Resolving the *Chandra* / ACIS PSF using Actual Data

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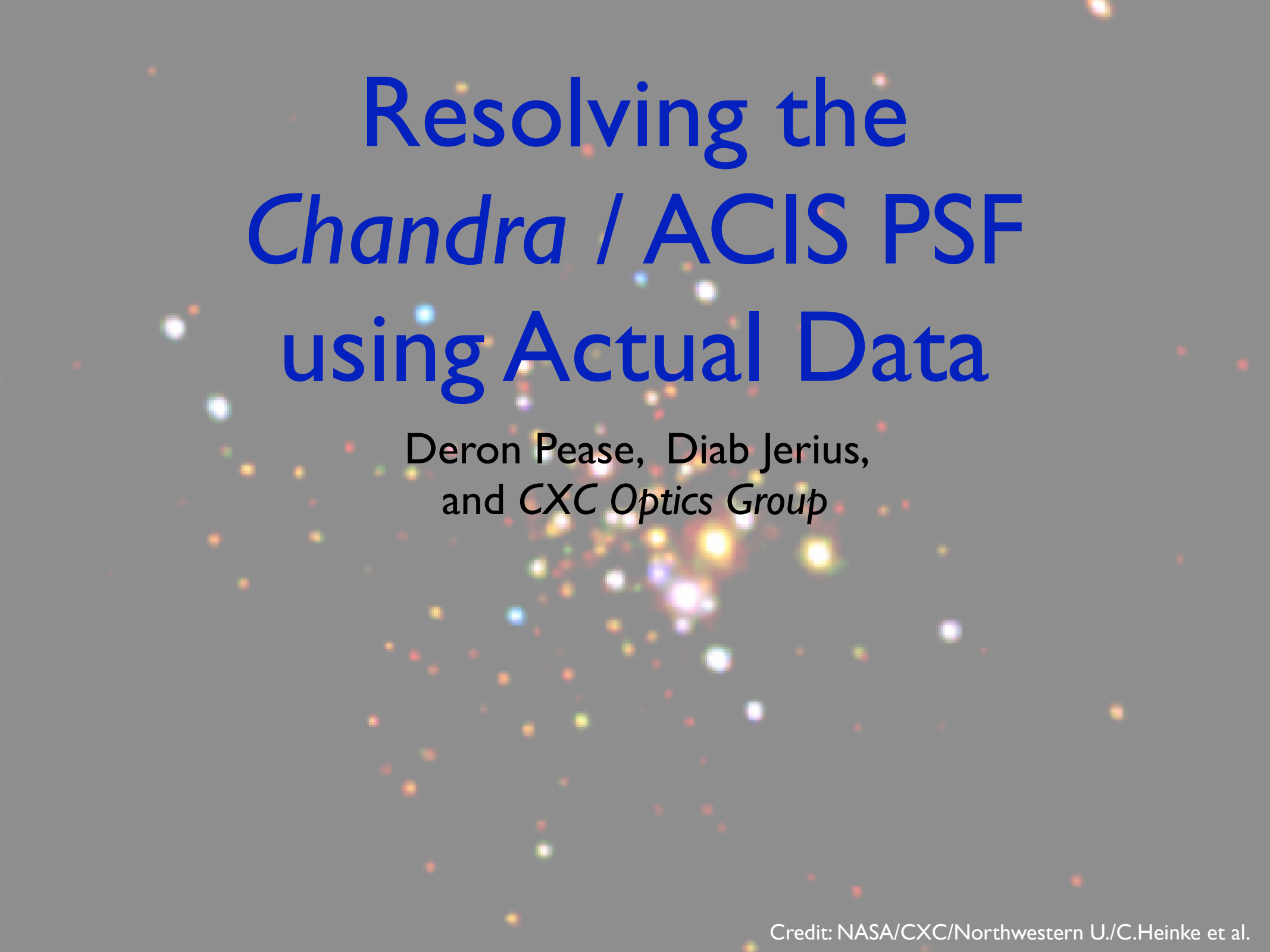


