The High Energy X-Ray Probe (HEX-P)

Probing the circum-nuclear environment in AGN down to extremely low luminosities

Peter Boorman[1], Francesca Civano[2], Daniel Stern[3], Elias Kammoun[4], James Aird[5,6], David Alexander[7], Tonima Ananna[8], David Ballantyne[9], Mislav Baloković[10], William Brandt[11], Murray Brightman[1], Chien-Ting Chen[12], Javier García[1], Brian Grefenstette[1], Ryan Hickox[8], Kristin Madsen[2], Stefano Marchesi[13,14], Emanuele Nardini[15], Ryan Pfeifle[2], Claudio Ricci[16,17,18], Guido Risaliti[15,19], Dominic Sicilian[20], Núria Torres-Albà[14], Xiurui Zhao[21] & the HEX-P Team

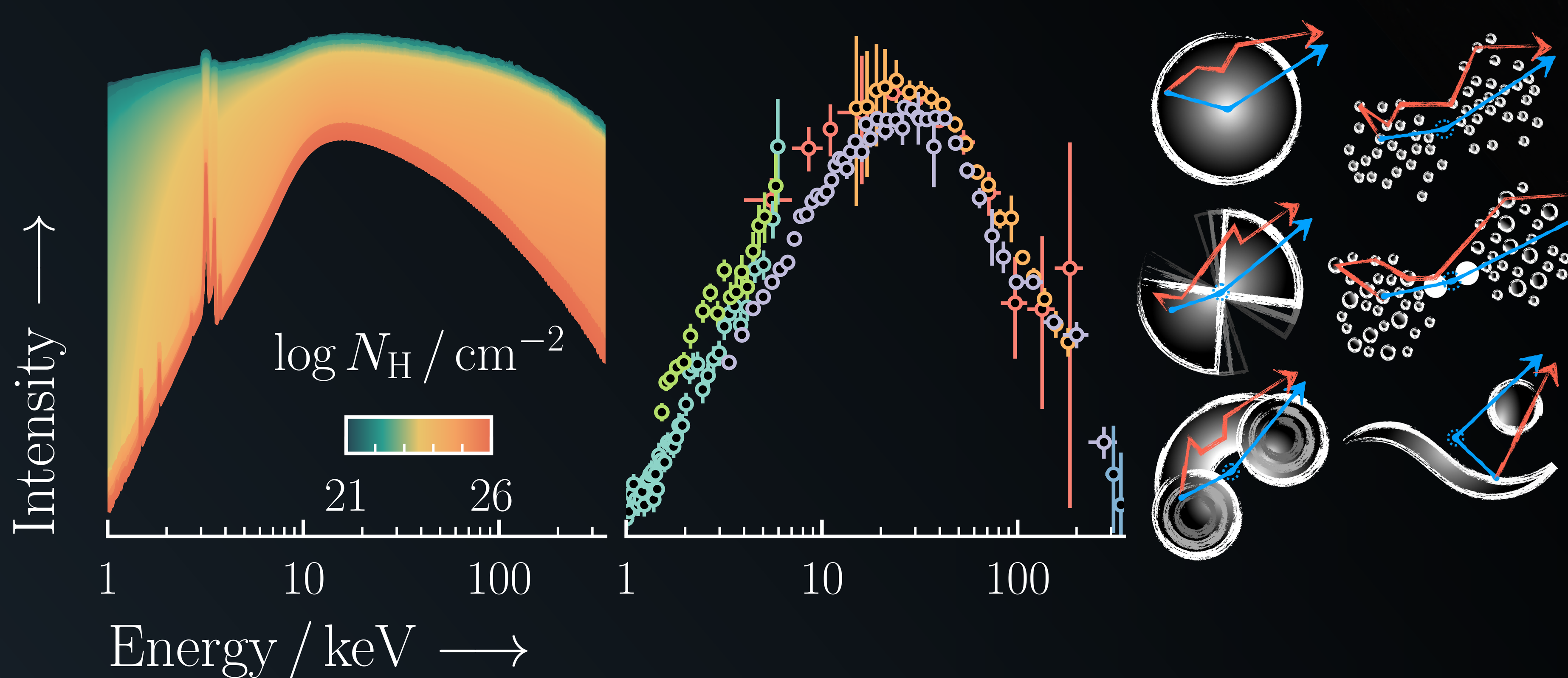
HEX-P will probe the dusty hearts of galaxies to reveal the complex structure of gas close to accreting supermassive black holes

