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

Tracking the Evolution of Black Hole X-ray Binary Outbursts

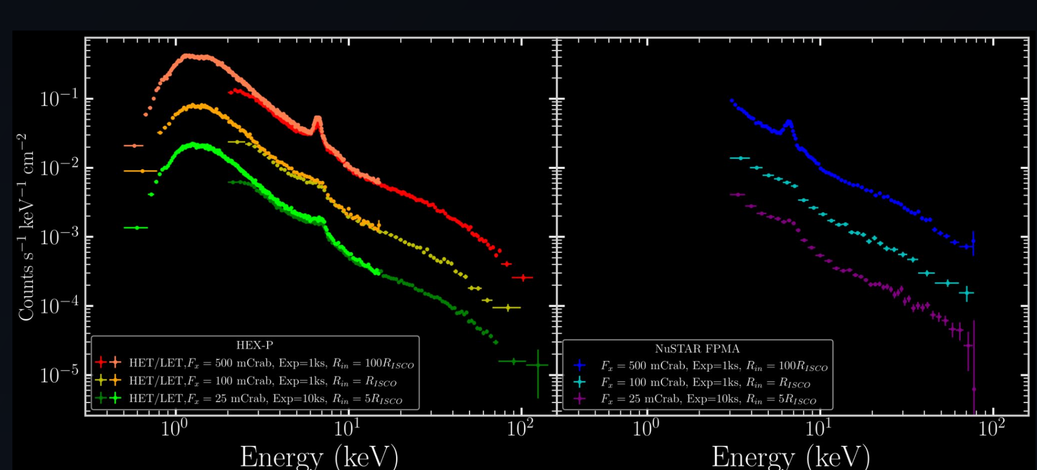
Paul Draghis[1], Riley Connors[2], John Tomsick[3], Javier García[4], Jon M. Miller[1], Benjamin Coughenour[3], Kristin Madsen[5], Daniel Stern[4,6] & the HEX-P Team

Overview:

HEX-P is a probe-class mission concept that will combine high spatial resolution X-ray imaging (<10 arcsec FWHM) and broad spectral coverage (0.1-150 keV) with an effective area far superior to current facilities (including XMM-Newton and NuSTAR) to enable revolutionary new insights into a variety of important astrophysical problems. We present the results of spectral simulations that highlight the ability of HEX-P to characterize relativistic reflection and measure the truncation of the inner accretion disk around stellar mass black holes in X-ray binary systems. Owing to its high effective area, HEX-P will allow obtaining spectra with unprecedented signal to noise ratios, and will allow complete, simultaneous characterization of the thermal continuum emission from the accretion disk and the galactic absorption at low energies, of the direct coronal emission up to energies higher than before, and of the features of relativistic reflection, namely the Fe K complex and the Compton Hump. When compared to current generation instruments such as NuSTAR, HEX-P spectra will enable placing reliable constraints on the parameters of the structure of the accretion disk in significantly fainter sources, or from relatively short observations of bright sources. Here, we focus on the ability of HEX-P spectra to measure the radius of the inner accretion disk. Characterizing the accretion flow in very faint sources will solve the currently elusive problem of inner disk truncation at extremely low Eddington fractions, while placing rapid constraints on the geometry of the accretion disk from very short observations of bright sources will lead to a complete characterization of the physical mechanisms behind highly variable sources. More information on HEX-P, including the full team list, is available at https://hexp.org.

