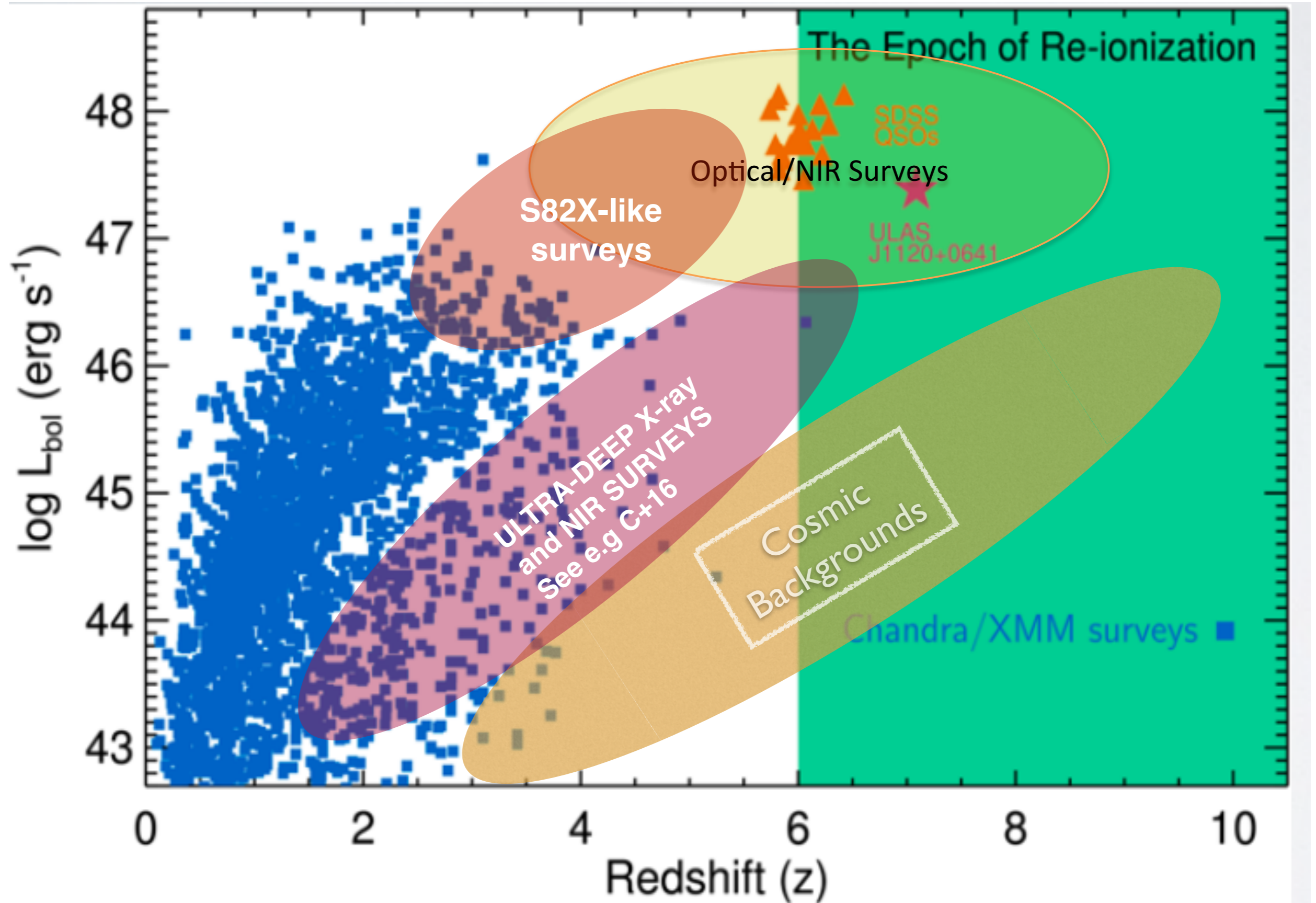


**EARLY BLACK HOLES:
SYNERGIES BETWEEN
CHANDRA AND SURVEYORS
OF THE 20^I'S.**

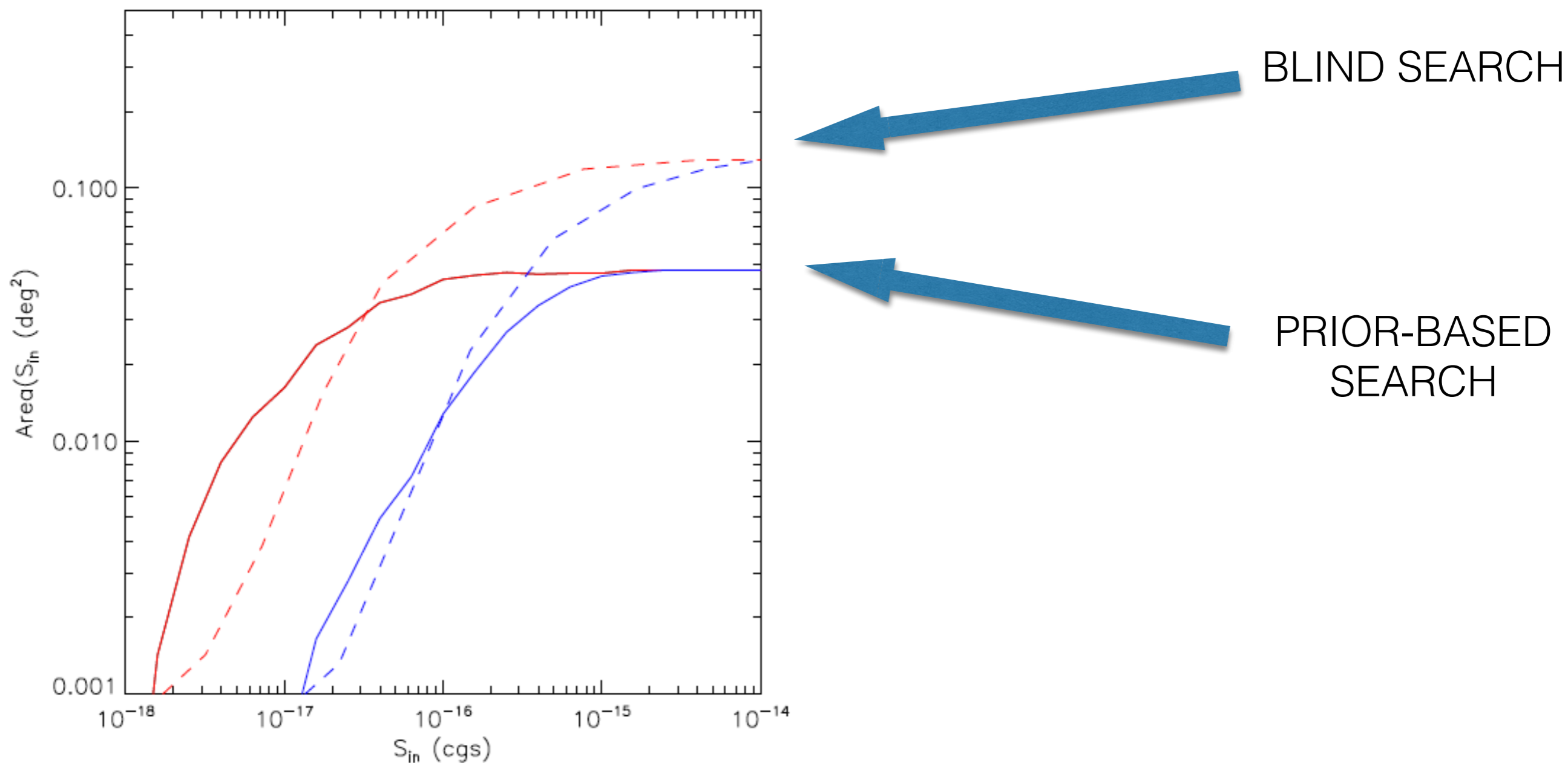
Nico Cappelluti
Yale University

*Günther Hasinger, A. Kashlinsky, Meg Urry, A. Comastri,
Priya Natarajan, R. Arendt, H. Moseley.*

How to find early BH?

