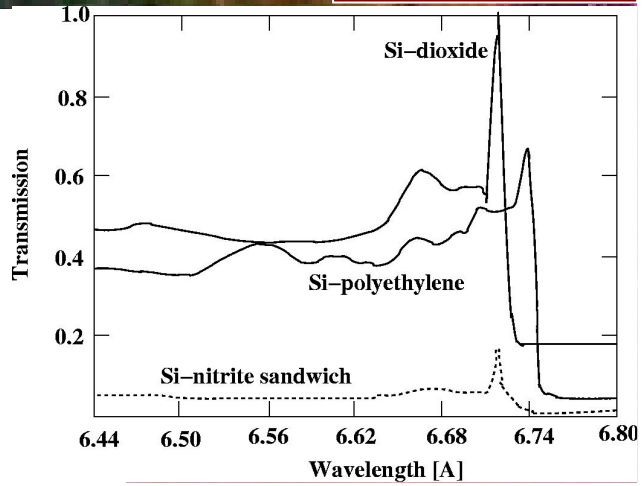




Features: edges - 1s-2p resonances - 1s-2n resonances
Ions: I, II, III; He-like, H-like

Edges:
O K -- 22.89 A
Fe L3 -- 17.55 A
Ne K -- 14.29 A
Mg K -- 9.34 A
Si K -- 6.74 A





Atomic Cross Sections: Theory & Experiments

TABLE 1

THEORETICAL PREDICTIONS FOR OXYGEN K EDGE FEATURES

Feature	Predicted λ (Å)	Shifted λ (Å)
Gorczyca & McLaughlin (2000)		
$1s–2p$	23.532	23.508[a]
$1s–3p$	22.907	22.884
$1s2s^22p^4$ (^4P)	22.781	22.758
$1s2s^22p^4$ (^2P)	22.576	22.553
Pradhan et al. (2003)		
O I $1s–2p$	23.45	23.508[a]
O II $1s–2p$	23.27	23.33
O III $1s–2p$	23.08	23.14
	23.02	23.08
	22.93	22.99
O IV $1s–2p$	22.73	22.79
	22.67	22.73
	22.46	22.52

[a] Referenced to weighted mean of observational results; see § 5.

Feature	Predicted λ (Å)	Measured λ (Å)
Kortright & Kim 2000		
Fe-L_3 edge[a]	17. 37	17.498±0.003
Fe-L_2 edge[a]	17.226	17.188±0.003
van Aken & iebscher 2002		
Fe^{2+}-L_3 edge[a]	17. 17	17.498±0.003
Fe^{2+}-L_2 edge[a]	17.206	17.188±0.003
Fe^{3+}-L_3 edge[a]	17.4w	17.498±0.003
Fe^{3+}-L_2 edge[a]	17.1 6	17.188±0.003
Gorczyca 2000		
Ne I $1s$-$3p$[b]	14.298	14.29 ±0.003
Ne I $1s$-$4p$	14.273	
Ne I $1s$- p	14.263	
Gorczyca 200 , in prep.		
Ne II $1s$-$2p$	14.60	14.608±0.002
Ne III $1s$-$2p$	14. 18	14. 08±0.002
Behar & Netzer 2002		
Ne II $1s$-$2p$	14.631	14.608±0.002
Ne III $1s$-$2p$	14. 26	14. 08±0.002
Ne IX $1s$-$2p$	13.448	13.4439±0.0013

[a]Position measured at avelength of maximum absorption.

[b]Position of $1s$-$3p$ transition ill be coincident ith edge avelength hen using a standard edge model.