The local census of AGN

(Left) simulated X-ray spectra from an AGN enshrouded by a clumpy gas obscurer, coloured by the column density of the gas clumps integrated along the line-of-sight.

(Center) the observed X-ray background spectrum (Gilli12), which is dominated by obscured AGN growth across cosmic time. However, little is known about the detailed structure and evolution of the circum-nuclear material within ~100 pc of AGN even in the closest sources (e.g., Annuar+20, Buchner+21)

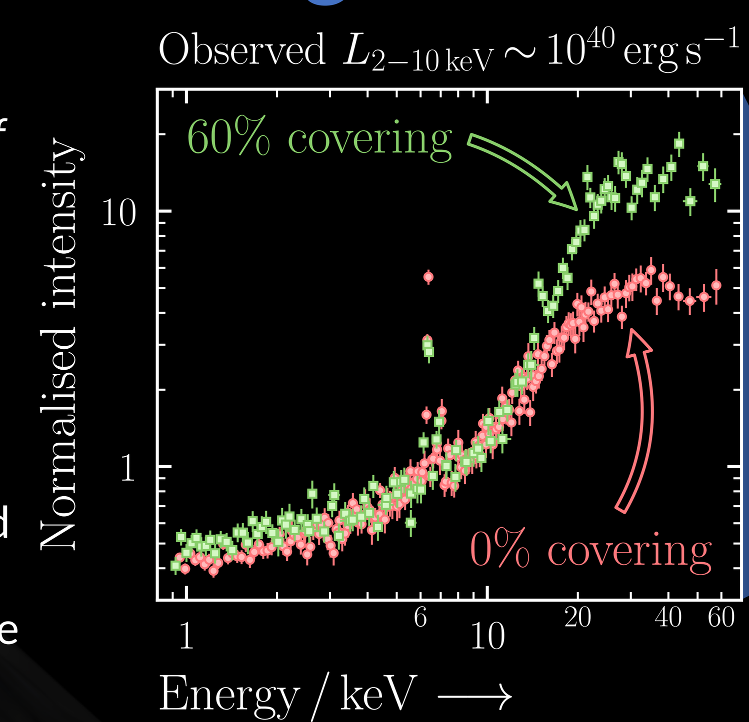
(Right) A selection of physically-motivated model geometries for studying the obscuration surrounding growing supermassive black holes (for models, see Brightman+11, Paltani & Ricci17, Baloković+18, Tanimoto+19, Buchner+19, Buchner+21)