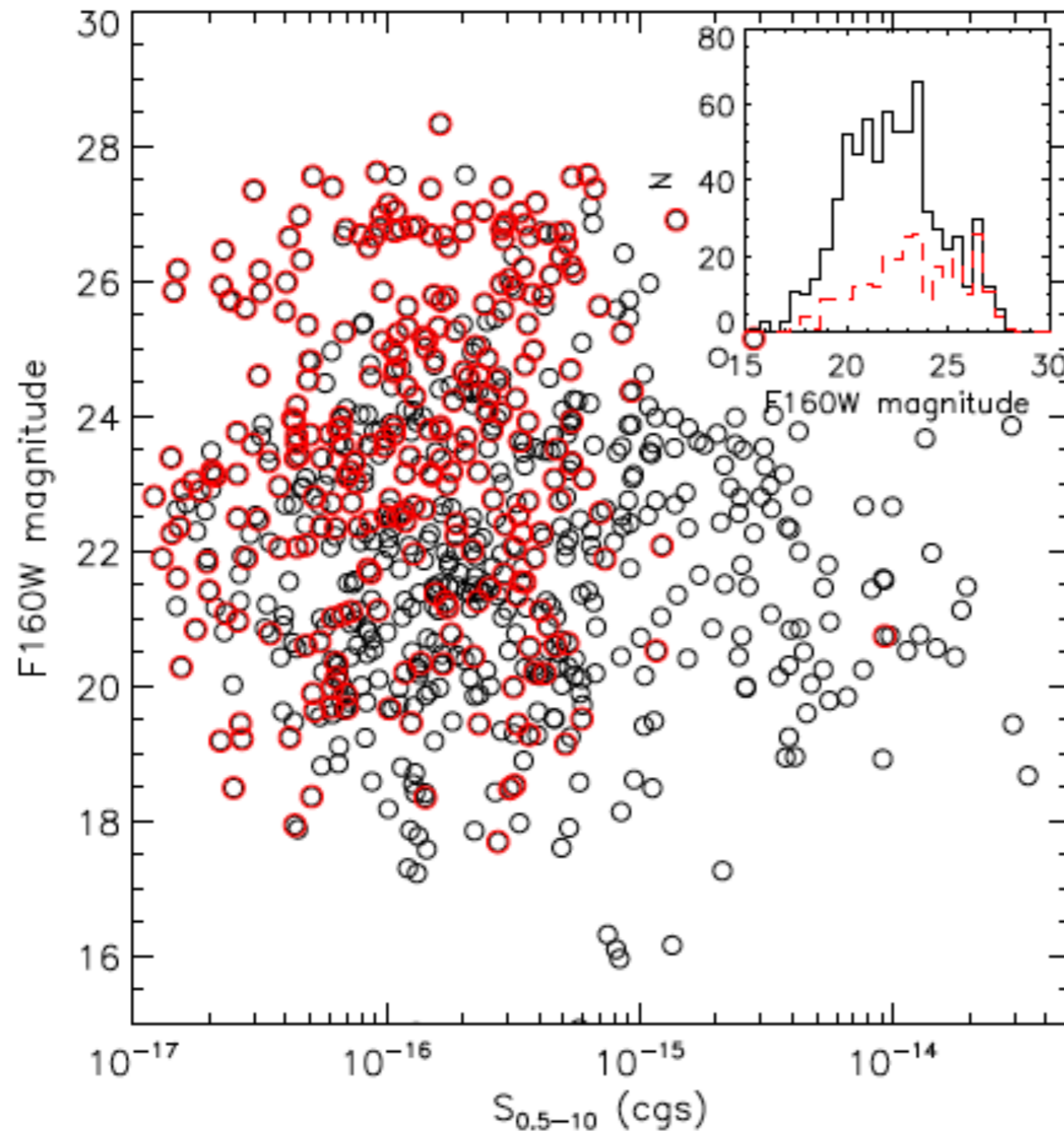


Using WFC3 sources as priors in the 4Ms CDFS



**Using priors increases the efficiency
in detecting faint sources**

Using WFC3 sources as priors in the 4Ms CDFS



