

NICER GO Cycle 8 - List of Selected Proposals

Prop #	Title	PI Name	Abstract
9001	AN ARCHIVAL STUDY OF X-RAY LAGS IN NEUTRON-STAR LMXBS	EDA SONBAS	We propose a spectro-temporal study of archival data from the NICER mission for a sample of (~ 60) neutron-star (NS)-LMXBs. Our central goal is to determine whether NS-LMXBs exhibit lag behavior consistent with that observed for black-hole (BH) binaries, or whether they follow a distinctly different pattern. Specifically, we will: (1) systematically measure energy- and frequency-resolved lags; (2) construct the first comprehensive database of NS-LMXB lag properties; and (3) use these results to constrain the geometry and scale of the corona/disk emission regions. The outcome will provide a direct comparison with BH systems and test whether NS accretion physics requires fundamentally different interpretations.
9004	PROBING ACCRETION PHYSICS IN LOW-LUMINOSITY AGN: AN ARCHIVAL STUDY	EDA SONBAS	Many X-ray analyses for bright AGN show a positive correlation of the spectral index (Gamma) with Eddington ratio. On the contrary, the few such studies on Low-Luminosity AGNs (LLAGNs) suggest an opposite trend. We propose an archival study using NICER data to systematically probe the accretion flows in LLAGNs and determine the sign of the Gamma-Luminosity correlation and test whether the correlation evolves with luminosity. The accretion rate in these sources is thought to be a key factor in determining the dynamics of the accretion flow in the vicinity of the central black hole; as such, this study can provide a uniform database for placing constraints on the theoretical picture of radiatively inefficient accretion flows that are thought to power the nuclear emission in these systems.
9012	A NICER ARCHIVE INTERACTIVE EXPLORER	JAMES STEINER	In the footsteps of efforts like TGCat for Chandra's grating catalog or XPQLT for IXPE, we propose to develop and deploy a public interactive web portal for exploring NICER's archive. This site will make readily available common scientific products such as energy spectra, hardness-intensity diagrams, lightcurves, and power-density spectra. Associated background and response files will likewise be available. The interface will allow navigation through all public NICER data, with an ability to explore at a per-GTI granularity. The aim is to enabling researchers to navigate NICER's archive with facility to identify observations, sources, or features of interest for a given objective. All data products will be site-downloadable and available to query via an API.

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9016	THE NICER COMET SURVEY: A LEGACY DATASET FOR CHARGE EXCHANGE IN THE HELIOSPHERE AND BEYOND	DENNIS BODEWITS	Charge exchange is a fundamental X-ray process from planetary atmospheres to galactic halos, yet remains poorly constrained. Comets provide natural laboratories, and the NICER archive offers a unique, unrepeatable dataset: nine comets observed between 2020-2025, more than doubling the benchmark Chandra sample. Using solar-wind models and a Bayesian framework for low-resolution spectroscopy, this project will quantify responses to fast/slow wind and CMEs, test debated 1-2 keV features, and measure how coma chemistry shapes CX spectra. The outcome is a uniform set of cometary spectra with ion ratios and freeze-in temperatures tied directly to solar-wind conditions a legacy dataset and benchmark for interpreting CX emission across diffuse astrophysical plasmas.
9017	NICER PHOTON INTERVAL STATISTICS MEASURE RAPID VARIABILITY	JONATHAN KATZ	Accretion flows onto neutron stars and black holes may vary on very short time scales of order 10^{-5} s. Direct accurate measurement of flux requires counting roughly 1000 photons, which limits the time resolution to about 0.1 s even for bright X-ray sources. A novel method was recently published that measures variability on time scales as short as the photon count rate by examining the distribution of intervals between photon counts. We propose to apply this method to study the black hole Cyg X-1 and the neutron star Sco X-1.
9018	NICER PHASE-COHERENT TIMING OF THE TRANSITIONAL PULSAR PSR J1023+0038	SLAVKO BOGDANOV	In 2013, PSR J1023+0038 transformed from a radio millisecond pulsar state to an accretion-disk-dominated X-ray pulsar state, where it has remained since. In its current state it shows coherent X-ray pulsations at very low luminosities ($\sim 10^{33}$ erg/s). Using these pulsations it was revealed that in the disk state the pulsar was initially spinning down significantly faster compared to the radio-loud state. However, more recent X-ray timing data hint at a puzzling decrease in the spin-down rate. We propose to conduct a thorough reanalysis of the 1.07 Ms NICER dataset of J1023 spanning seven years to obtain the first definitive phase-coherent timing solution and closely examine any long-term evolution in its X-ray spectrum and variability pattern.