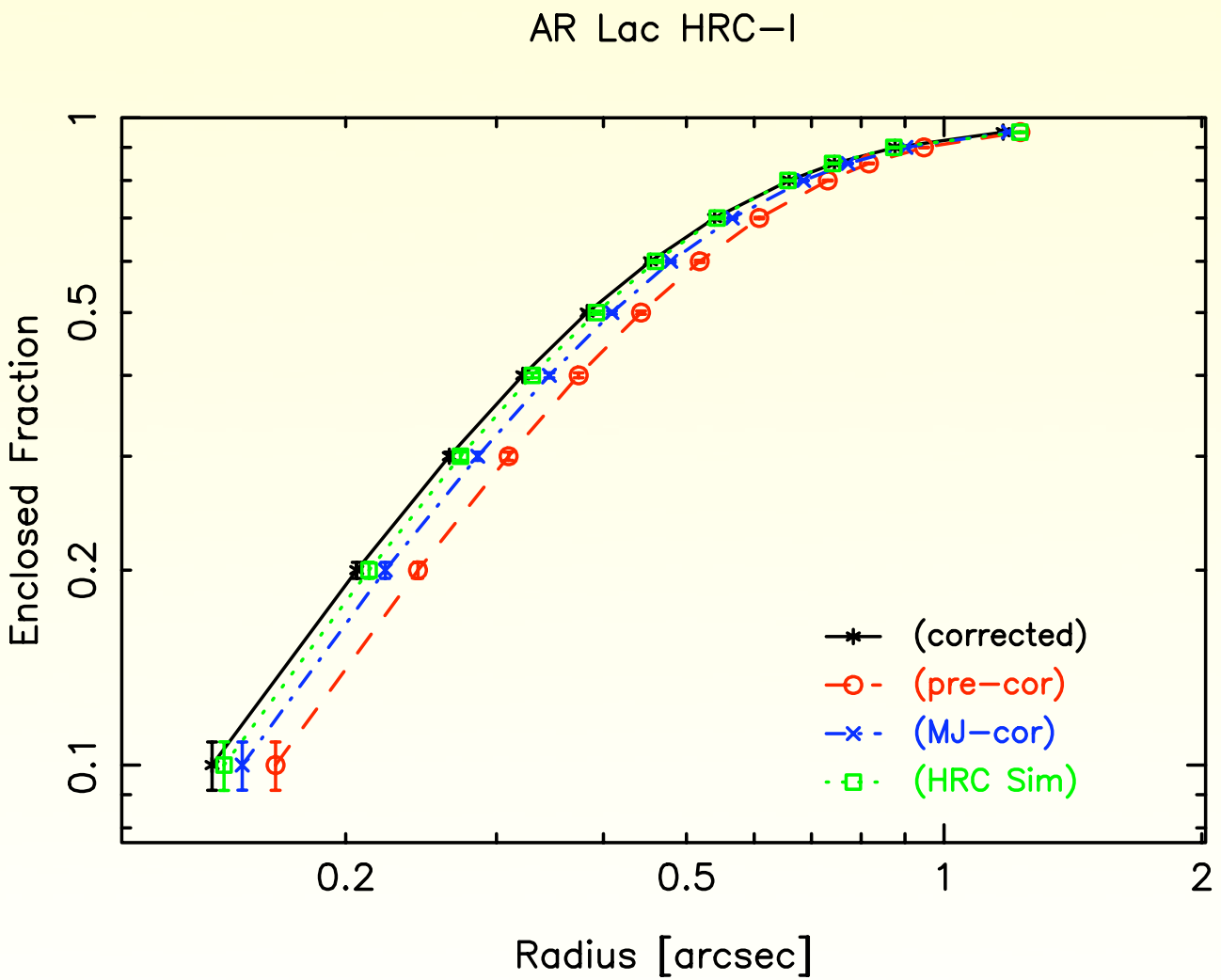
Credit: NASA/CXC/Northwestern U./C.Heinke et al.