8 new candidate
Photo- $z > 4$ sources

4 are upper-limits

Photo- z do not agree
from catalog to catalog

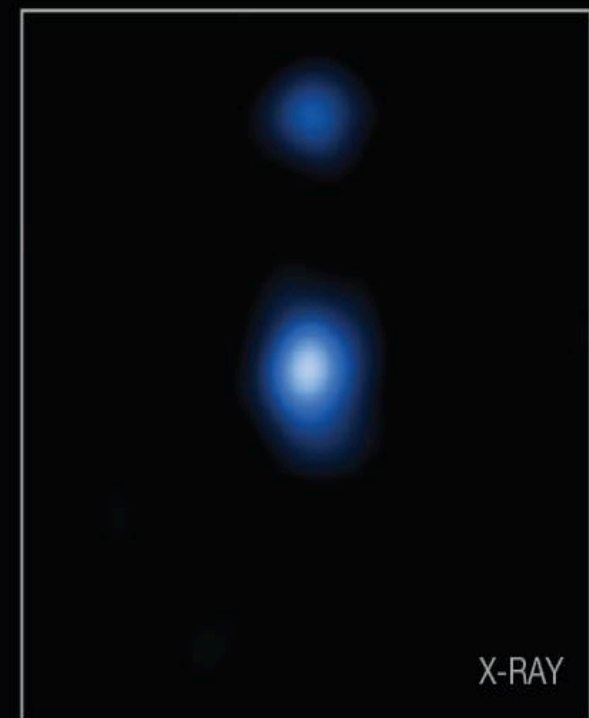
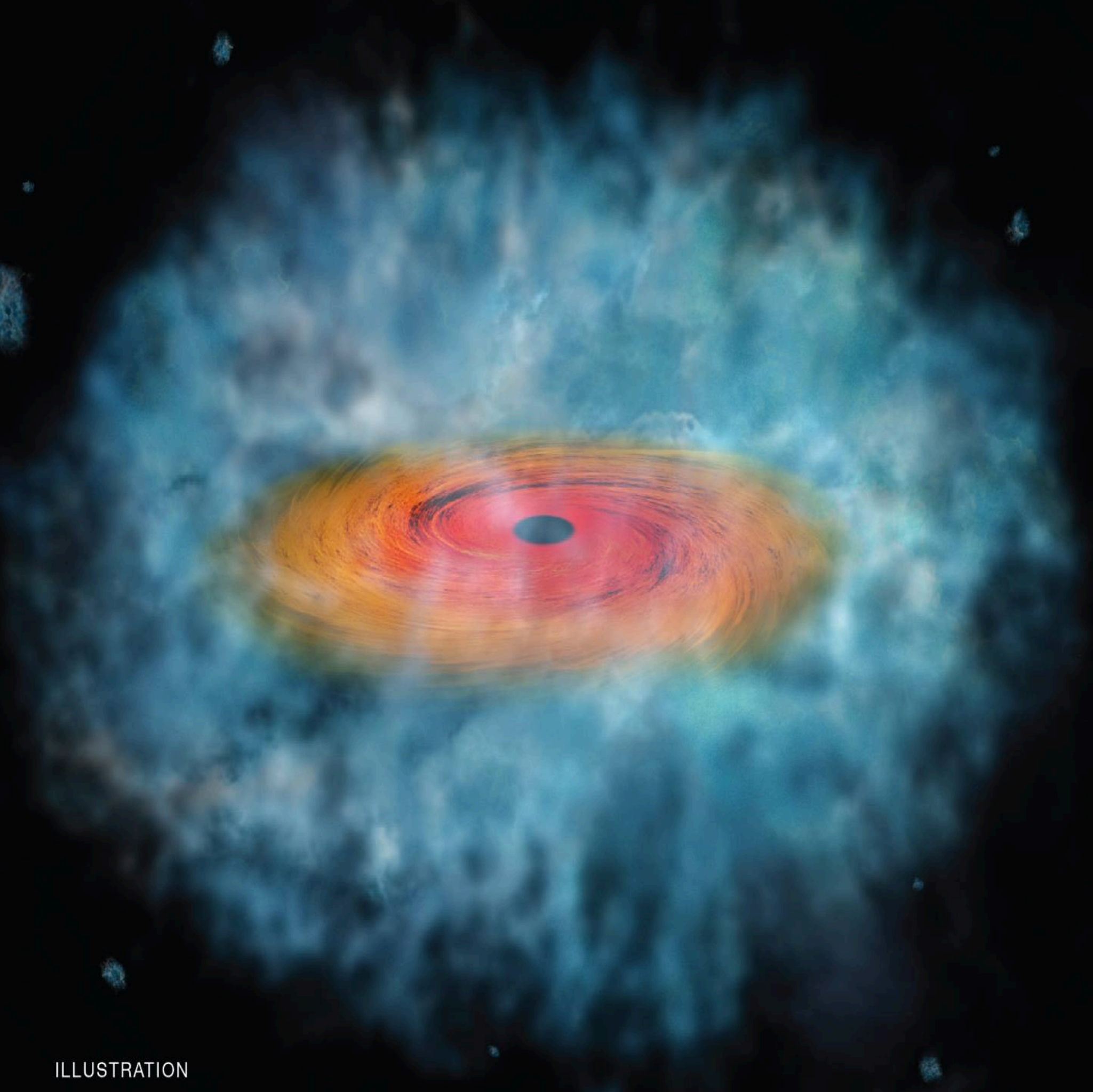
Cappelluti+16