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9020	PROBING THE CORONAL EVOLUTION IN NEUTRON STAR Z SOURCES WITH NICER ARCHIVAL DATA	YUEXIN ZHANG	We propose to exploit the NICER archive to probe the coronal evolution of neutron-star Z sources. Unlike previous missions, NICER uniquely combines soft X-ray sensitivity, sub-microsecond timing, and high throughput, enabling direct connection between soft seed photons and quasi-periodic oscillations (QPOs). Using the time-dependent Comptonization model, ν Kompth, which jointly fits energy, rms, and lag spectra, we will measure coronal size and feedback fraction across Z branches with QPO detections. Results will provide the first systematic constraints on Z-source coronae, establish comparisons with black-hole X-ray binaries, and release public timing products, advancing a unified framework for accretion in strong gravity.
9023	A NICER ARCHIVAL LEGACY SURVEY OF LMXBS: THE LARGEST HOMOGENEOUS NICER AND OPTICAL DATABASE	PAYASWINI SAIKIA	We propose a NICER archival legacy survey to retrieve, uniformly reduce, and homogeneously analyze all NICER observations of a well-defined sample of transient LMXBs. Our analysis will include hardness intensity diagrams, spectral decompositions to separate thermal and non-thermal emission, and timing studies to measure QPOs and broadband noise. We will combine these X-ray products with over a decade of optical monitoring from the Faulkes Telescopes and LCO network, providing the most complete multi-wavelength coverage of LMXB outbursts to date. All products will be publicly released, creating a community resource to address key questions in accretion physics, including outburst triggers, accretion-flow evolution, dipping behavior, and jet disc coupling.
9025	QPOS AND THE UNIFIED PICTURE OF NEUTRON STAR LMXBS	MALU SUDHA	Harnessing NICER's unique capabilities in the soft X-ray band, this project will build the first comprehensive public database of spectro-temporal properties of neutron star low-mass X-ray binaries (NS LMXBs) to unravel the origins of quasi periodic oscillations (QPOs) that map accretion flow and emission regions, unify NS LMXB classification, and train the next generation of scientists. This project advances NICER's science and legacy by using 8649 NICER observations of 100+ NS LMXBs to enable a population wide systematic study of timing features of NS LMXBs. The database will be released in < 1 year. Using this data, we train undergraduates from four-year and community colleges on NICER data analysis and timing tools, expanding mission impact and encouraging early research involvement.

