



The Need for
Laboratory Astrophysics
for High-Resolution Spectroscopy

Gabriele Betancourt-Martinez, IRAP/CNRS

IACHEC 2019

The Need for Laboratory Astrophysics

Astro2020 Science White Paper

for High-Resolution X-ray Spectroscopy
Unlocking the Capabilities of Future
High-Resolution X-ray Spectroscopy Missions
Through Laboratory Astrophysics

Thematic Areas: Galaxy Evolution Cosmology and Fundamental Physics

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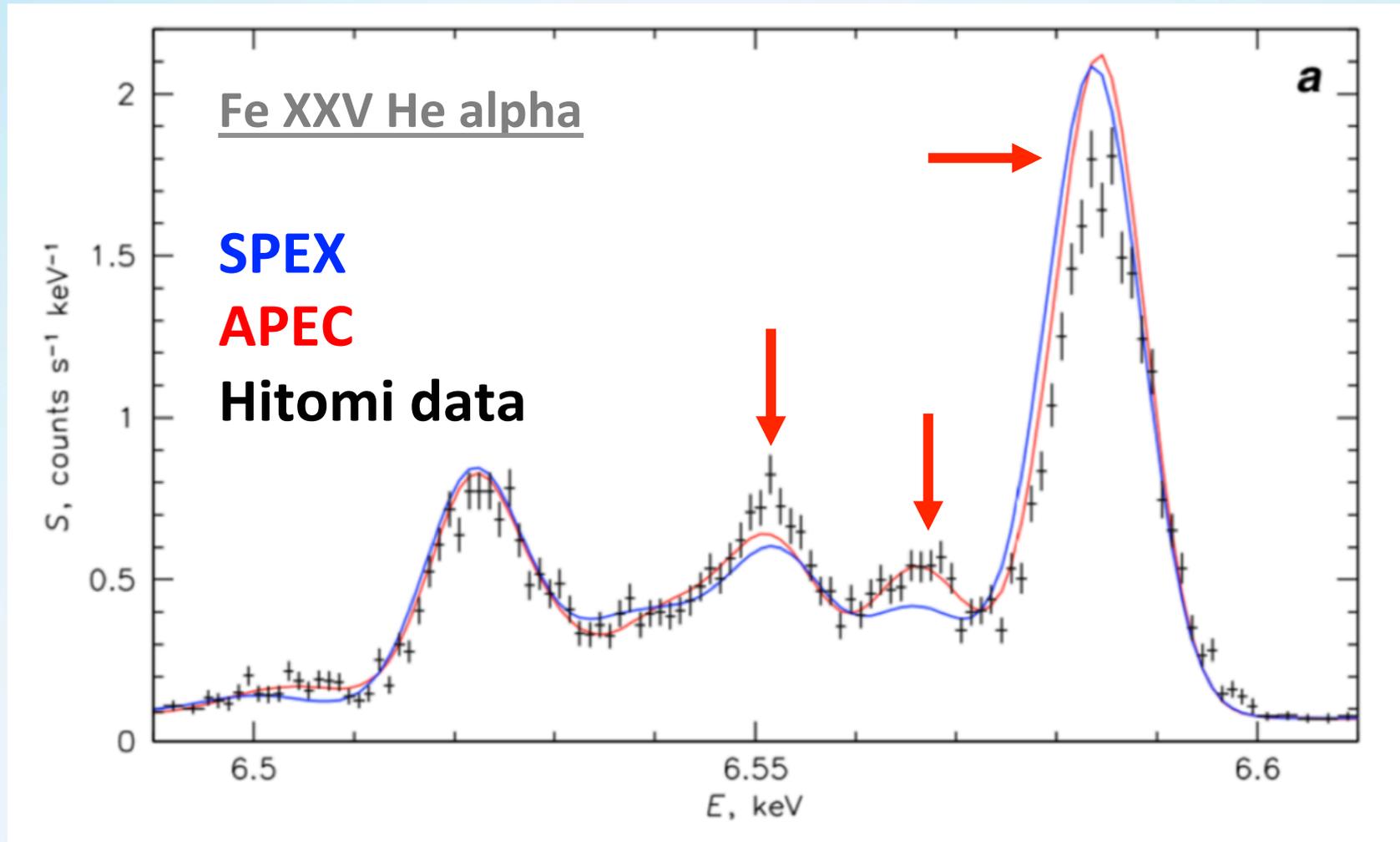


The Utility of
~~The Need for~~
Laboratory Astrophysics
for High-Resolution Spectroscopy

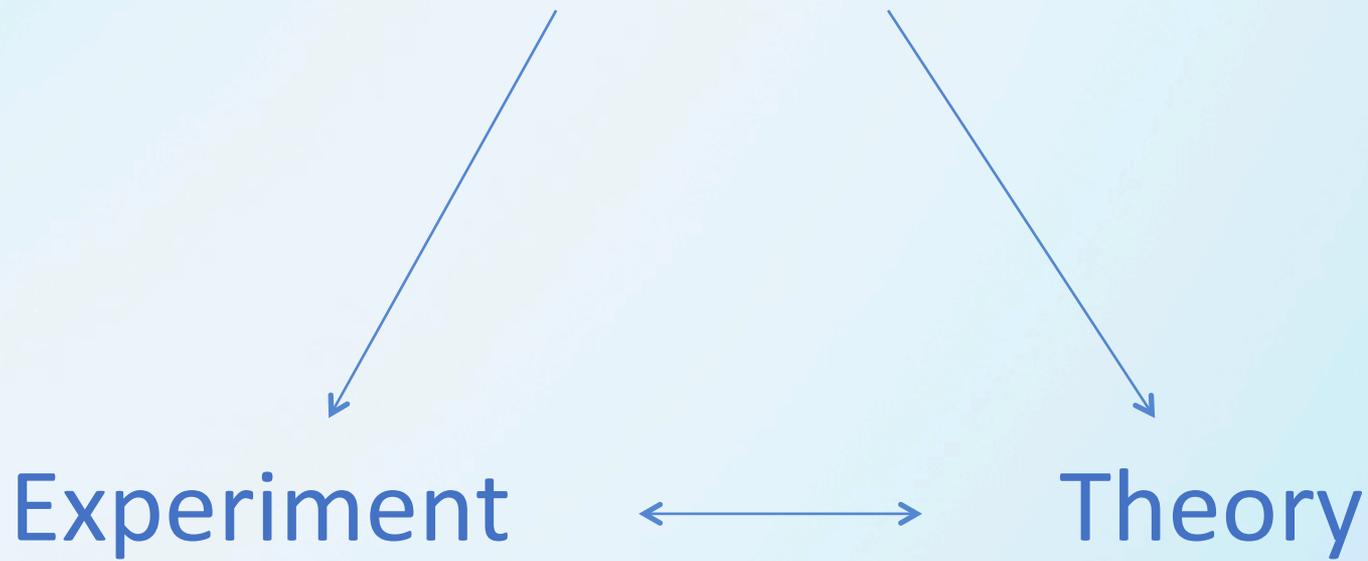
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(What happens at high resolution...)