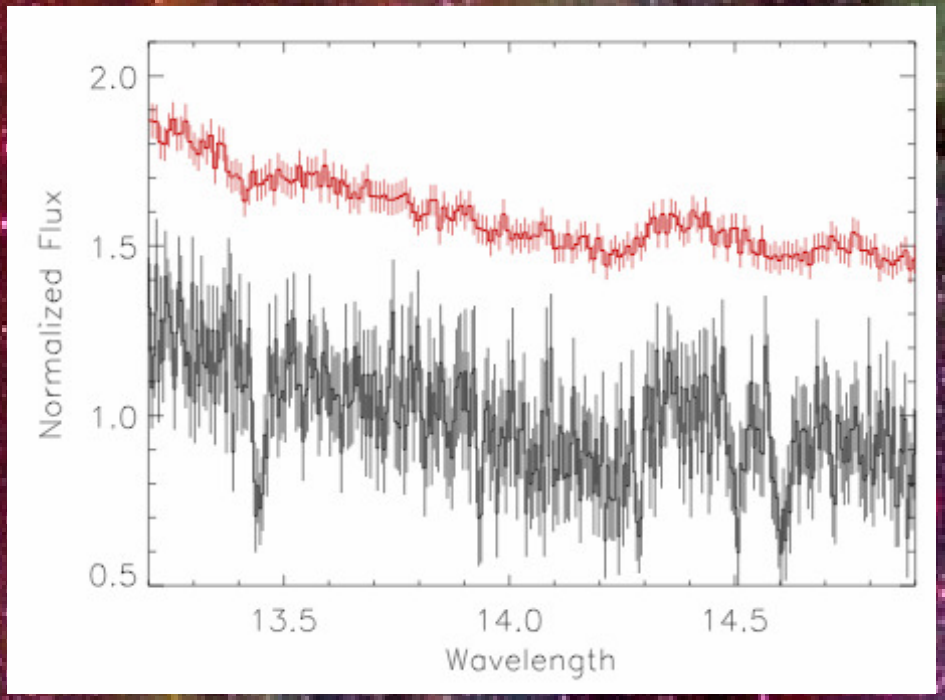
Spectral Requirements & Analysis

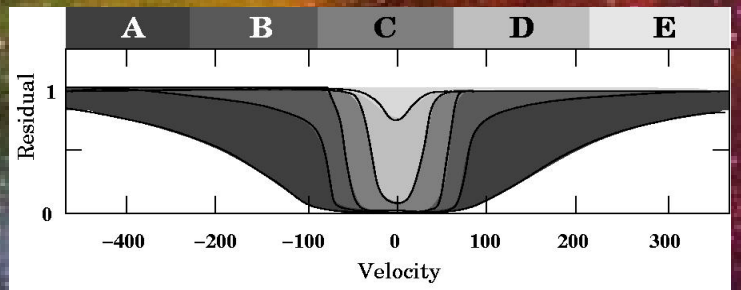
Wavelength range (z = 0): 45 (C-K) -- 1.7 (Fe K) Angstrom

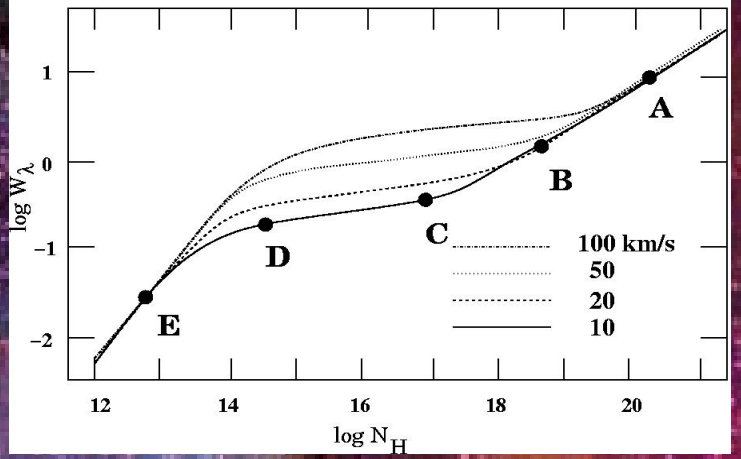
Resolving Power: > 1500 at all wavelength