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9030	THE NICER DATABASE OF FOURTEEN NOVAE AND RELATED SOURCES	MARINA ORIO	Novae in outbursts are known as multi-wavelength sources, and perhaps some of them will be multi-messenger sources. The X-rays offer a window to study the white dwarfs as it shrinks back to almost pre-outburst radius but remains very hot - observable as a supersoft X-ray source - and also to measure the spectra of the powerful shocks in nova winds. The NICER database for this consists of seven monitoring datasets of classical short-period novae, three of recurrent symbiotic novae, three of supersoft X-ray sources never observed in outburst, and one WZ Sge-type large amplitude outburst. More than half of the observations have never been published, and even in the published datasets there are more aspects to analyse and discover. This project will make this NICER legacy shine.
9031	THE SPECTRAL-TIMING CONNECTION OF TRANSIENT BLACK HOLE X-RAY BINARIES IN THE SOFT-TO-HARD TRANSITION	OLE KOENIG	NICER is the main discovery machine to detect features in the variability of accreting black hole binaries, particularly due to its soft X-ray coverage and high-cadence monitoring capabilities. The series of discoveries includes the detection of a timing feature in the soft-to-hard transition, a phenomenon that is particularly strong at soft X-rays. However, a conclusive physical interpretation of this phenomenon is missing. Phenomenological modeling of many sources is required to assess whether it is of geometrical origin. A positive detection through a correlation with the accretion disk parameter, e.g., if the disk shows significant truncation when the feature occurs, may associate its origin with Lense-Thirring precession, where a hot inner flow precesses within a truncated disk.
9033	A NICER TDE VARIABILITY SAMPLE	JOHEEN CHAKRABORTY	The study of Tidal Disruption Events (TDEs) has progressed rapidly in the past several years, in large part due to wide-field time-domain surveys accelerating their discovery to a population of over a hundred. Perhaps one of their most surprising features has been the remarkable diversity in their X-ray emission properties on both short and long timescales. While canonical models suggest the soft X-ray emission rises on timescales of ~ 1 month then declines smoothly, repeated monitoring to late times with NICER and Swift have shown the X-rays rarely follow this simple picture. We have compiled a sample of X-ray bright TDEs with long-baseline coverage spanning months to years, and propose to undertake a systematic, population-level analysis of their diverse variability properties.

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9034	DETECTION AND TIMING OF ULTRA-LUMINOUS X-RAY PULSARS	JULIA DENEVA	We propose to analyze NICER data on seven known ULXPs and one ULXP candidate with the goal of detecting pulsations. Only three of the ULXPs have had NICER pulsations published so far, and none of the sources have had their full NICER data sets analyzed. Our goal is to use the pulsation detections for producing estimates of the orbital period and rotational period derivative for sources that do not already have these parameters measured, improve existing estimates for sources that do, and search for time-domain phenomena like (anti-)glitches that would allow us to probe the neutron star interior. This project will provide legacy pulse times-of-arrival files and timing ephemeris files for the wider community that will facilitate future studies of time-domain phenomena in ULXPs.
9035	SIMULTANEOUS RADIO/X-RAY OBSERVATIONS OF THE VELA PULSAR	PAUL DEMOREST	We propose NICER archival research and data analysis on the Vela pulsar. Our main goal is to analyze simultaneous radio and X-ray single-pulse data to measure correlated behavior. Correlations between X-ray and radio are predicted to arise via magnetospheric processes that "reprocess" radio photons to higher energies. A previous analysis using RXTE did find such a correlation; we aim to replicate and improve on this past result. NICER archives include 210 hours (760 ksec) worth of existing data on Vela; 34 hours of this has simultaneous coverage with ongoing long-term radio monitoring of Vela. NICER data will also provide an updated look at the spectral transition from thermally- to non-thermally dominated emission in this well-known young pulsar.
9037	DECODING X-RAY VARIABILITY PATTERNS IN MICROQUASARS USING DYNAMIC MODE DECOMPOSITION	RUO-YU SHANG	Microquasars are bright X-ray sources powered by accretion onto stellar black holes, exhibiting distinct spectral and temporal states. The origins of their X-ray variability and state transitions - potentially linked to MHD turbulence and plasma instabilities - are poorly understood. Traditional Fourier methods have limitations in determining these nonlinear behaviors. We proposed to apply Dynamic Mode Decomposition, a well-developed tool for analyzing nonlinear time series data, to NICER data of GRS 1915+105, MAXI J1820+070 and Cygnus X-3. This novel approach could revolutionize the classification of microquasar states, provide new diagnostics to determine the physical processes that drive X-ray variabilities in comparison with GRMHD simulations, and even predict future state transitions.