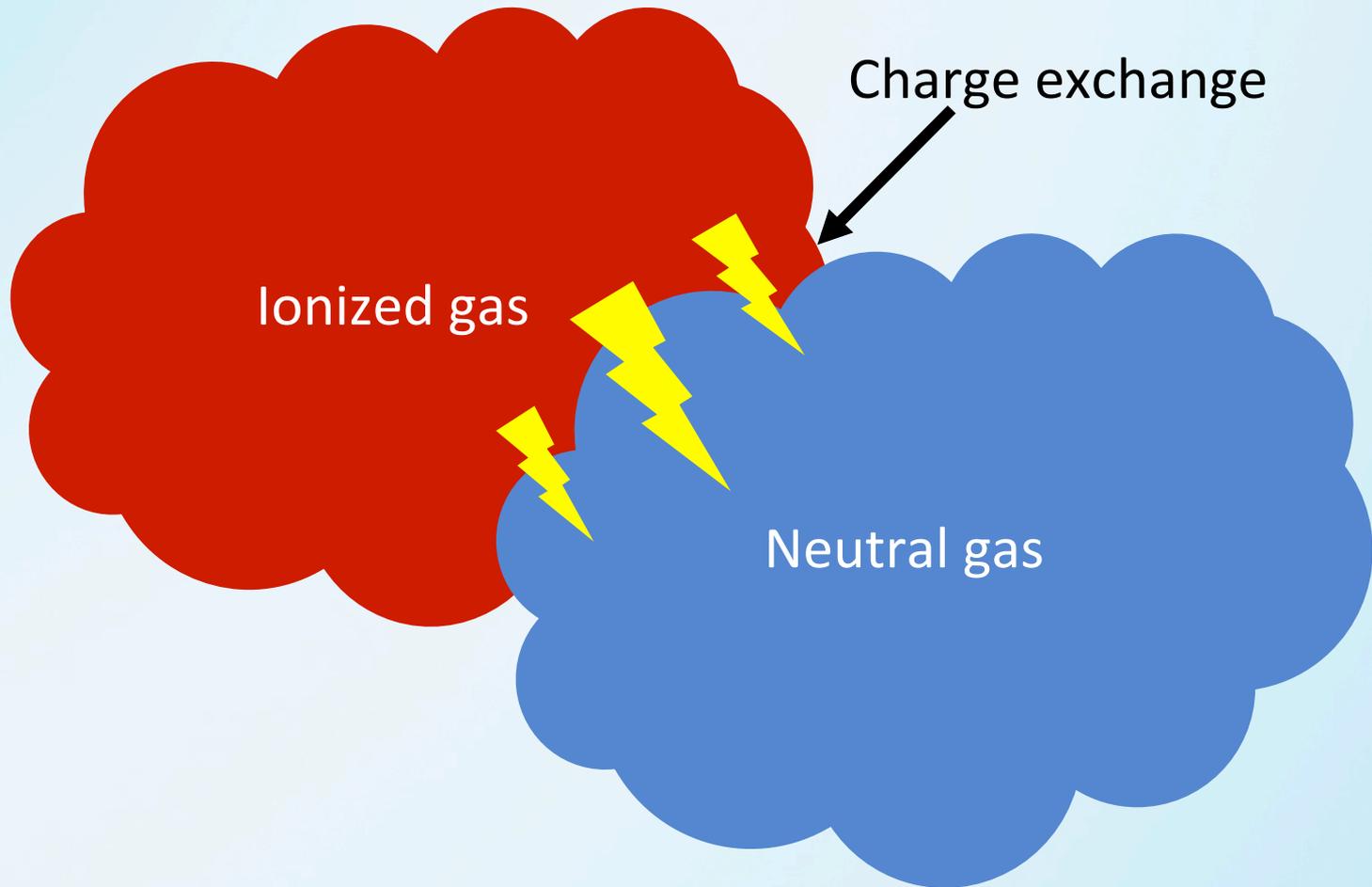
Laboratory Astrophysics



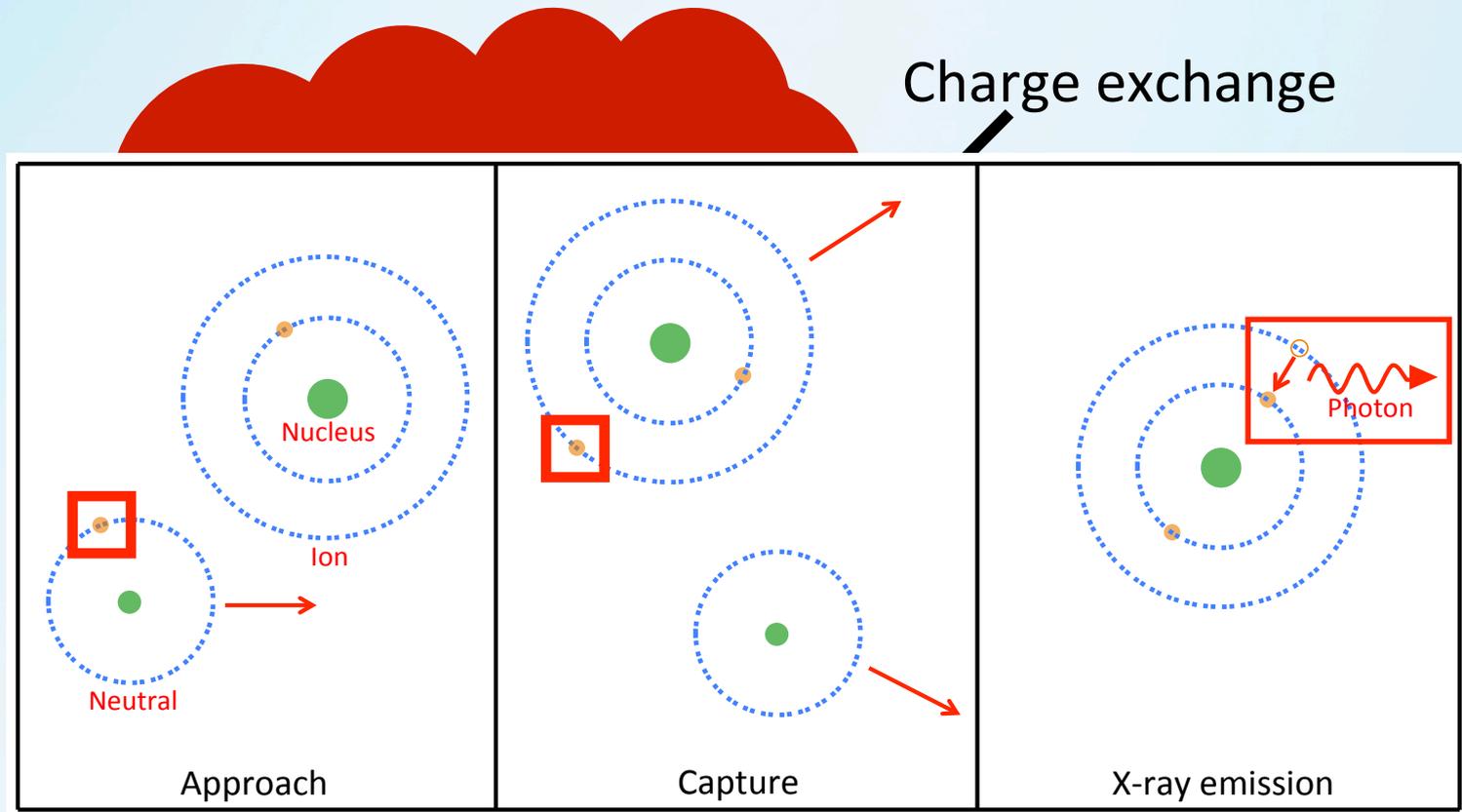
Two examples:

1. Charge exchange
2. Atomic oxygen calibration

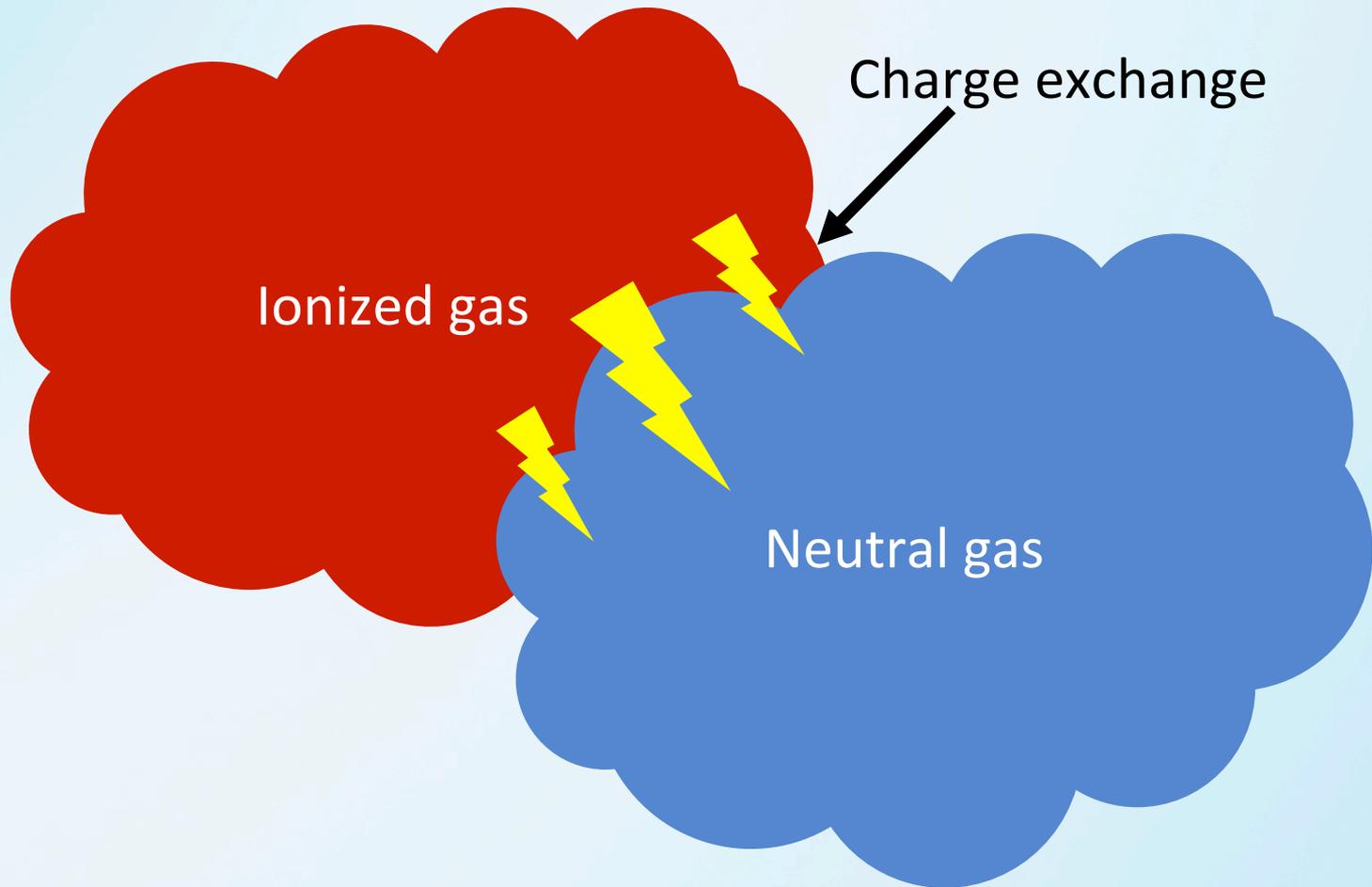
(1) Charge Exchange



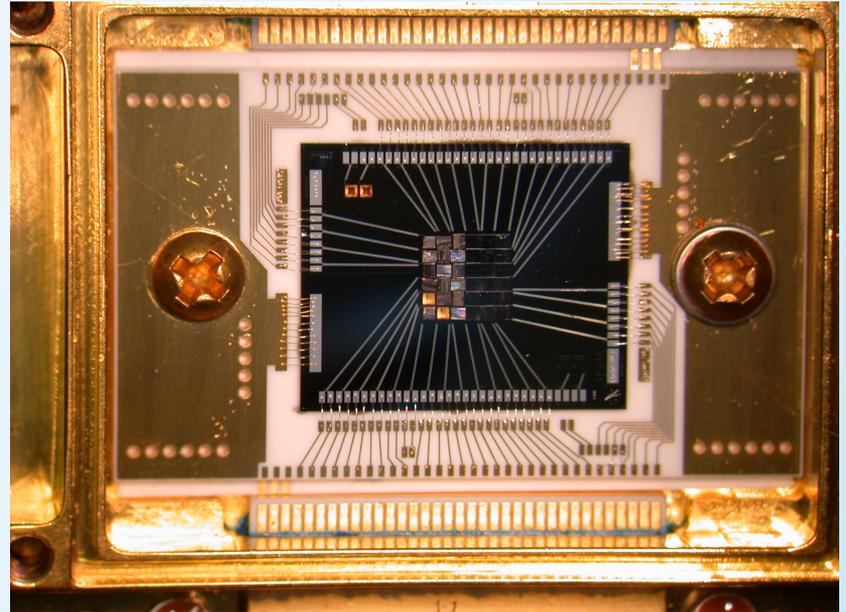
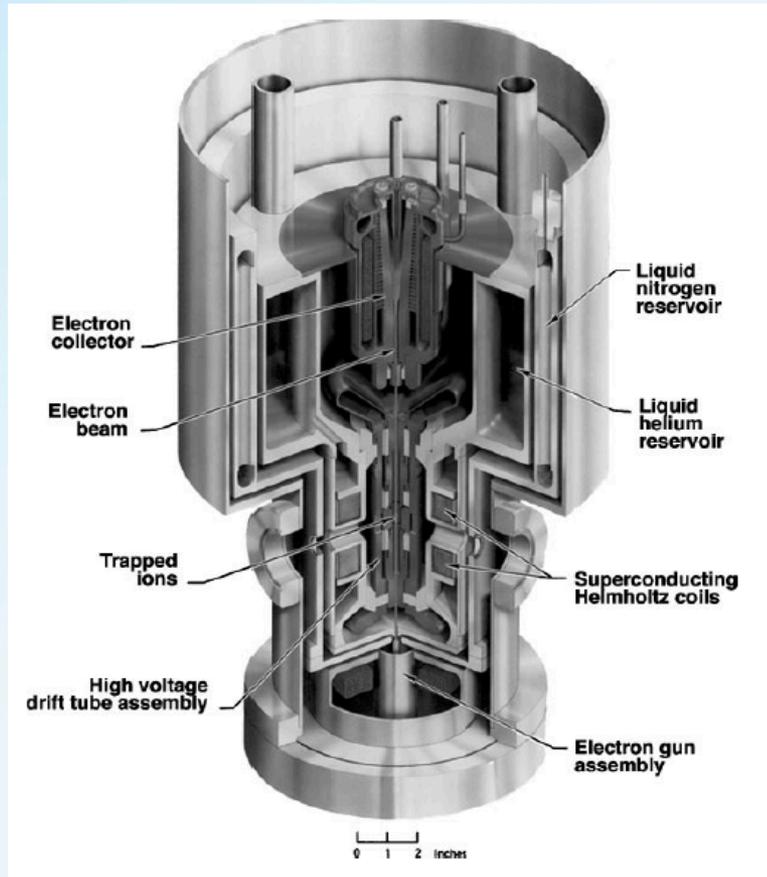
(1) Charge Exchange