Wide energy coverage

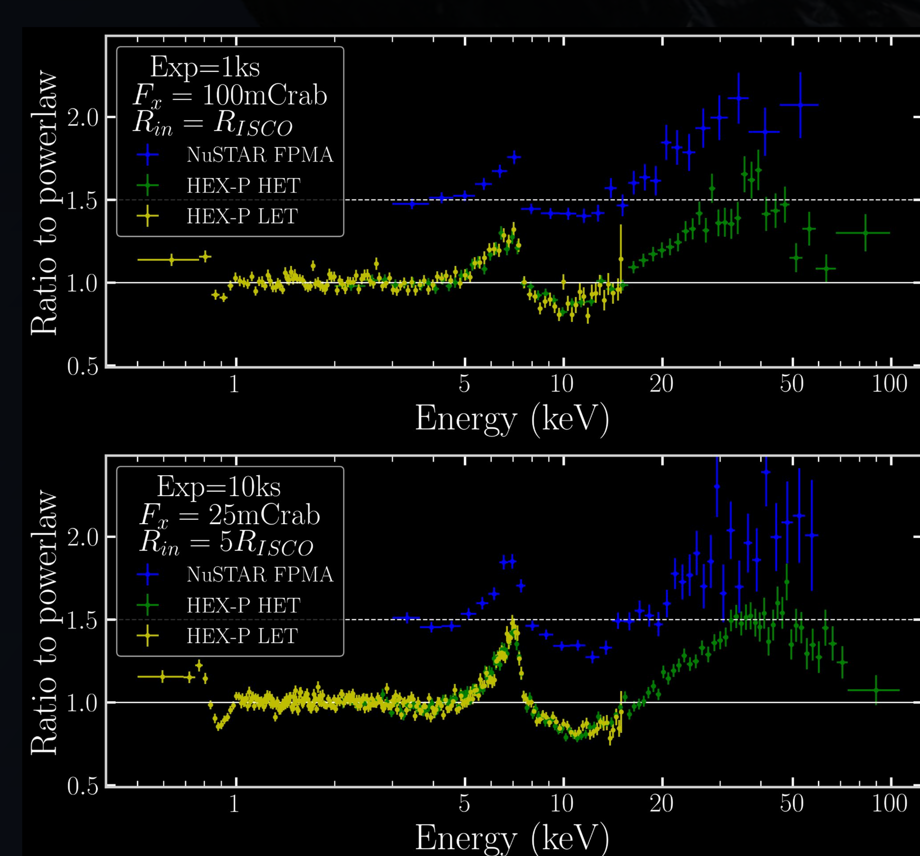
- The broad energy band pass (0.1-150 keV) will extend significantly over current generation instruments.
- For XB studies, this will allow placing better constraints on the shape of the continuum emission, by properly characterizing disk emission, galactic absorption, and high energy cutoffs.