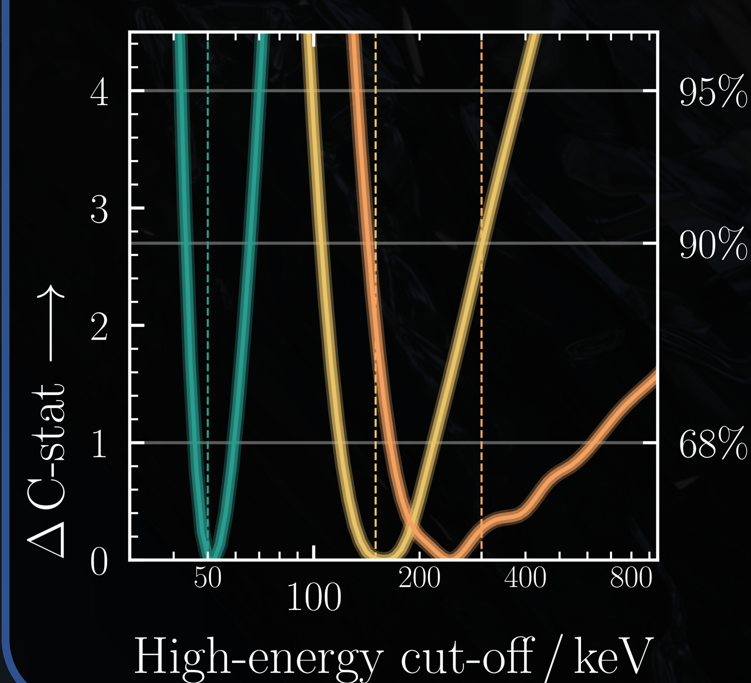


New insights into AGN growth

The X-ray spectrum above 10 keV depends strongly on the structure of the circum-nuclear material.

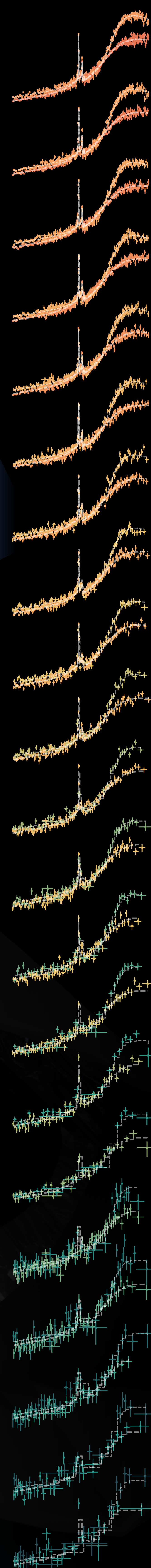
(Right) An inset from a set of simulated AGN at 15 Mpc (Annuar+20). The full set (right strip of poster) were simulated with unabsorbed luminosities $L_{2\text{-}10\,keV} = 10^{40.5} - 10^{42.5}$ erg s^{-1} and two different covering factors. Both scenarios are distinguishable for all luminosities considered.





HEX-P will gain insights into the corona in obscured AGN by disentangling obscuration reprocessing from the high-energy coronal turnover.

(Left) work led by Elias Kammoun showcasing the high-energy cut-off constraints attainable for local (~100 Mpc) heavily obscured AGN ($N_H = 10^{24}$ cm^{-2}).