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9044	A LIBRARY OF OUTBURSTS FROM ACCRETING X-RAY PULSARS	PAYASWINI SAIKIA	NICER has provided an unprecedented soft X-ray view of Be/X-ray binary (BeXRB) outbursts, capturing spin evolution, spectral changes, and super-Eddington events across both Galactic and Magellanic Cloud systems. We propose a systematic re-analysis of all NICER observations of >20 BeXRBs, building the first uniform library of outbursts. For each snapshot, we will deliver calibrated light curves, spectra with residuals, spin measurements, and energy-resolved pulse profiles. These standardized, publicly available products (coupled with analysis notebooks) will enable population-level studies of neutron star magnetic fields, torque reversals, and extreme accretion physics, securing NICER's long-term legacy for accreting pulsars.
9045	APPLYING IMPROVED MODELING TECHNIQUES TO TEST THE X-RAY/UV CONNECTION IN THREE AGN WITH INTENSIVE NICER/SWIFT MONITORING	ETHAN PARTINGTON	Reprocessing models in which X-rays heat and drive variability in UV/optically-emitting AGN disks have been challenged in nearly a dozen sources by weak and inconsistent X-ray/UV flux correlations. Advances in spectral modeling with NICER have also revealed that the variability of the X-ray soft excess is inconsistent between AGN, sometimes following trends in the UV while disconnected from the X-rays. The SCORPEON background model now enables such tests even for faint AGN. We propose to analyze the archival NICER/Swift monitoring campaigns on Mrk 142, Mrk 876, and Mrk 335 to determine the relationships between each X-ray emission component and the UV. This analysis will broaden NICER's legacy as a tool uniquely suited to test for X-ray reprocessing across a range of black hole parameters.
9050	UNDERSTANDING HYSTERESIS IN BLACK HOLE STATE TRANSITIONS USING NON-LINEAR TIMING TECHNIQUES	KAVITHA ARUR	Black Hole X-ray binaries (BHXBs) exhibit variability on a wide range of timescales. The nature of mechanisms governing this variability is still under debate. A systematic analysis of the non-linear variability of BHXBs is critical to understanding the nature of accretion physics and to inform the theoretical modeling of this process. We propose to conduct the first comprehensive non-linear analysis of NICER observations of 10 BHXBs using two highly complementary advanced timing analysis techniques: the bispectrum and recurrence plots. These analyses will provide crucial insight into the nature of non-linearity of the variability across accretion states and the origin of the hysteresis during state transitions.

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9052	TESTING THE ORIGIN OF SOFT X-RAY EMISSION IN THE AGN MRK 841, A WARM CORONA CANDIDATE	ETHAN PARTINGTON	The standard description of AGN variability on timescales of days to years involves a central X-ray source that drives variability in the accretion disk via thermal reprocessing. Mrk 841 defied this picture with a dramatic drop in its optical and UV flux over two decades despite a constant hard X-ray flux. The soft X-rays dim alongside the UV/optical, suggesting the presence of a "warm corona," an elusive Comptonizing region that may be attached to the accretion disk and could produce most of the ionizing radiation in the AGN. Our proposed analysis will harness the unique potential of NICER to determine the location of the soft excess source in Mrk 841 using contemporaneous X-ray/optical monitoring and single-epoch spectral modeling techniques.
9055	GPU-ACCELERATED PULSE-PROFILE ANALYSIS OF NICER MSPS WITH PHYSICS-BASED HOTSPOT MODELS	YURAN CHEN	The measurement of neutron star mass and radius via X-ray pulse-profile modeling is the main objective of the NICER mission. We propose to utilize a new GPU-accelerated pulse profile calculation code, together with a physics-based surface hot spot temperature model to reanalyze the NICER archival data for 3 millisecond pulsars: PSR J0030+0451, PSR J0437-4715, and PSR J0740+6620. Our proposed project will improve on existing pulse profile modeling pipelines and provide an independent constraint on the neutron star compactness, potentially improving our understanding of the underlying equation of state of nuclear matter. Simultaneously, the analysis will also reveal the magnetic field geometry of these pulsars, enhancing our understanding of their magnetospheric structures.
9056	CONSTRAINING BLACK HOLE ACCRETION PHYSICS IN LMC X-3 WITH NICER ARCHIVAL OBSERVATIONS	SWATI RAVI	We propose an archival analysis of NICER observations of LMC X-3 to investigate how black hole accretion disks deviate from the thin-disk paradigm at high luminosities and to identify systematics affecting continuum-fitting spin measurements. LMC X-3 is an ideal target, being persistently bright, disk dominated, and minimally absorbed. We will reprocess over 150 NICER exposures, construct a global light curve and hardness intensity diagram, and perform spectral fits using both thin- and slim-disk models. By examining inner radius stability, temperature profiles, accretion rates, and color correction factors, we will determine when advection and finite-thickness effects become significant and quantify their impact on spin inference.