Velocities (turbulent): 10 -- 200 km/s

Equivalent Widths: < 15 mA

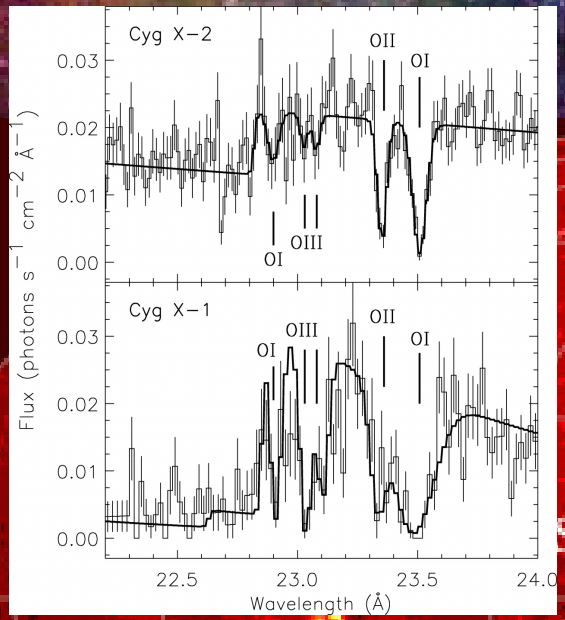


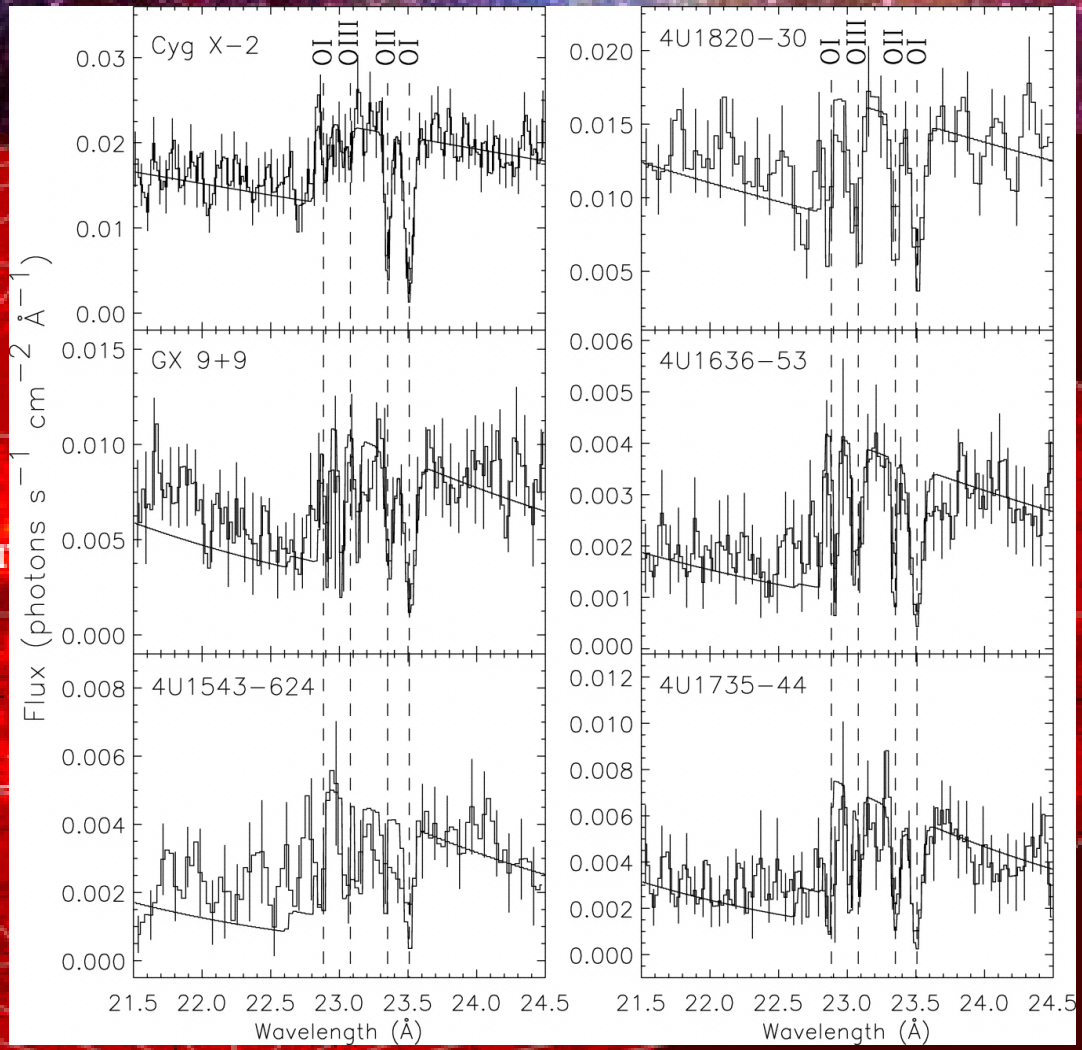




The Chandra Survey -- First Results