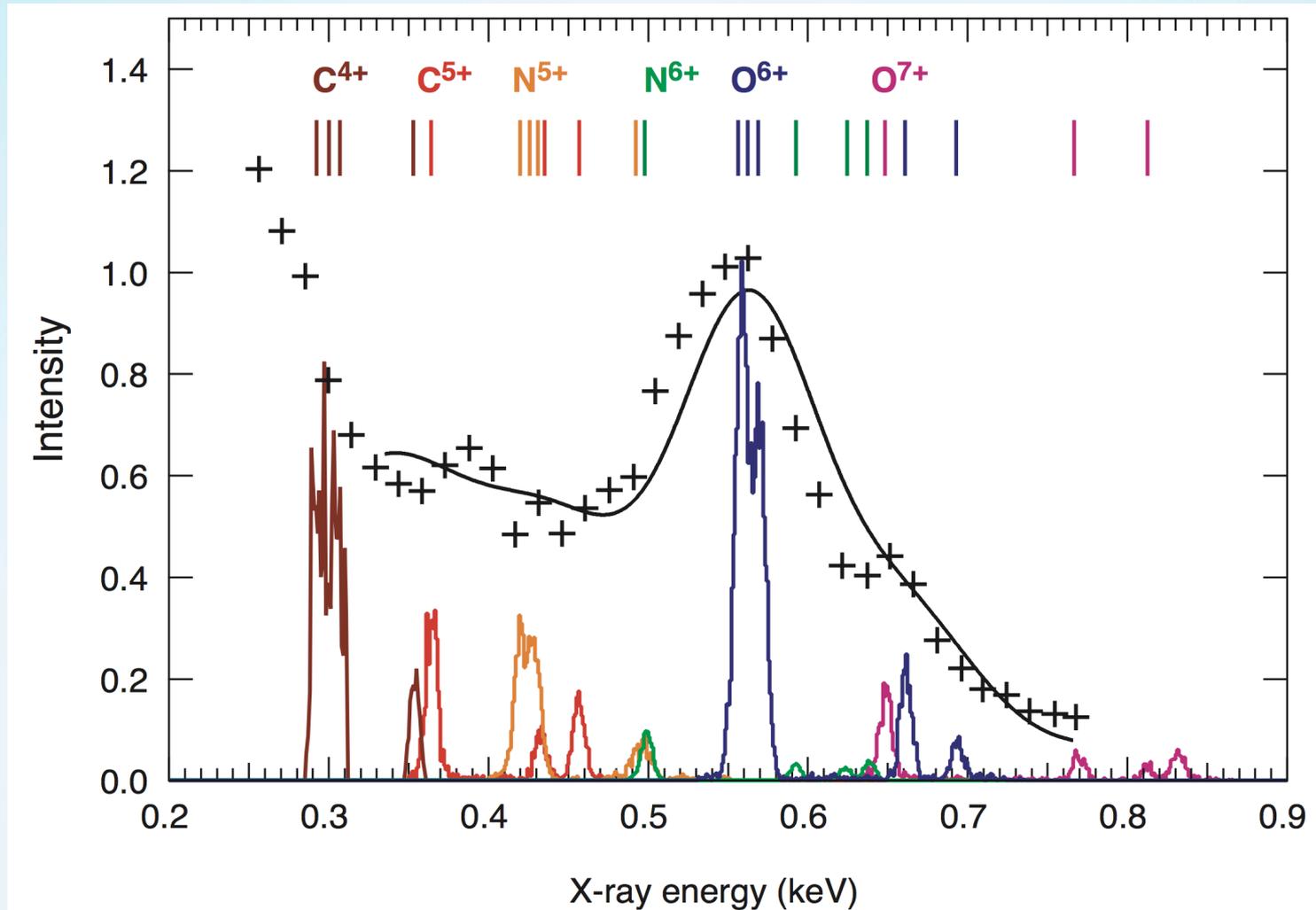
(1) Charge Exchange



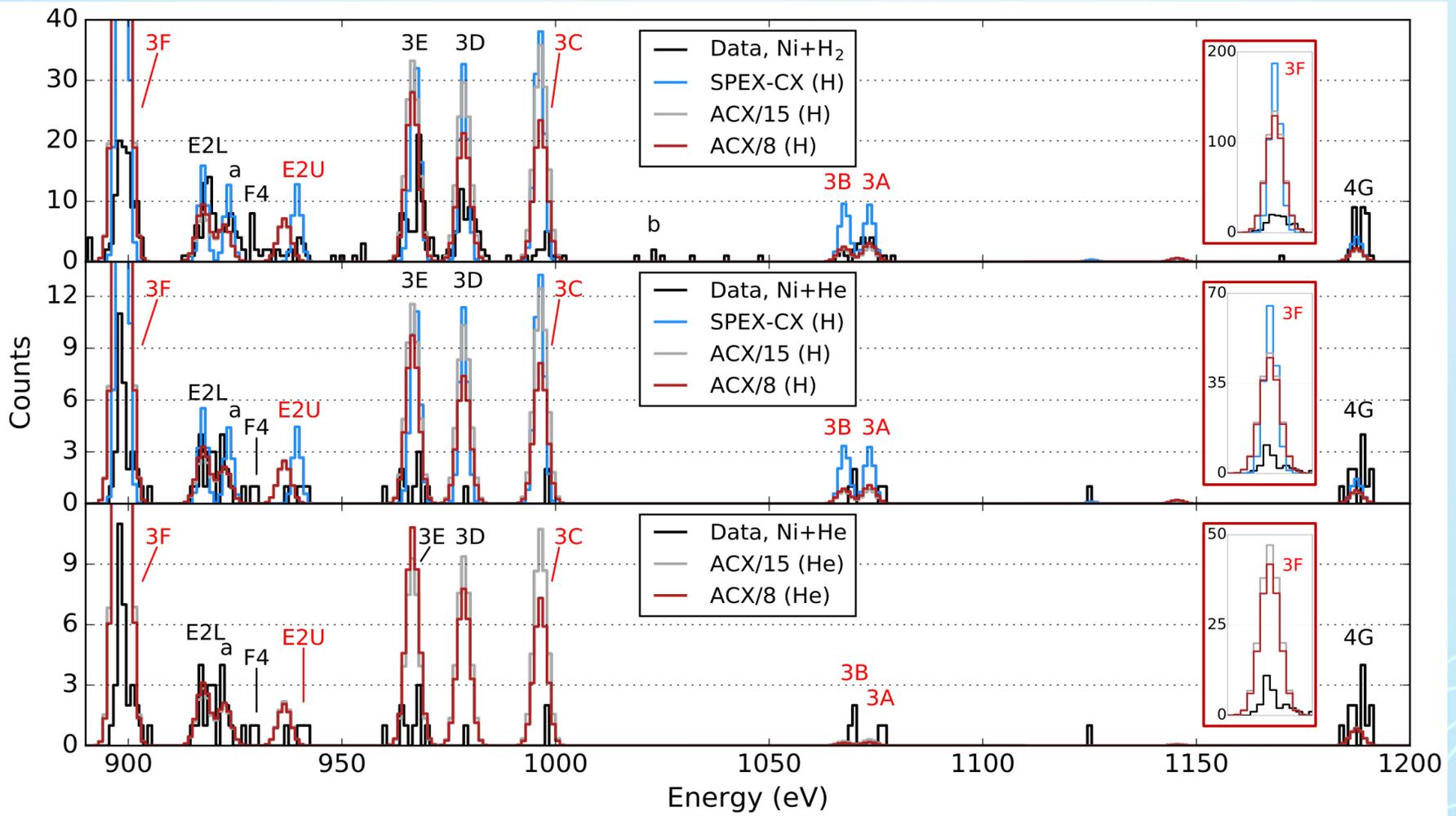
EBITs + microcalorimeters: powerful tools for CX at low energy