*This assumes that a window mode is implemented for the LET

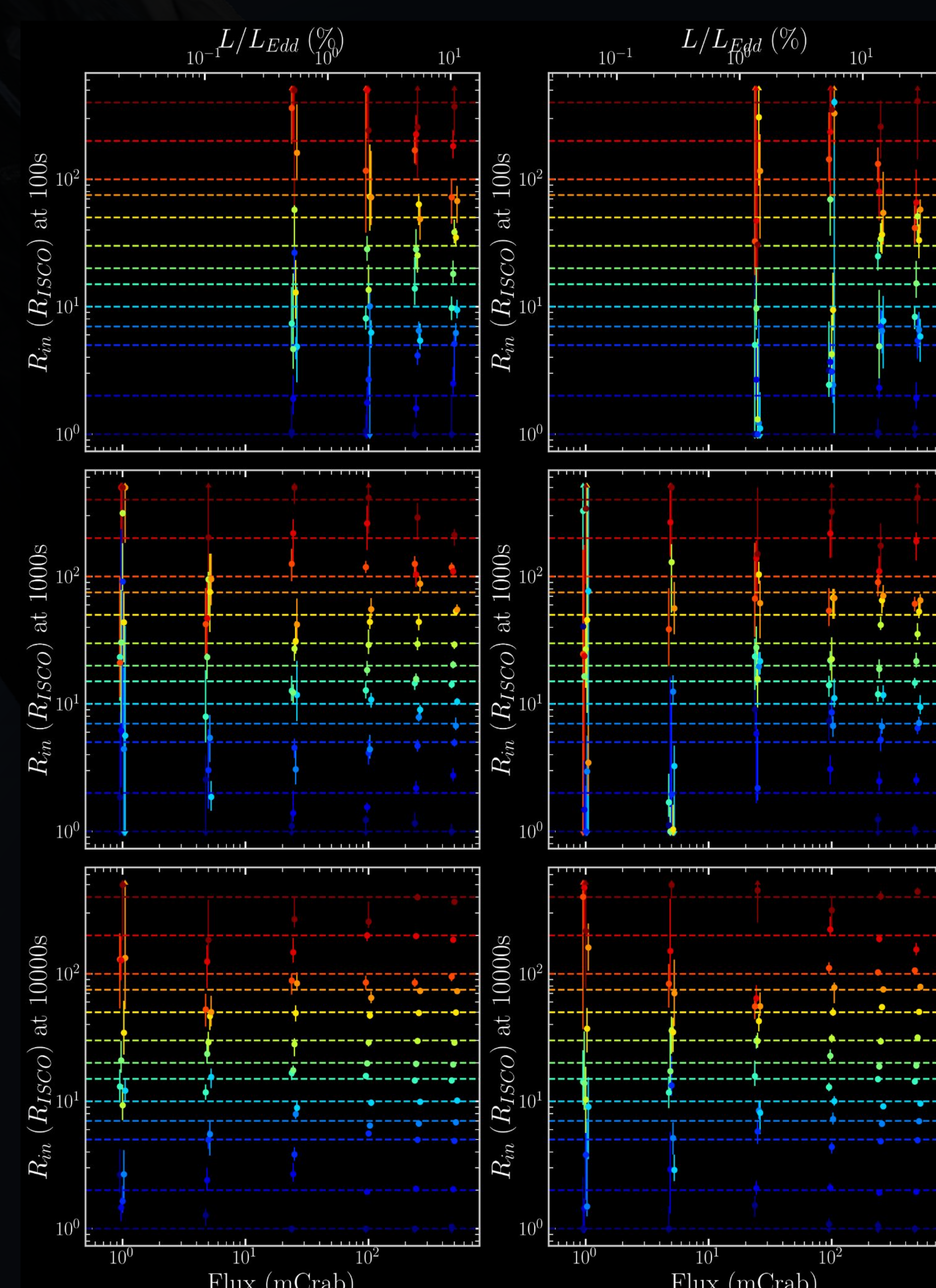
High effective area

- The increased effective area and energy resolution will facilitate constraining reflection features in XB systems, probing the innermost regions of accretion disks.



Solving the problem of disk truncation and probing accretion disk evolution

- The figures highlight the ability of HEX-P to measure the inner disk radius at different observed fluxes, for 100s, 1ks, and 10ks exposures, for a source similar to GX 339-4, with an assumed mass of 10 solar masses, at a distance of 8kpc, while in a hard (left) and soft (right) spectral state.
- HEX-P will be able to probe Eddington rates lower than ever before, uncovering the mysteries of the disk-corona-jet interactions.



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

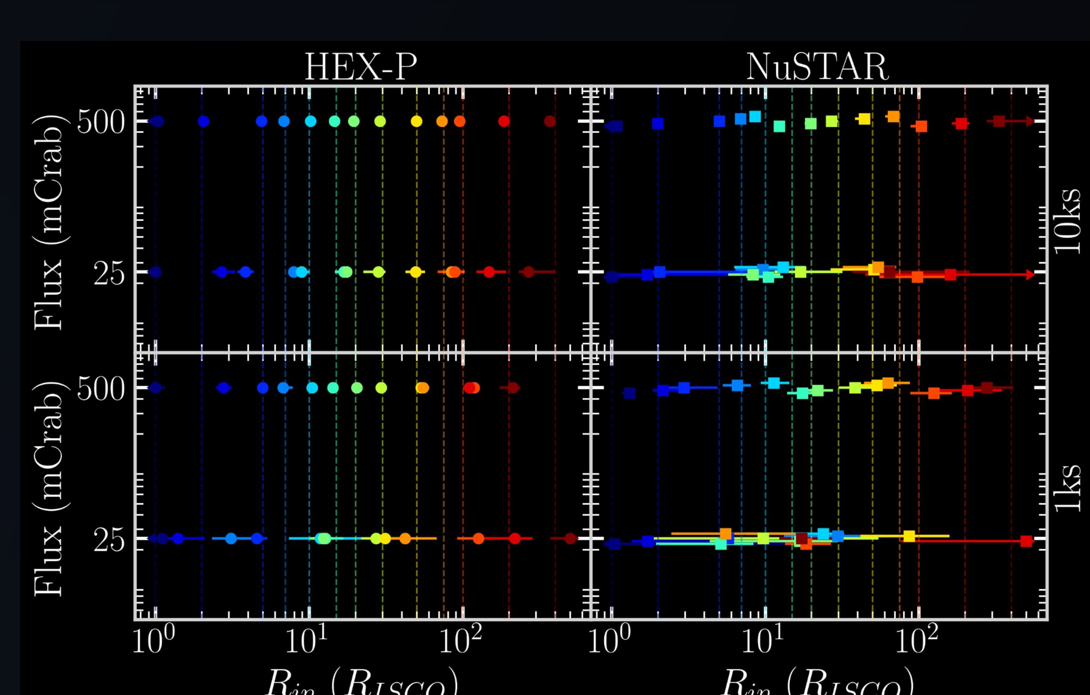
hexp.future@gmail.com
pdraghis@umich.edu

hexp.org
sites.google.com/umich.edu/pdraghis

@HEXP_Future

Precision tracing of the accretion flow structure

- When compared to NuSTAR, HEX-P will enable more precise inner disk radius measurements on shorter timescales, in fainter or more distant targets.



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HEX-P
HIGH ENERGY X-RAY PROBE

[1]University of Michigan, [2]Villanova University, [3]SSL/University of California Berkeley, [4]California Institute of Technology, [5]NASA Goddard Space Flight Center, [6]Jet Propulsion Laboratory,