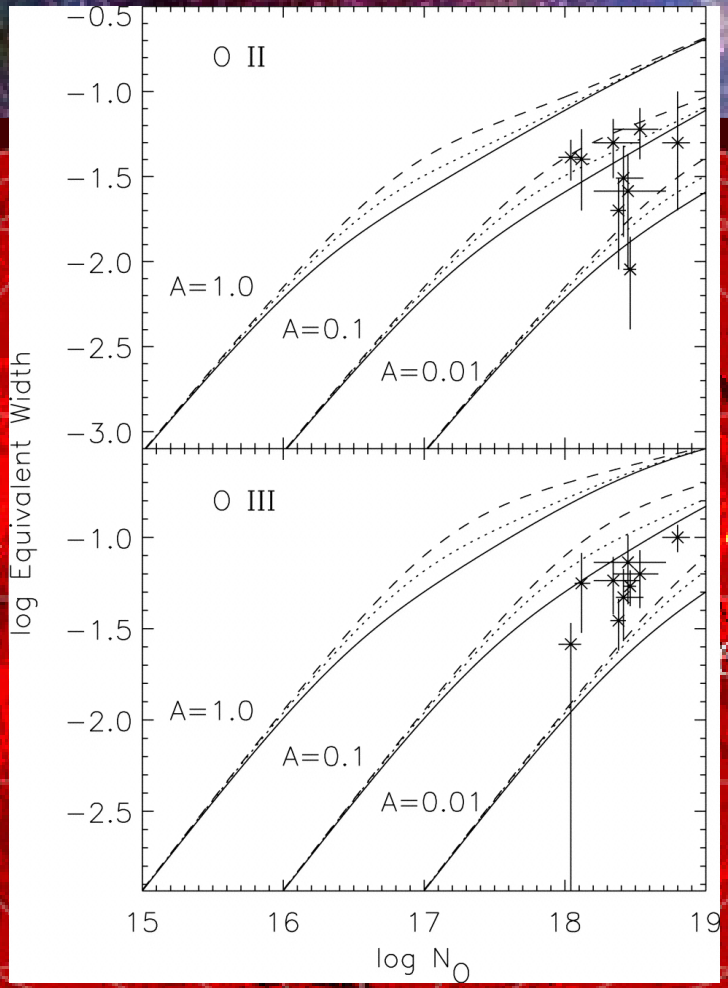
O-K absorption





The Chandra Survey -- First Results

O-K absorption



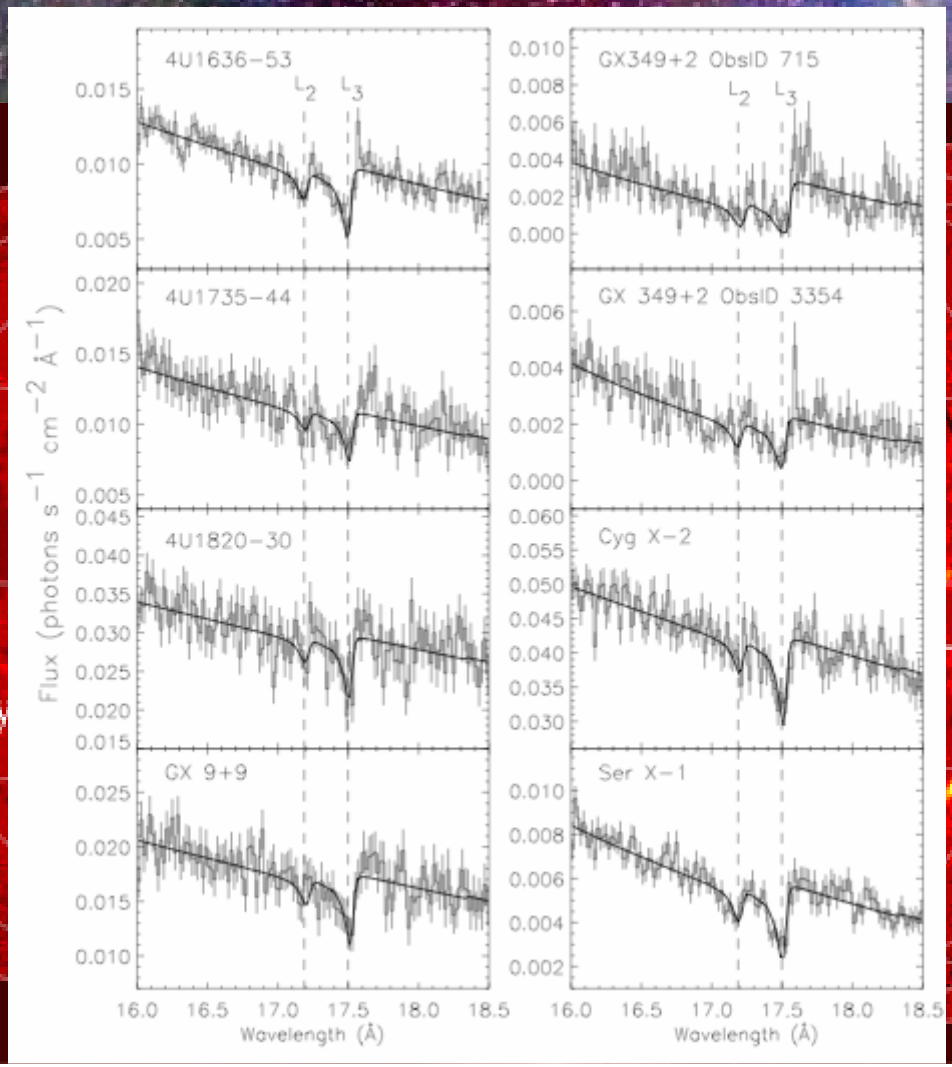
Cyg X–1

Cyg X–2

6–536

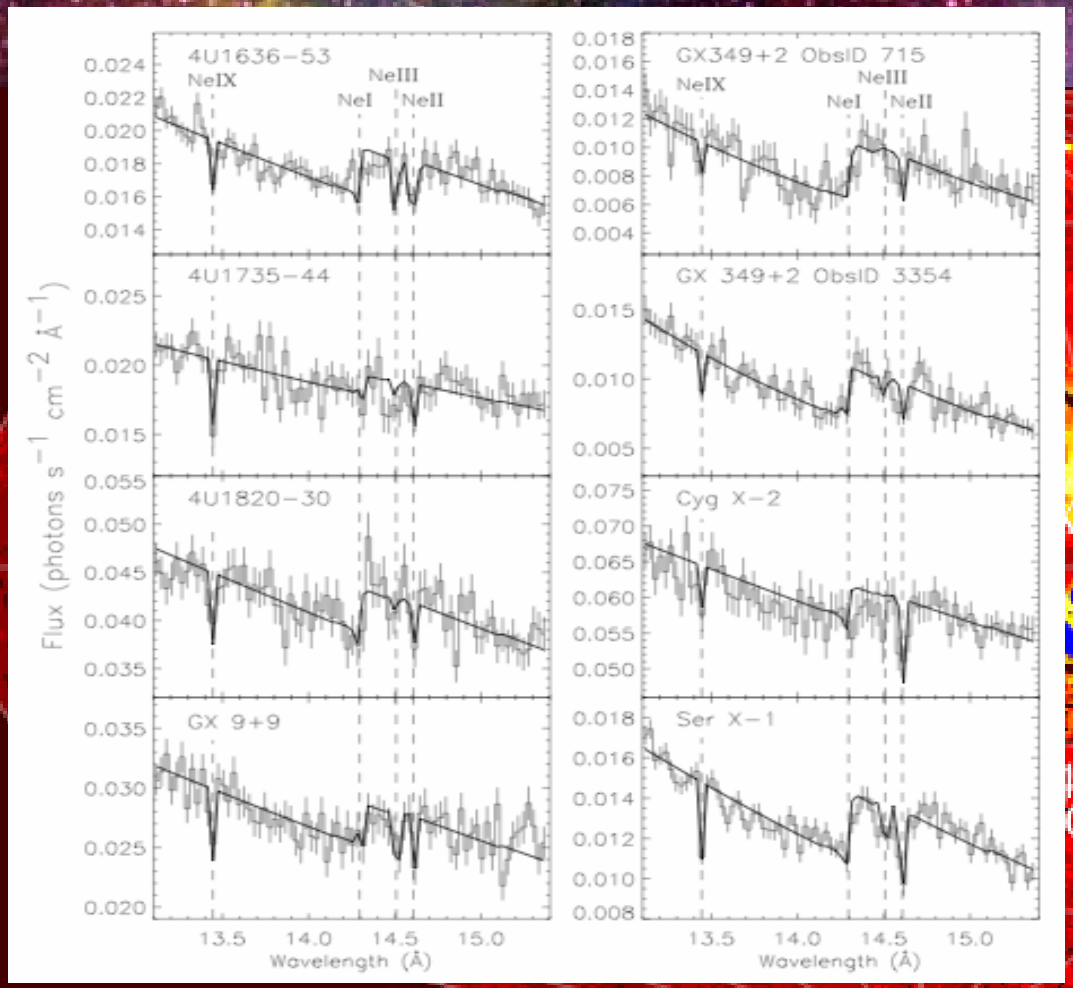