Previous Studies: HRC

- AR Lac on HRC-I
  ObsID 1385 (~19ks)

- correct for systematic errors in event positions

- Model: HRMA + 20 *μm* HRC blur + 0.″06 Aspect blur



Previous Studies: ACIS

- DJ's *SPIE* paper from 2003
- 12 sources
- ACIS-I & -S
- Various coadditions
- Energy cuts
- Comparison with HRC-I AR Lac

$\Rightarrow$

Extended, "puffy"

Expectations?

Source Selection Criteria

- Point sources (stars, QSOs)
- Within 50″ of optical axis

- High galactic latitude $\Rightarrow$ $|b| > 10°$
- Low counts per frame $\Rightarrow$ < 0.1
- High counts $\Rightarrow$ ≥ 100, prefer ≥ 1000 *
- FAINT, VFAINT mode to further select low count rates
- No grating (excludes most high energy sources) *

- Preferably uncrowded fields
- Any other concerns — literature info

Sources Found & Analyzed

1. Start with ~100,000 sources
2. 1st cut ⇒ ~250 Stars ~290 AGN (all followed up)
3. 2nd cut ⇒ 28 Stars 12 AGN (these fully analyzed)
4. 3rd cut ⇒ 3 Stars 2 AGN (these best by far)

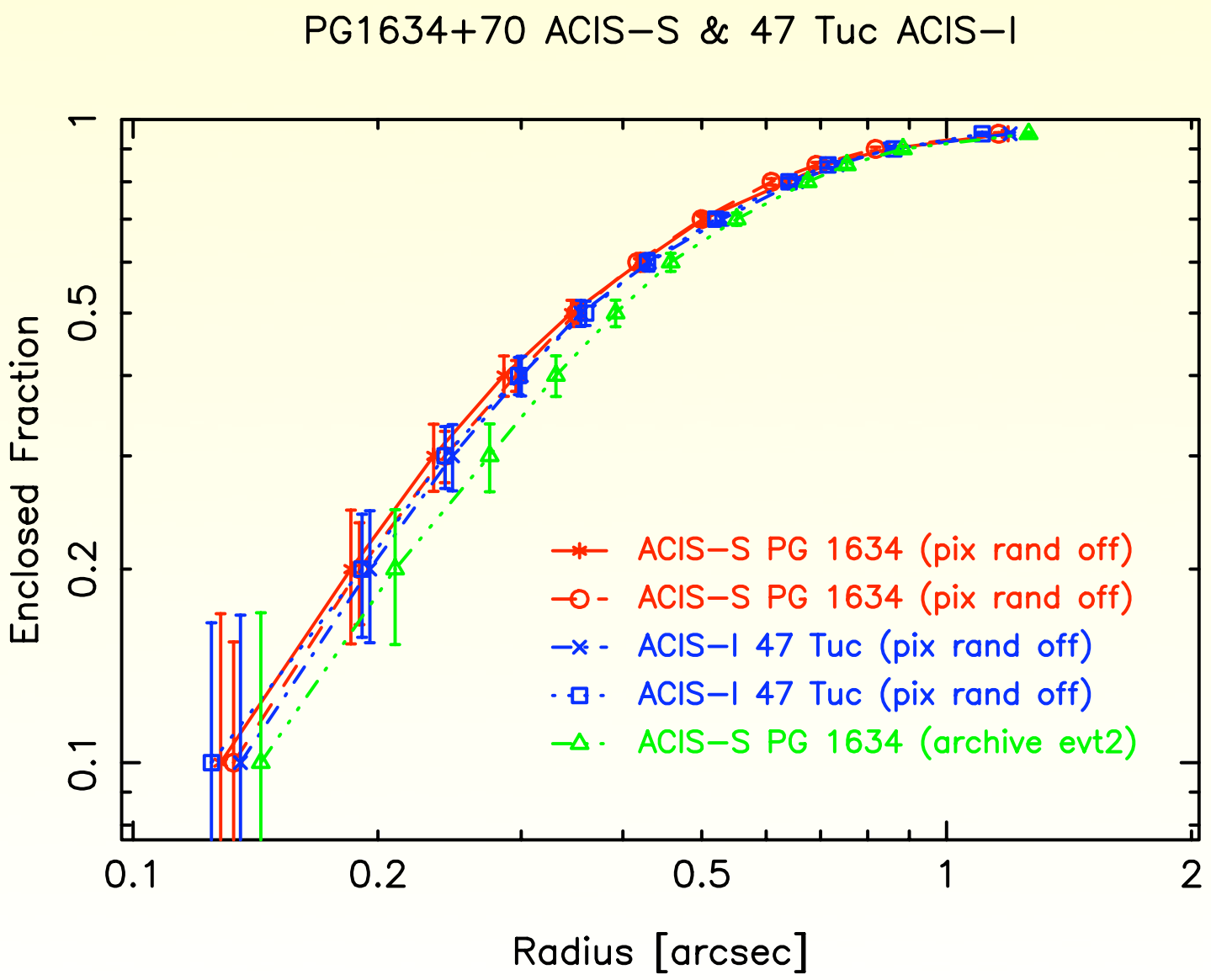
➡ 47 Tuc & PG 1634+70

- Visual inspection
- De-Roll
- Clean & filter data properly (dmtools, funtools)
- Light-curve inspection
- Grade analysis — looking for pile-up effects
- Encircled energy & radial profile analysis