Similar to Giallongo et al. 2015 but less sources

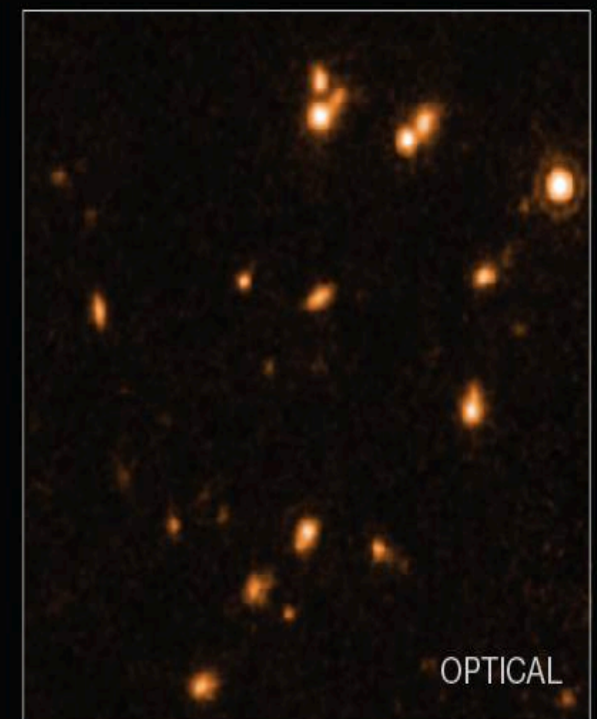
With WFIRST, EUCLID (JWST+HST)

- All the possible Chandra point source counterparts will be already in EUCLID/WFIRST/JWST/HST the catalogs.
- To take advantage that we need to re-think our search for X-ray sources.
- Develop multi-facility observing strategies on wide and deep surveys.
- Multitude of phot. filters: develop selection criteria to isolate high redshift black holes detected also by Chandra.