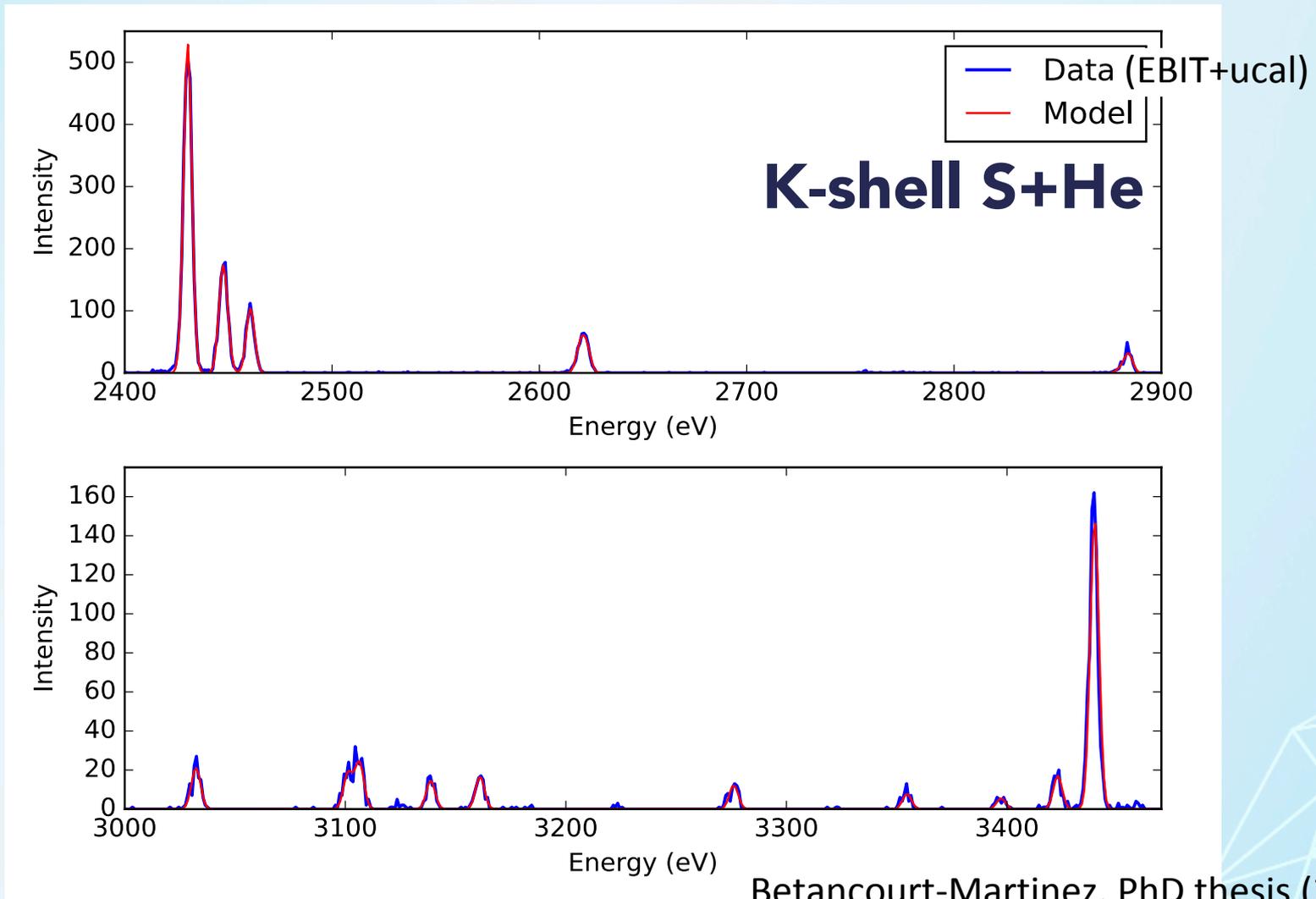
EBIT data match Chandra observation of cometary CX



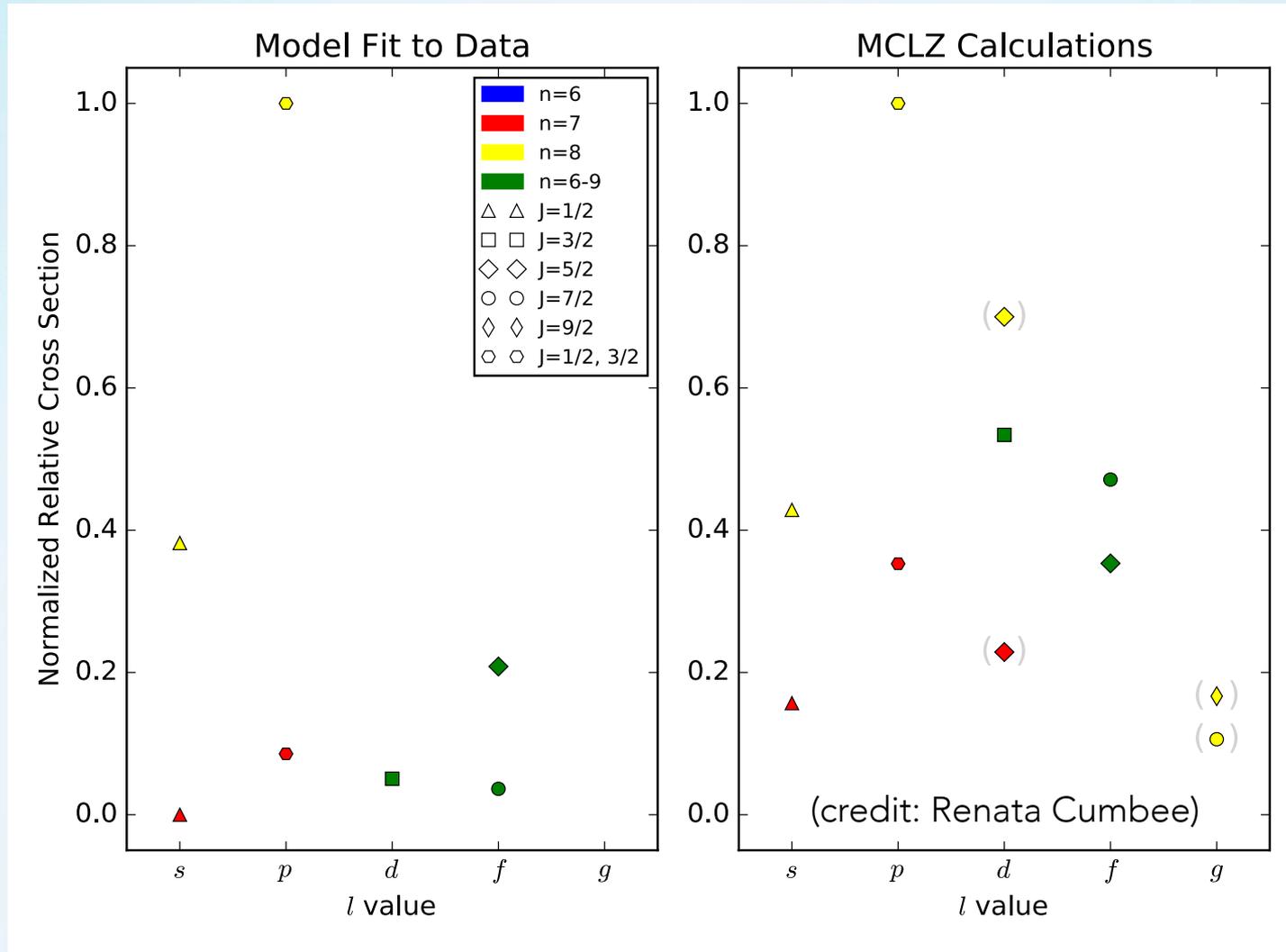
Benchmarking models—still have work to do