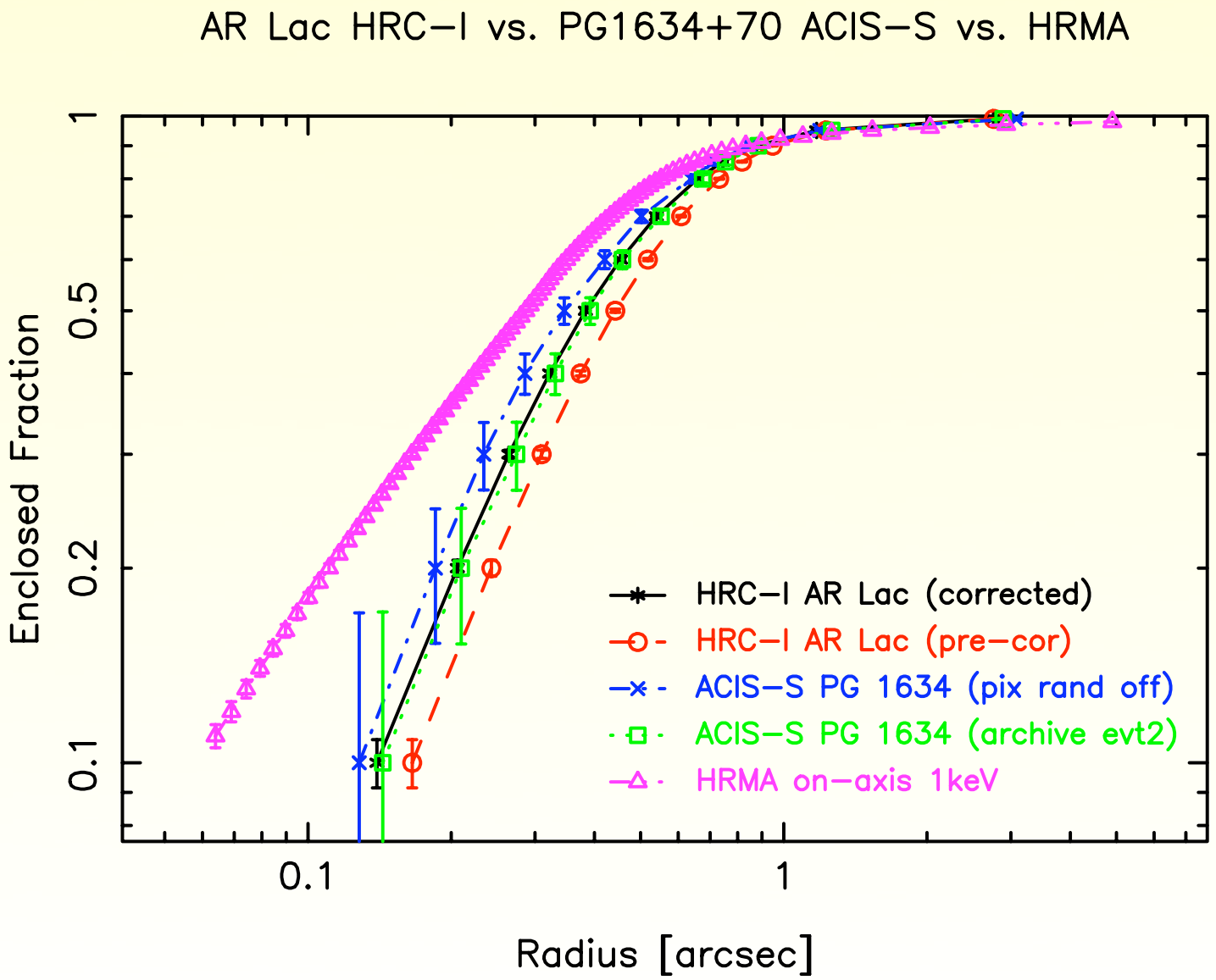
Observations

Source	ObsID	Detector	Exposure (sec)
PG 1634+70 (QSO)	69	ACIS-S	5713.55
	1269	ACIS-S	13309.95
47 Tuc (GC)	953	ACIS-I	33368.23
	955	ACIS-I	33368.73
AR Lac	1385	HRC-I	18831.93