Pacucci+16



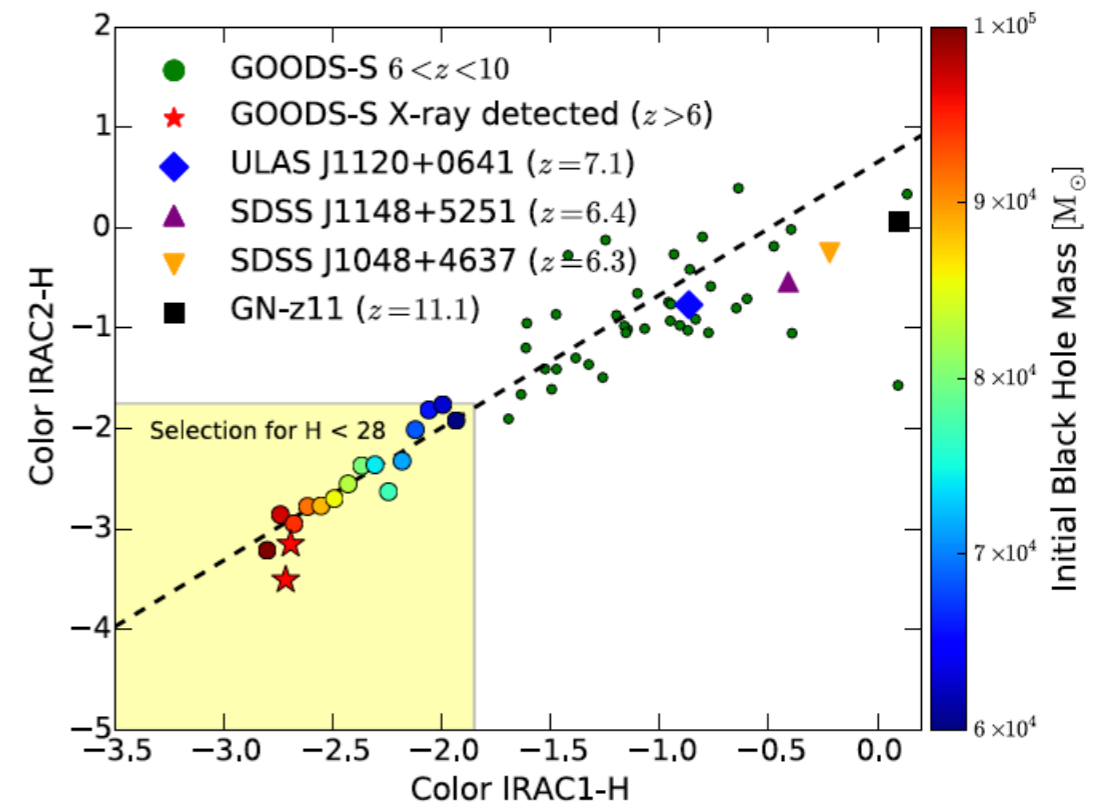
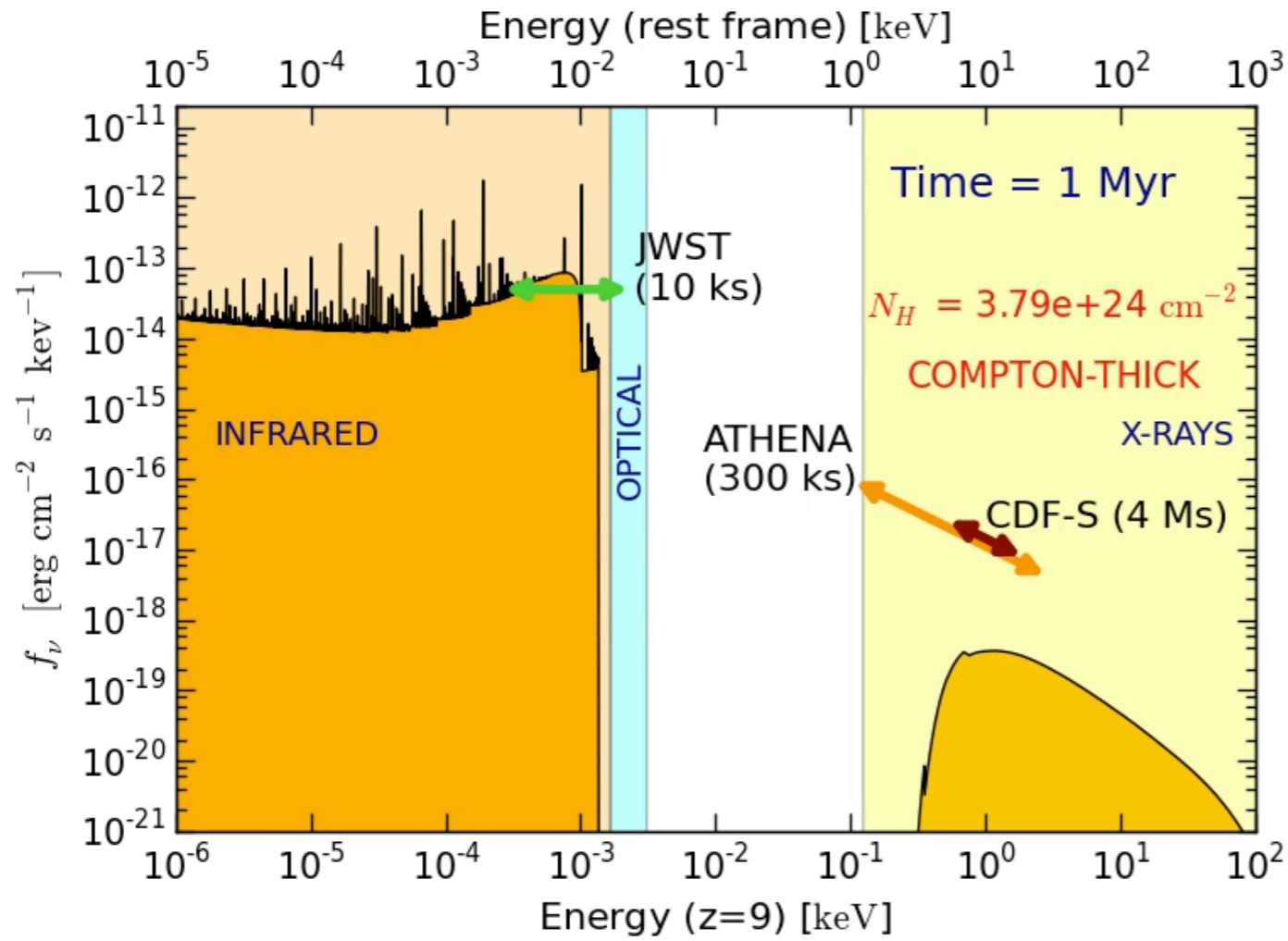
X-RAY