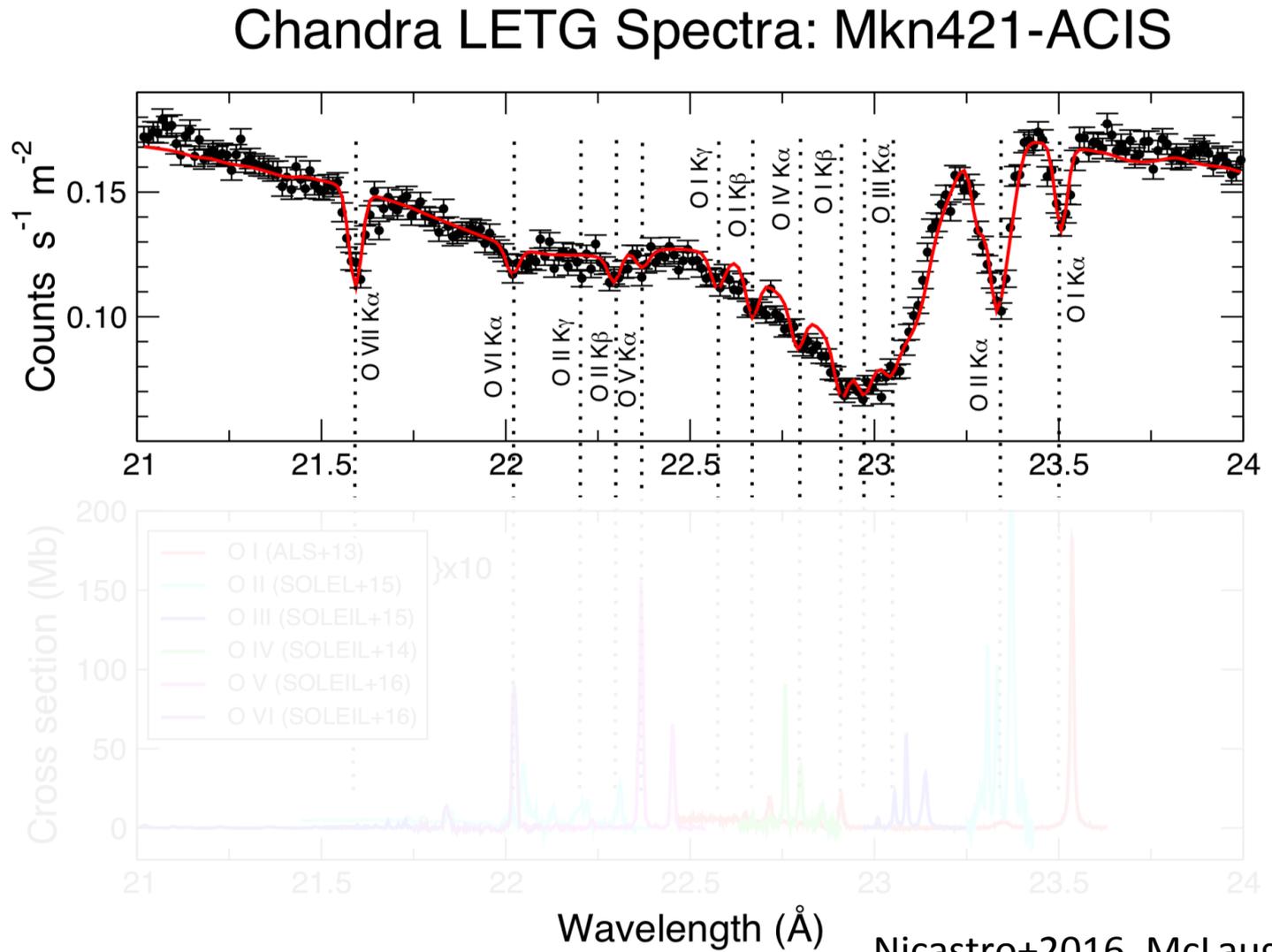
Use high-resolution spectra to probe atomic physics