The Chandra Survey -- First Results

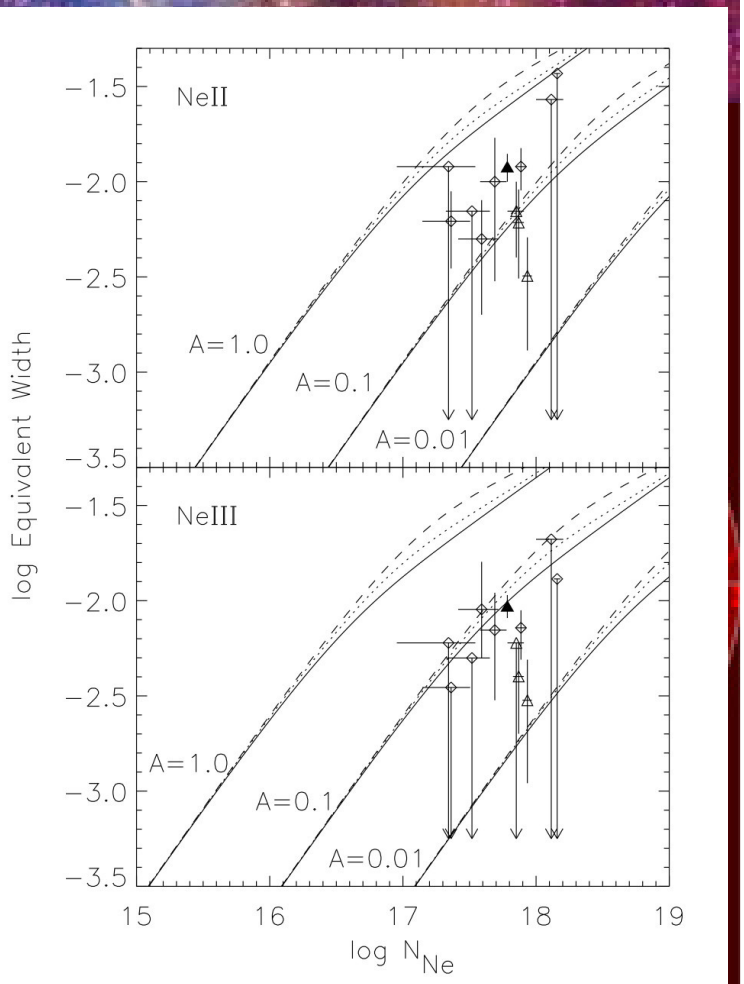
Fe $L_{3/2}$ absorption



The Chandra Survey -- First Results

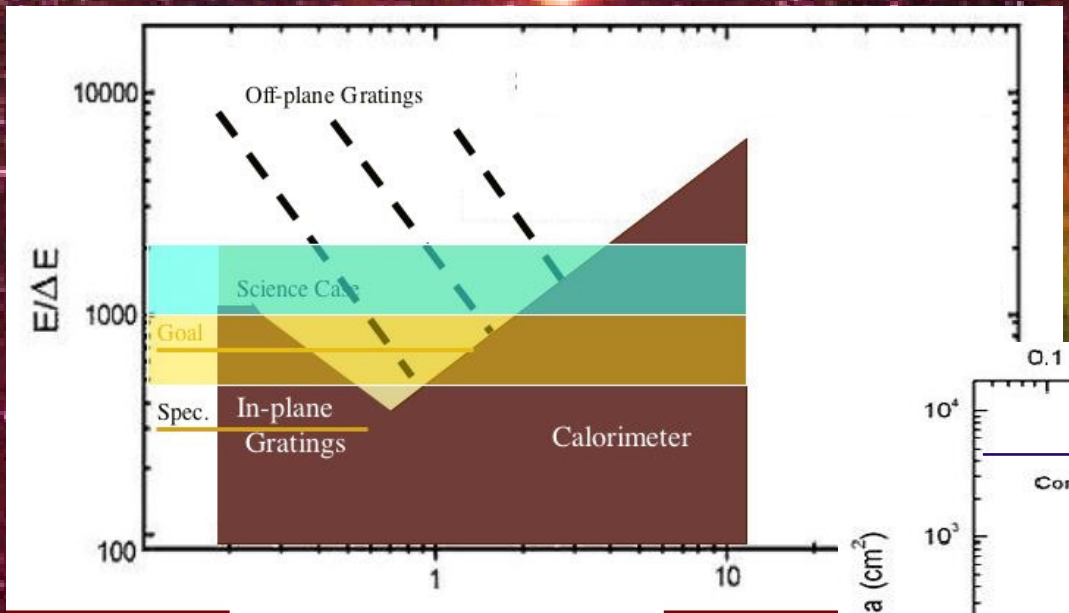