OPTICAL

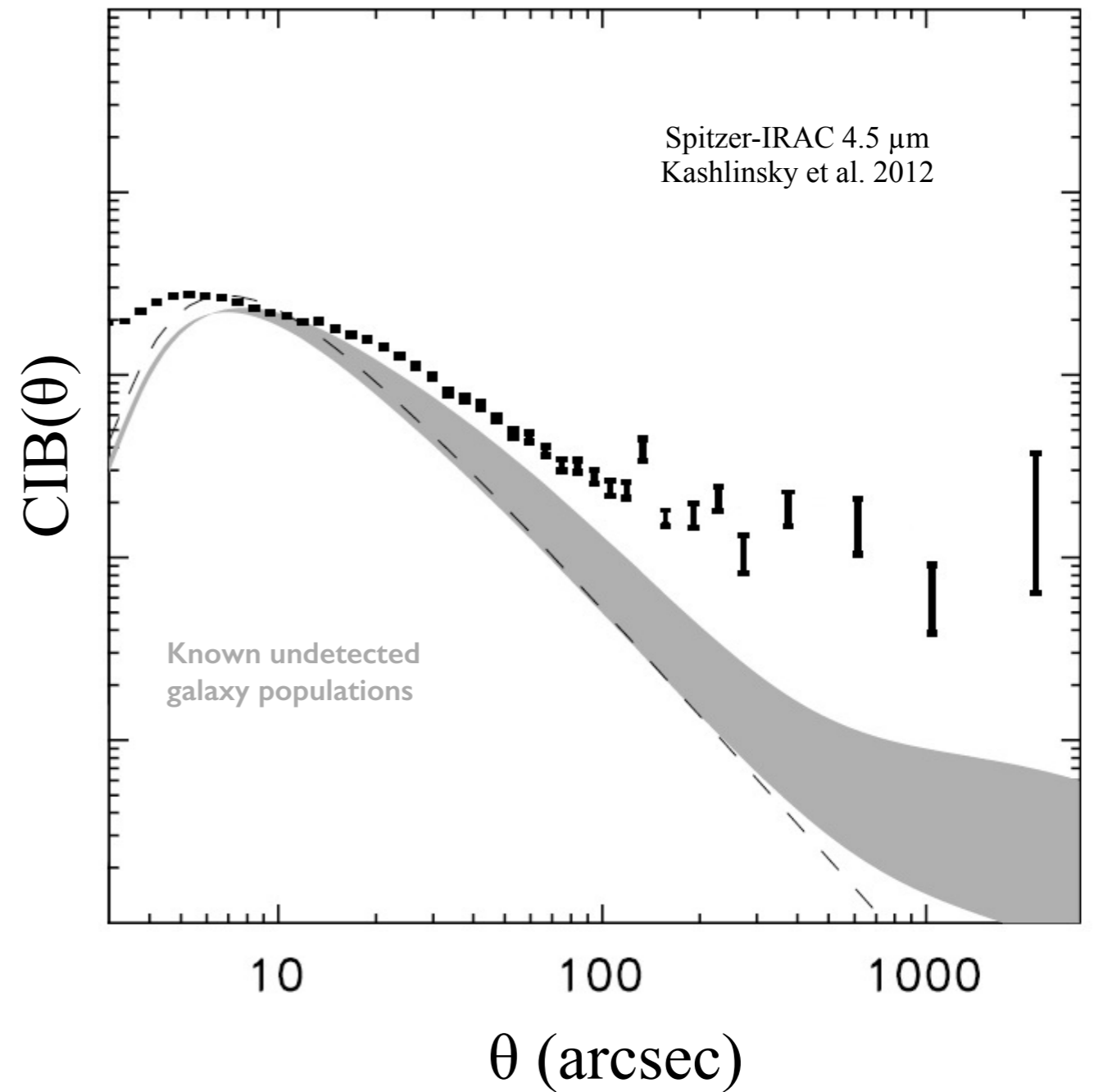
ILLUSTRATION

The SED of DCBH



Signatures of a DCBHs population in Cosmic backgrounds

Auto power of CIB fluctuations



Spitzer @3.6 μ m-8 μ m

Known Properties

Large scale excess:

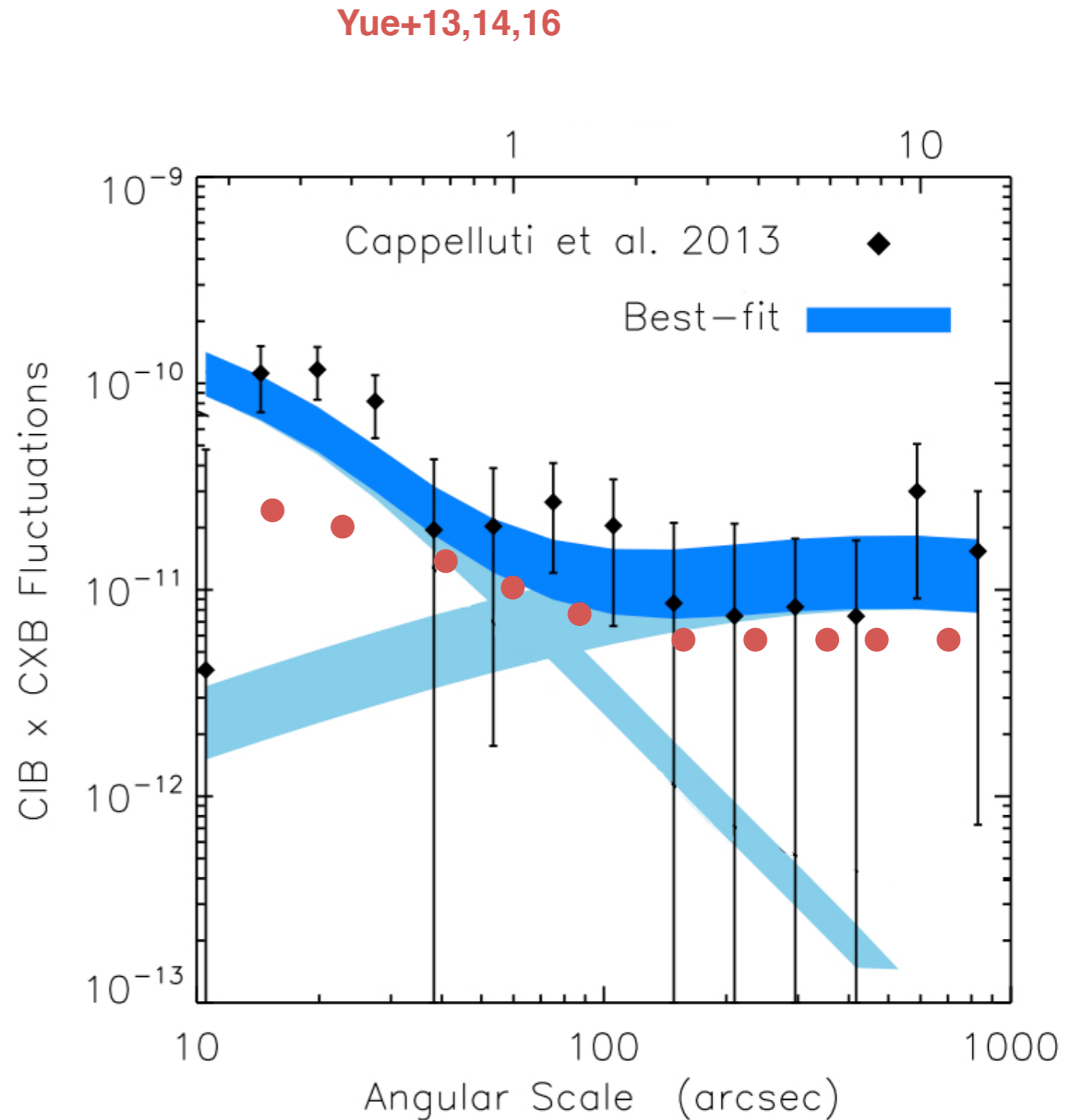
- IRAC $m > 25$
- No correlation with $< 1 \mu\text{m}$
- Optical $m > 28$
- Lyman Break $\sim 1 \mu\text{m}$

Large scale excess:

- Consistent with population in high- z structures
- Scales larger than $5'$ fundamental

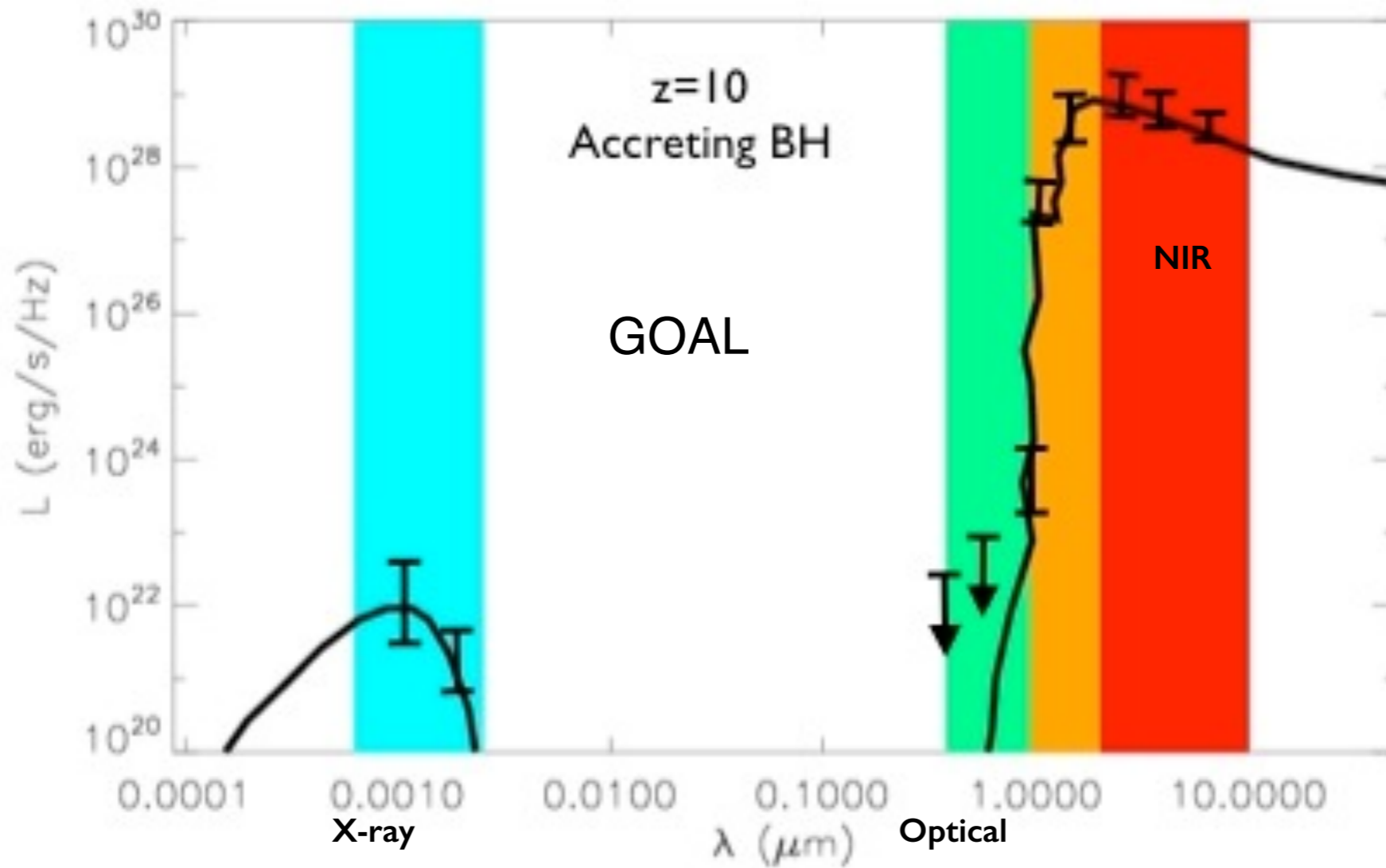
Large scale excess:

- Correlations with the CXB
- Significant BH population



CIB x CXB crosspower

SED of EBL Fluctuations?



The NASA-LIBRAE program

- Looking for IR Background Radiation Anisotropies with Euclid. (P.I. A. Kashlinsky)
- NASA funded Euclid effort till 2028

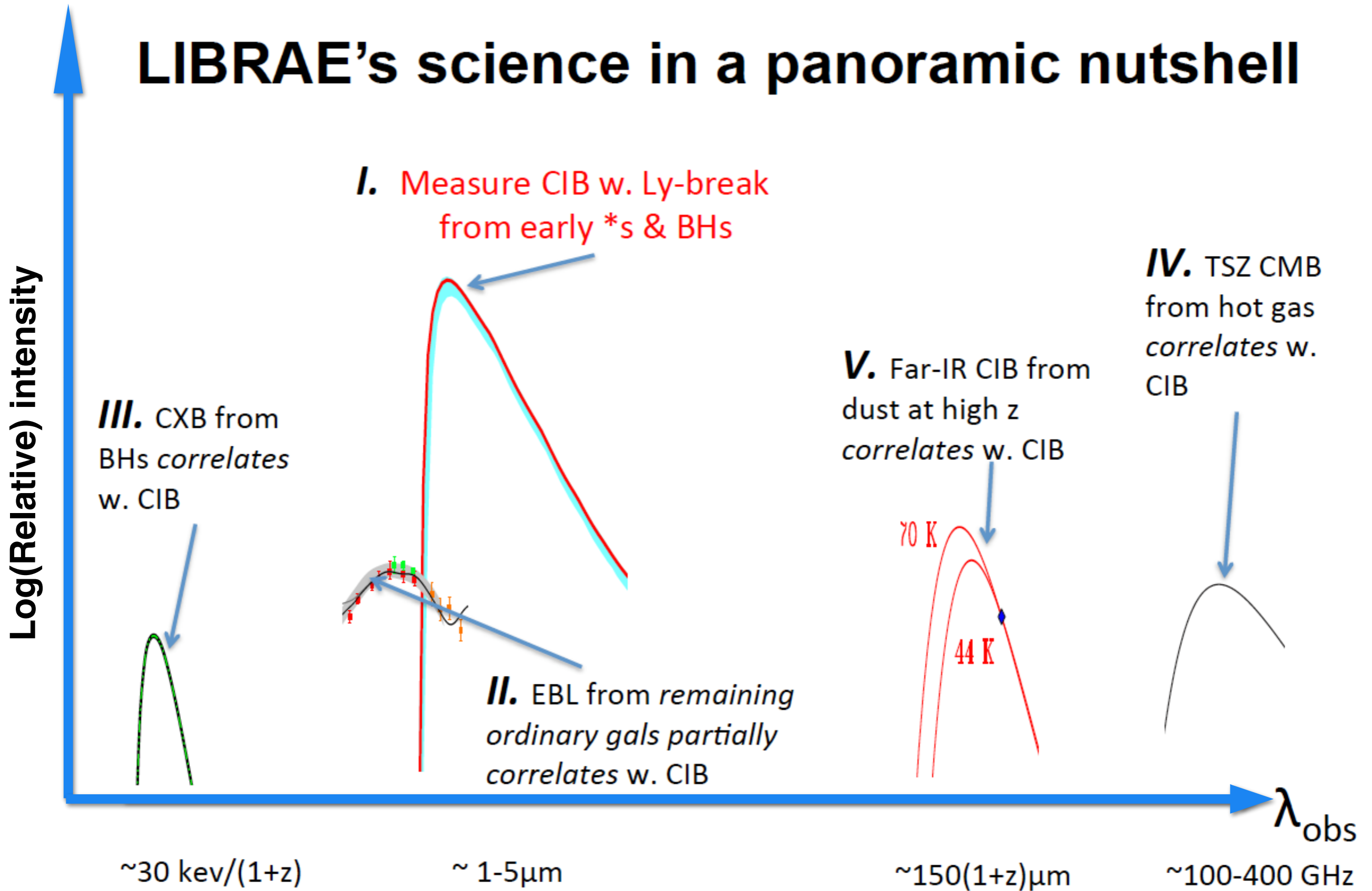
Goals:

- **Determine the typical redshift of the sources producing EBL anisotropies**
- Derive their SED with multi-mission analysis.

Role of Chandra:

- **Provide (deep) coverage in EUCLID deep fields.**
- Key role to provide evidence of accretion.

LIBRAE's science in a panoramic nutshell



Thanks!