Use high-resolution spectra to probe atomic physics

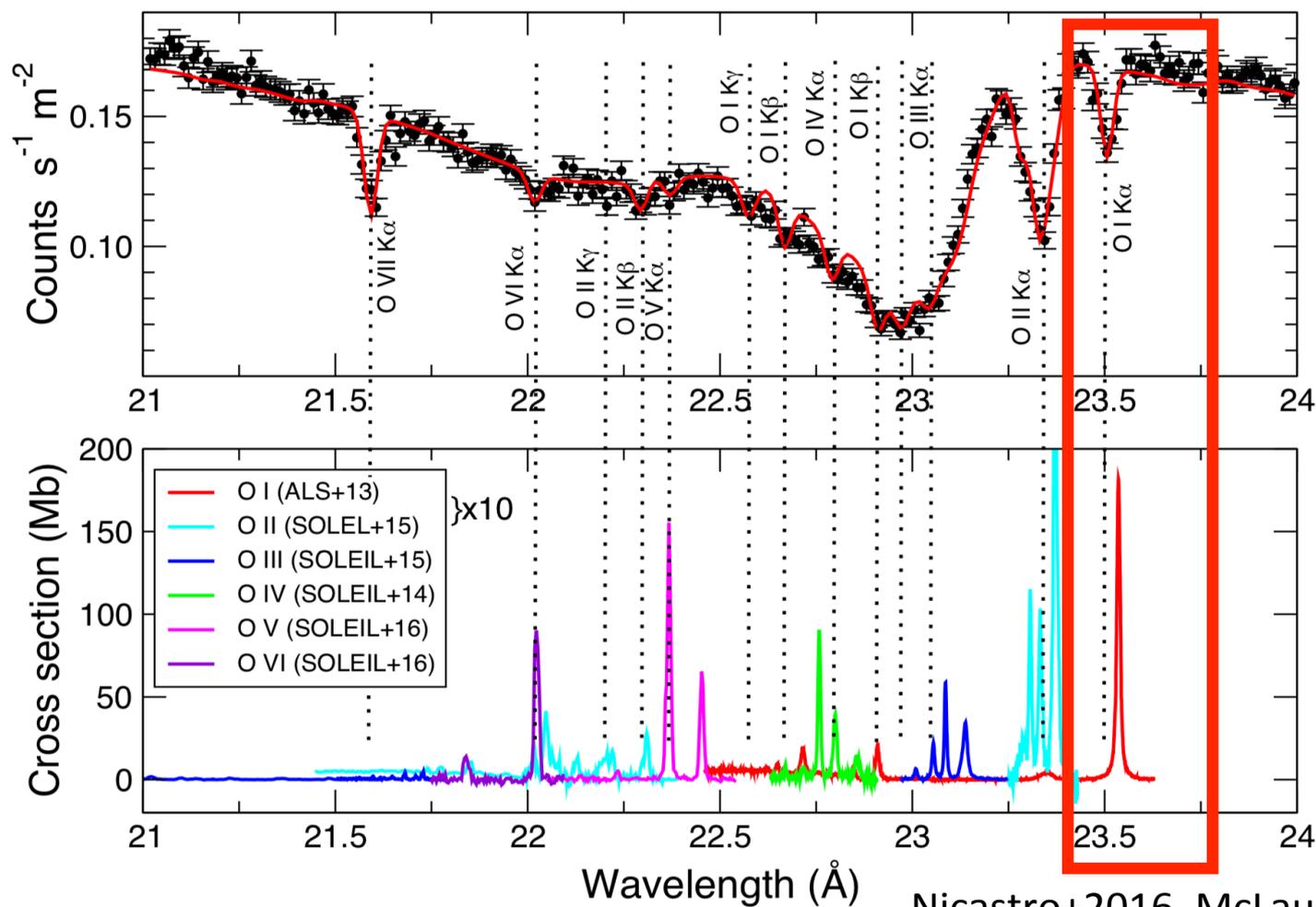


(2) Discrepancy in energy of O

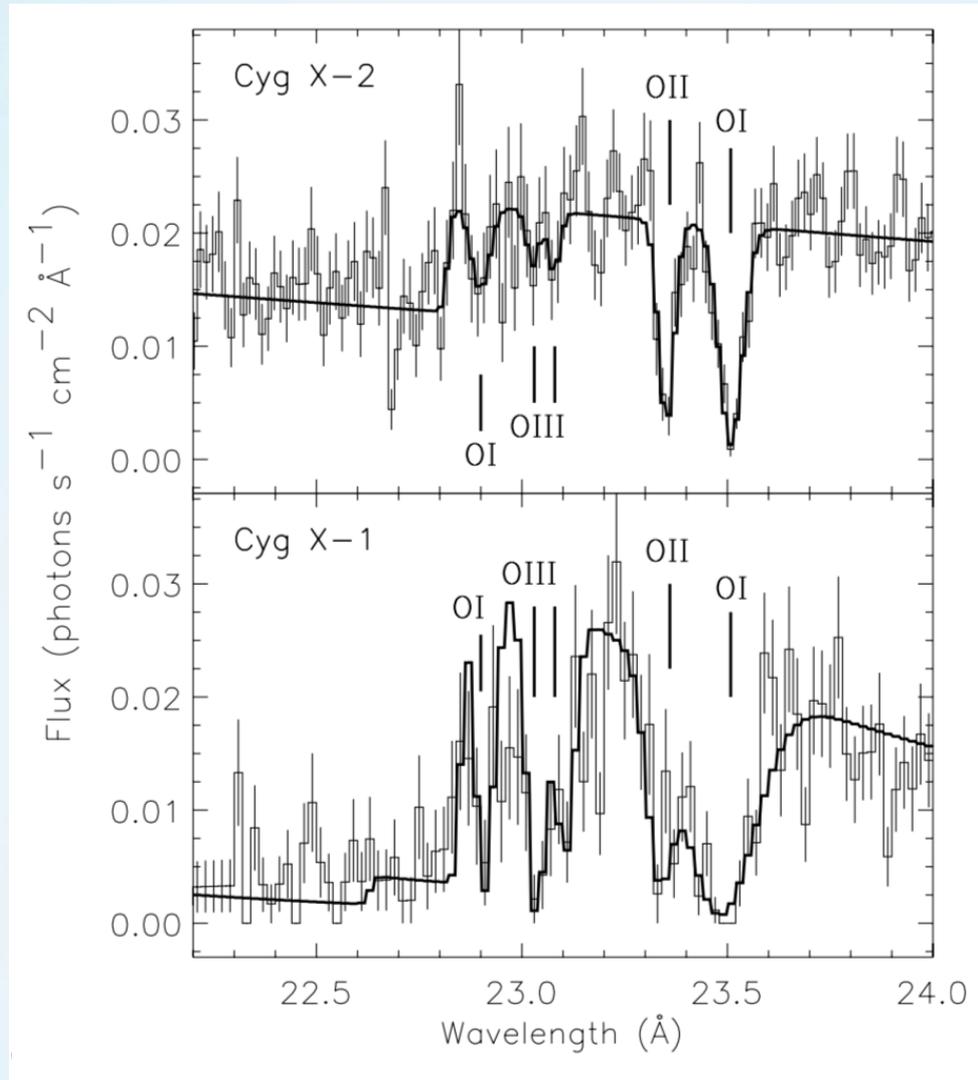


(2) Discrepancy in energy of O

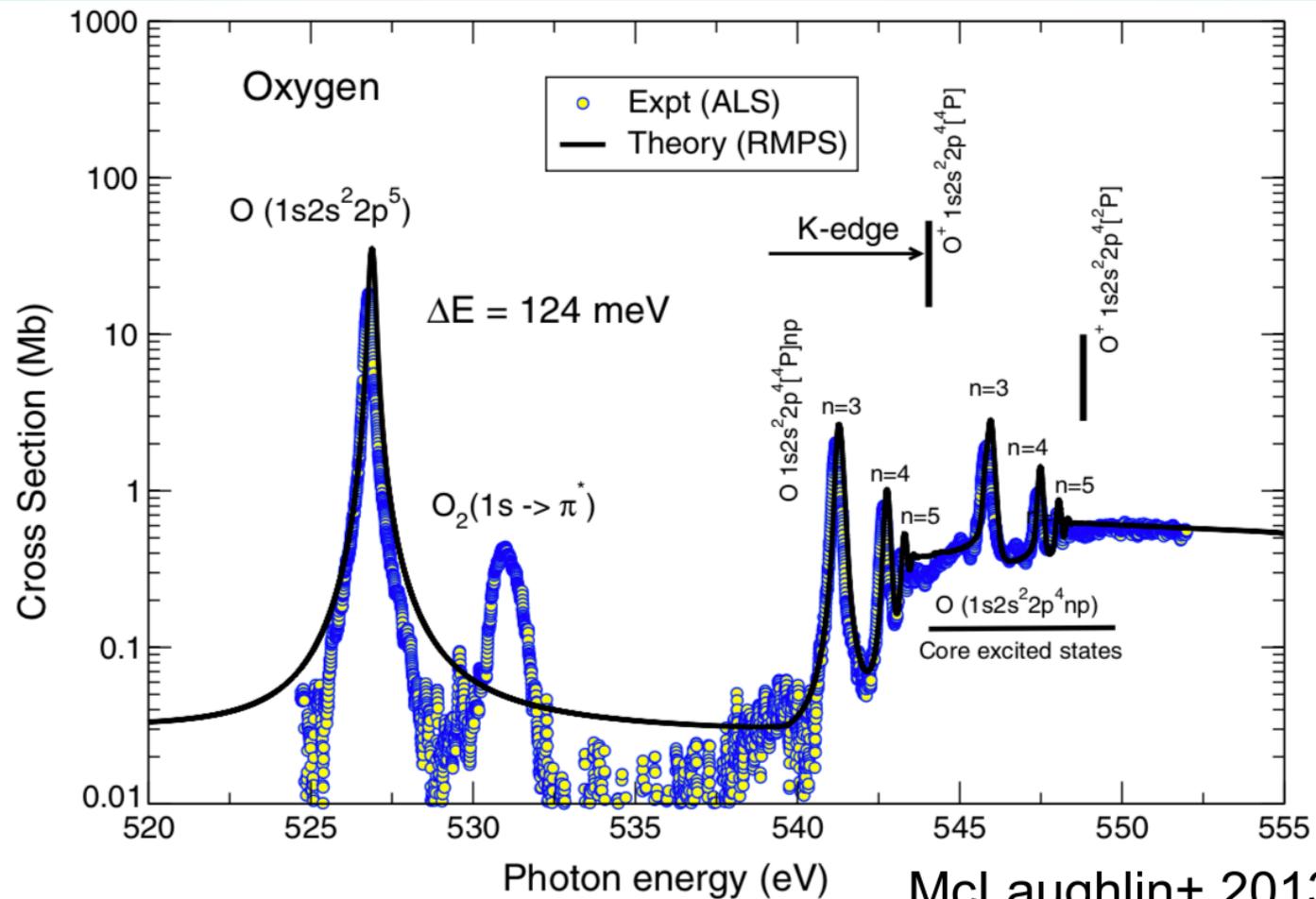
Chandra LETG Spectra: Mkn421-ACIS



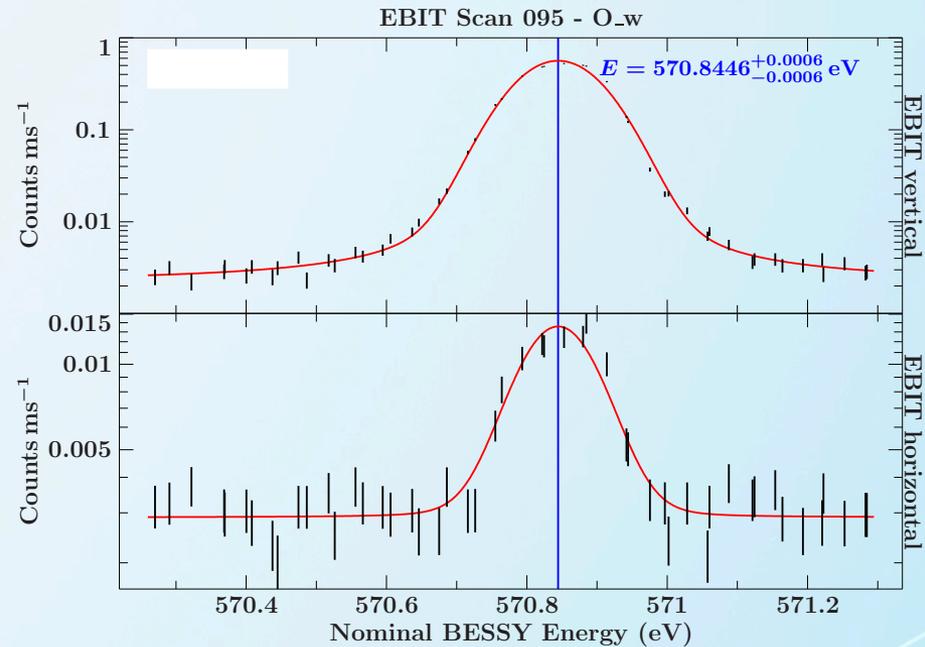