Ne K absorption: Ne II, III, IX

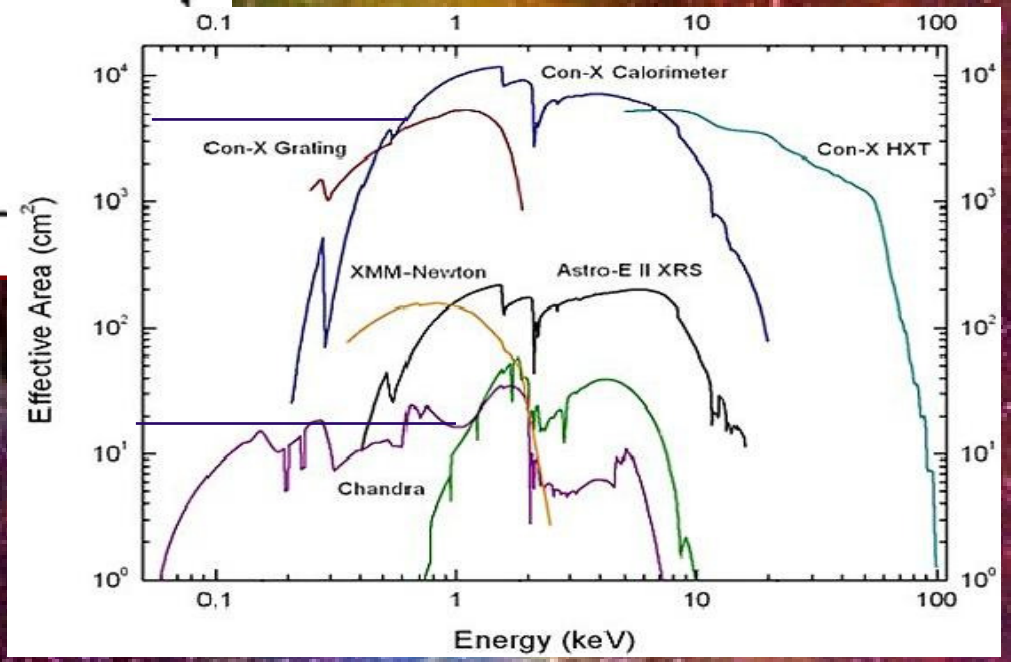




Con-X Specifications in Context

Off-plane gratings close resolution gap





High Efficiency between 0.3 - 2 keV (45 - 6 A)

Surveys with Con-X

~5000 Galactic Sources:
Log f_x = [-9, -13]
<exposure> > 10 ks

~ $10^{2.2}$ Nearby Galaxies/AGN:
Log f_x > -13]
<exposure> > 30 ks

> 10^3 Deep Survey Sources:
Log f_x = [-10 -14]
<exposure> > 100 ks