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9057	STUDY OF THE TIMING AND MODE-CHANGING BEHAVIOR OF THE GAMMA-RAY PULSAR PSR J2021+4026, USING NICER ARCHIVAL OBSERVATIONS	RISHANK DIWAN	PSR J2021+4026 is a unique radio-quiet gamma-ray/X-ray pulsar known to undergo mode changes, characterized by significant flux drops correlated with increases in spin-down rate. Previous XMM studies revealed a complex X-ray/Gamma-ray relationship, including phase shifts that suggest a possible magnetospheric restructuring or long-term precession. We propose a comprehensive study of the archival NICER dataset of 256 observations (421 ks). By combining observations into 40 70 ks intervals, we will perform timing and flux analyses to probe the joint gamma/X-ray pulsation variability and phase evolution. Our study will provide the most complete X-ray characterization of J2021 to date, directly testing competing models and contributing to NICER's rich legacy in pulsar astrophysics.
9058	AN ARCHIVAL SEARCH FOR QUASI-PERIODIC ERUPTIONS FROM ZTF TDES TO CONSTRAIN THE RATE OF EXTREME MASS RATIO INSPIRALS	DHEERAJ PASHAM	Quasi-periodic eruptions (QPEs) are emerging as powerful EM tracers of extreme-mass-ratio inspirals (EMRIs). Motivated by NICER's recent QPE detections long after optical tidal disruption events (TDEs), we will perform the first systematic search for QPEs in archival, high-cadence NICER follow-up of a clean, late-time ZTF TDE sample. Mining these data with uniform timing analyses and rigorous vetting, we will constrain the first robust empirical lower bound on the cosmic EMRI rate. Detections will provide immediate multi-wavelength targets and illuminate how viscously spreading TDE disks ignite QPEs; non-detections will be equally constraining for EMRI production channels. The result will be a roadmap for Rubin-era discovery, while anchoring LISA forecasts with real EM constraints.
9062	A TIME-DEPENDENT VIEW OF XRB OUTBURSTS: SPECTROSCOPY BEYOND STEADY-STATE MODELS	MURYEL GUOLO	Black hole X-ray binary (BHXR) transients are ideal labs for accretion physics in strong gravity. Their outbursts arise from disk instabilities, yet most analyses use steady-state models that ignore their time-dependent nature. Analytical Green's function solutions to the relativistic disk equation, recently implemented in pyXSPEC, now enable fully time-dependent spectral modeling with parameters limited to black hole properties and initial conditions. We will apply this to all NICER-observed BHXR in soft-state outbursts to test models, constrain masses and spins from spectral and temporal evolution, and measure disk masses fueling the outbursts, offering the first population-level, time-dependent view of BHXR outbursts.

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9063	UNVEILING THE PHYSICS OF ACCRETION DISK-MAGNETOSPHERE INTERACTION USING 1.27 MEGASEC NICER OBSERVATIONS OF PSR J1023+003	NAVIN SRIDHAR	<p>Transitional millisecond pulsars offer a unique laboratory to probe the physics of accretion disk-magnetosphere interaction. In this proposed study, we will utilize the 1.3 Ms data collected by NICER by observing PSR J1023+003 from 2017 to 2025. This long exposure, high time-resolution data would let us place the first and most stringent constraints on the long-term evolution of the neutron star spin period from its X-ray pulsations during its transition between different accretion modes. NICER's superior soft X-ray exposure will enable us to simultaneously monitor the dynamics of the inner edge of the accretion disk. This combination allows us to disentangle the estimated neutron star torque budgets due to various processes, including the emission of continuous gravitational waves.</p>