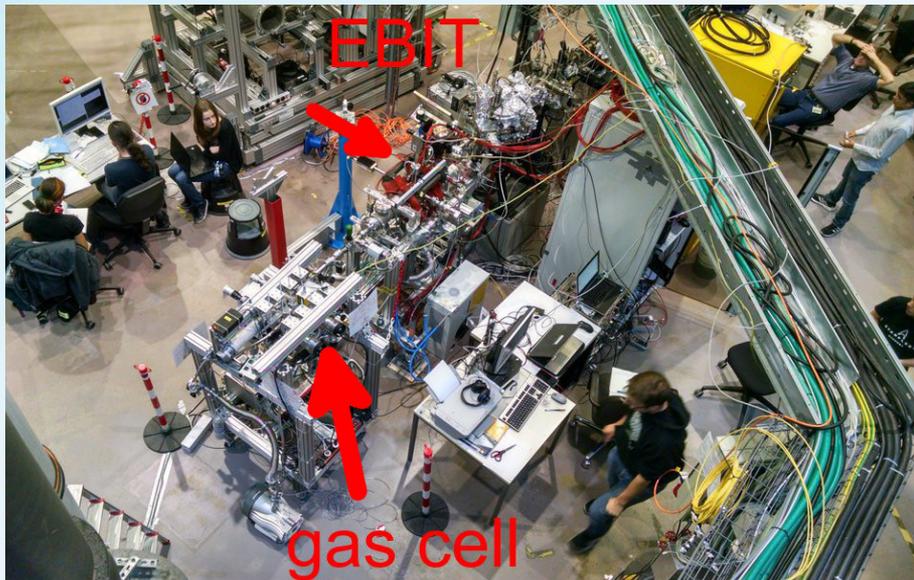
This isn't new...



Atomic O calibrated to O₂

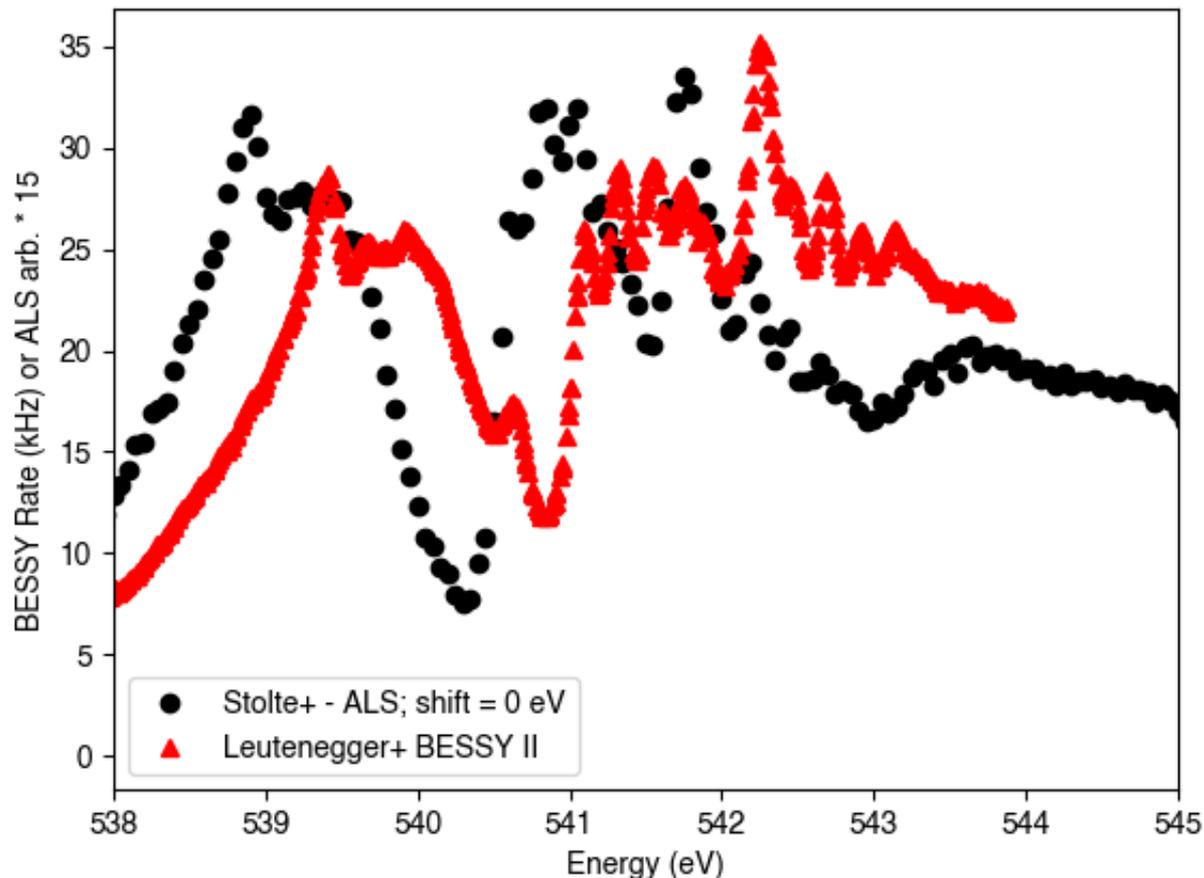


New calibration using highly charged ions in the MPI-K Polar-X EBIT



Leutenegger+ in prep.

New calibration using highly charged ions in the MPI-K Polar-X EBIT



More stories to come!