ACIS Results



Chandra ECF

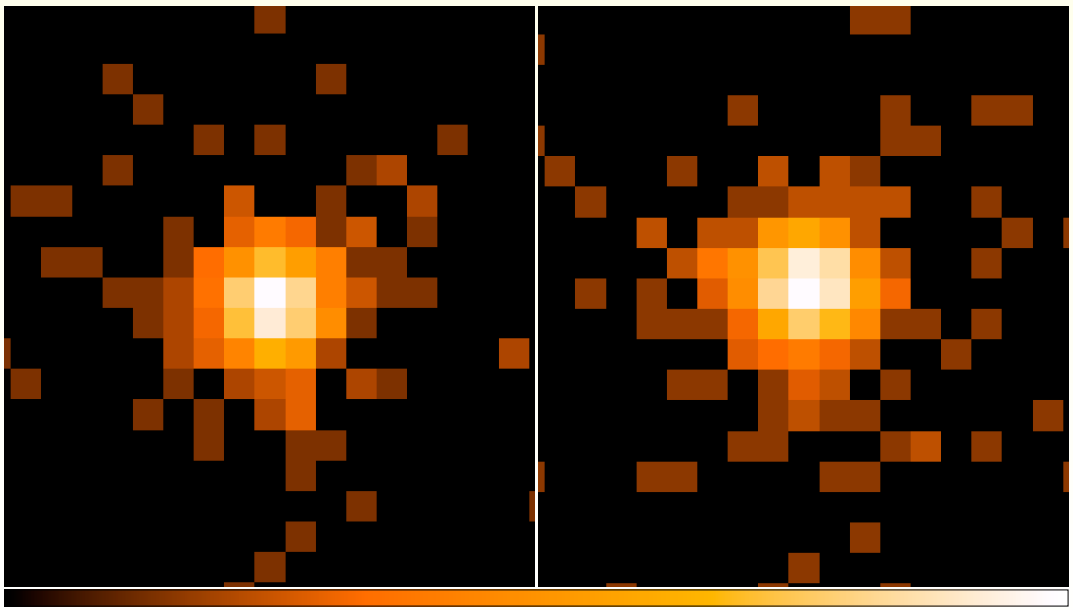


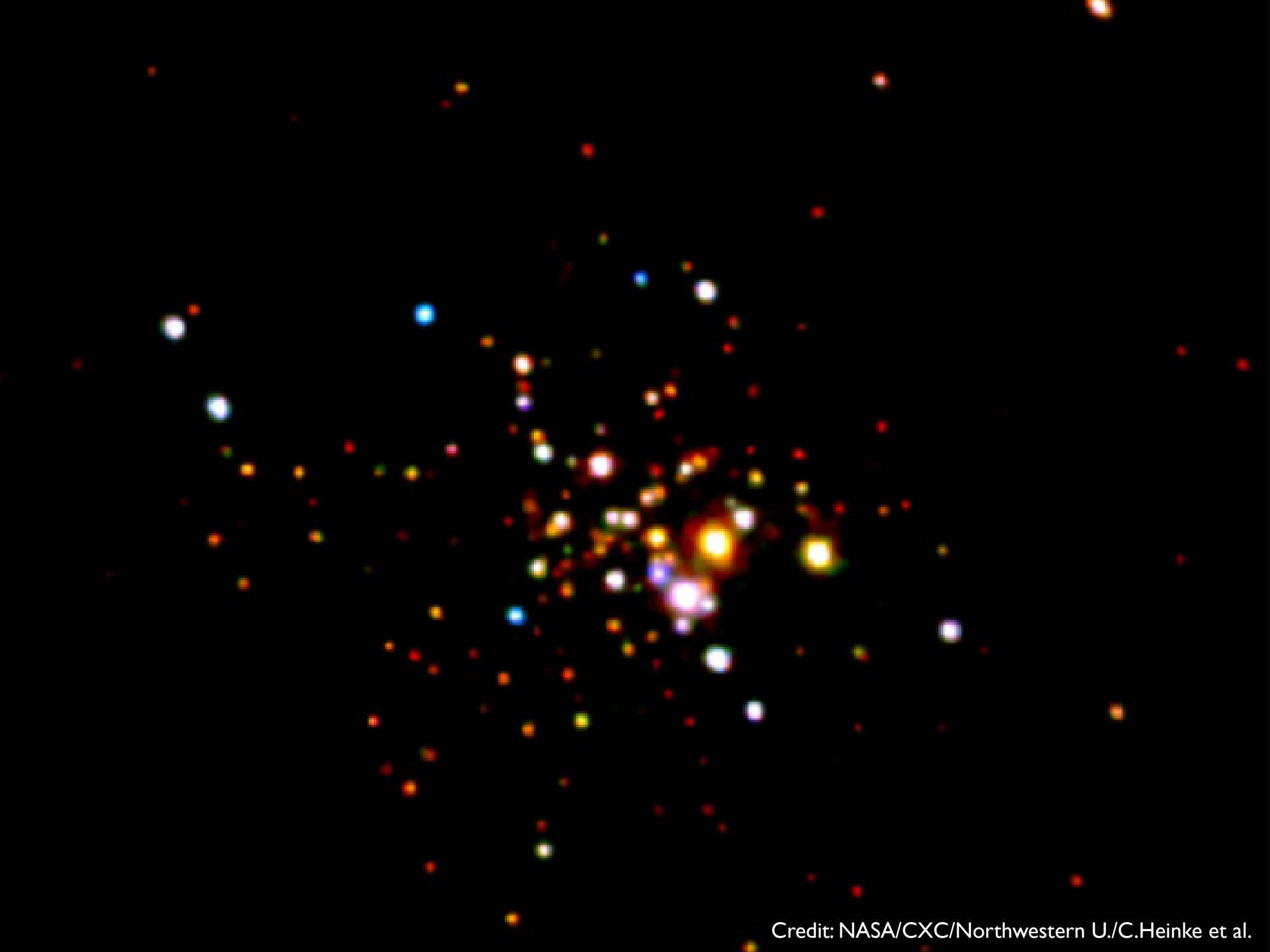
Detector	FWHM (arcsec)
HRC	0.70
HRC (pre-cor)	0.80
ACIS	0.72
ACIS (no pix rand)	0.63

Conclusions

✓ We've shown that the ACIS PSF (with pixel randomization) is comparable to the HRC PSF

- But what's going on with pixel randomization off?
  - One might say: pixel randomization is necessary because we don't know where an event landed in a pixel. EOS
  - But clearly there is a significant difference:





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