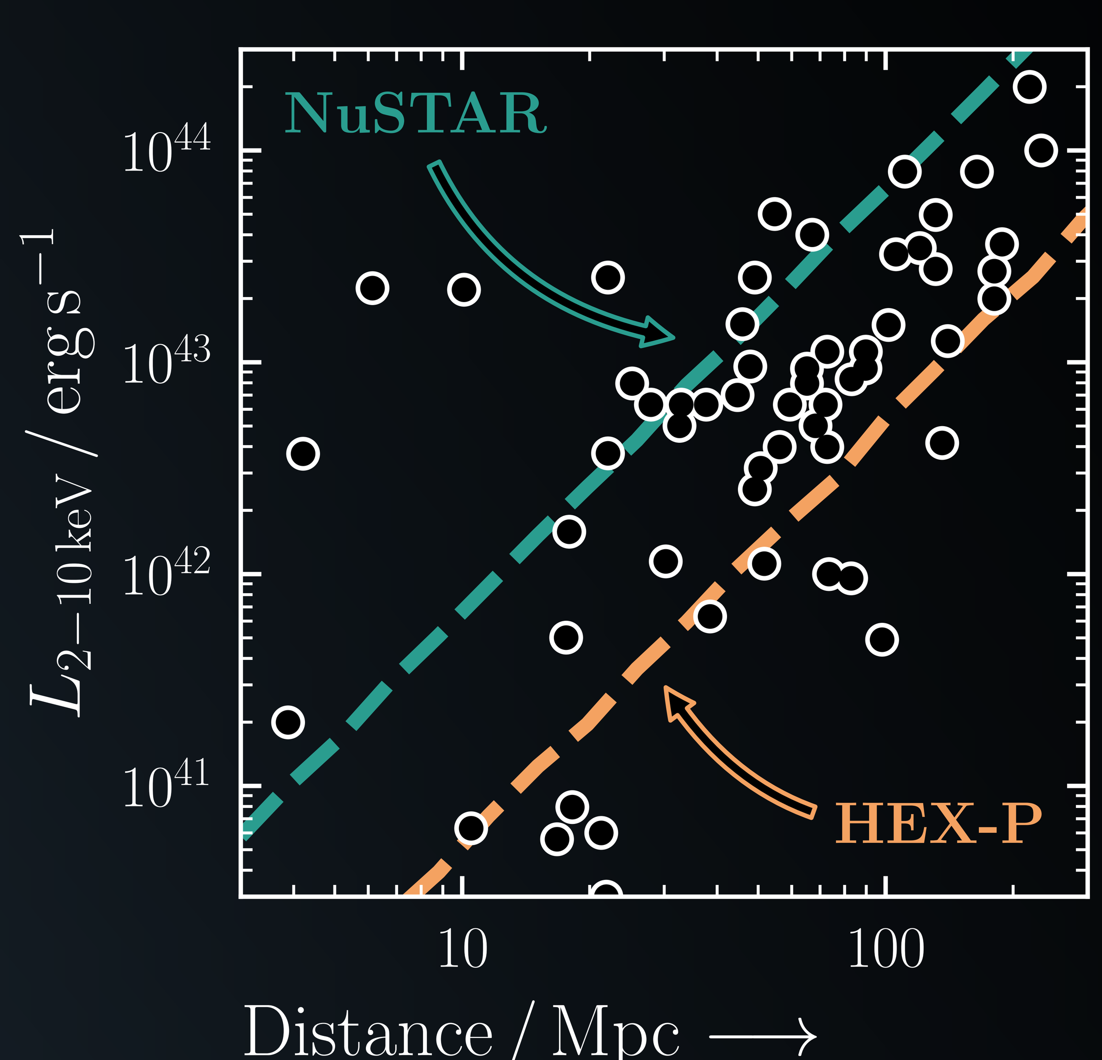
Do you have ideas for how HEX-P would revolutionize your science? Get in touch!

hexp.future@gmail.com
boorman@caltech.edu

hexp.org
peterboorman.com

@HEXP_Future
@boorm

Prospects & next-generation synergies



(Left) Distance vs. unabsorbed X-ray luminosity for the most obscured AGN confirmed with NuSTAR. The dashed lines represent the same signal-to-noise cut in the 3-15 keV energy band for simulated heavily obscured AGN. With HEX-P, the bulk of the population will reach the same spectral quality as the brightest nearby heavily obscured AGN with NuSTAR.

Combined with next-generation multi-wavelength & gravitational wave facilities, HEX-P will study the dusty hearts of galaxies and enshrouded AGN, as well as the co-evolution between supermassive black holes and their host galaxies across cosmic time.

HEX-P
HIGH ENERGY X-RAY PROBE

[1]California Institute of Technology, [2]NASA Goddard Space Flight Center, [3]Jet Propulsion Laboratory, [4]IRAP, Université de Toulouse, [5]Edinburgh University, [6]Leicester University, [7]Durham University, [8]Dartmouth College, [9]Georgia Institute of Technology, [10]Yale University, [11]Pennslyvania State University, [12]NASA Marshall Space Flight Center, [13]INAF-Bologna, [14]Clemson University, [15]INAF-Arcetri, [16]Universidad Diego Portales, [17]Kavli Institute, Peking University, [18]George Mason University, [19]University of Florence, [20]Miami University, [21]Harvard & Smithsonian