NICER GO Cycle 1 - Proposals Recommended for Selection

Proposal	PI Last Name	Title	Abstract
2058	BELLONI	BLACK HOLES TRANSITIONS: NICER AND MULTIWAVELENGTH	Black hole X-ray binaries (BHXBs) cycle through different accretion states rapidly, providing a time- resolved view of how matter behaves in a strong gravity environment. Simultaneous multi-wavelength observations are the optimal tool that exposes this view. However, these campaigns (connecting the evolving accretion inflow and jet outflow) have been rarely achieved. We request a TOO consisting of five 10ks NICER visits of a BHXB as it transitions from the hard to the soft state to complement our Astrosat accepted coverage. Our target list contains 15 candidates. We target the transition to reveal both the rapid orbit-to-orbit X-ray variability and the slower X-ray variability that characterize the significantly changing accretion disk (derived from X-ray spectra and timing), and directly
2087	BHATTACHARYYA	A NICER-ASTROSAT CAMPAIGN FOR BRIGHT NEUTRON STAR LOW-MASS X-RAY BINARIES	Two large area high time resolution X-ray astronomy instruments, NICER (0.2-12 keV) and AstroSat/LAXPC (3-80 keV), are currently available. A careful program to observe neutron star low-mass X-ray binaries (LMXBs) utilizing the unique capabilities of these two instruments in largely complementary energy ranges will be useful to probe the fundamental physics of dense matter and strong gravity by studying kilohertz quasi-periodic oscillations and thermonuclear burst oscillations. Such joint NICER/AstroSat observations will also probe the X-ray spectral components and their evolution in an unprecedented way. Here we propose to observe three bright and persistent neutron star LMXBs for a total exposure of 225 ks with NICER jointly with AstroSat (AstroSat program PI: Sudip Bhattacharyya).

Proposal	PI Last Name	Title	Abstract
2004	BOGDANOV	OBSERVING THE NEXT X-RAY BINARY - RADIO MILLISECOND PULSAR TRANSITION WITH NICER	In recent years, three millisecond pulsar binaries have been observed to switch between accreting and rotation-powered pulsar states, thereby unambiguously establishing the long-suspected link between low-mass X-ray binaries and "recycled" pulsars. In the low-luminosity accreting state, they exhibit X-ray and optical variability unlike anything observed in other X-ray binaries. We propose to commence a NICER Target of Opportunity program to trigger on the next nearby binary recycled pulsar transformation to an accreting state. This would result in an improved understanding of the peculiar phenomenology of these systems, which, in turn, may shed light on the little-understood physics of the quiescent regime in NS X-ray binaries.
2031	BOGDANOV	NICER TIMING OF THE TRANSITIONAL PULSAR PSR J1023+ $0038: A UNIQUE TESTBED FOR LOW-LEVEL ACCRETION PHYSICS	In 2013, PSR J1023+0038 transformed from a rotation-powered radio millisecond pulsar state to an accretion-disk-dominated X-ray pulsar state, where it has remained since. In its current accretion-disk state it shows coherent X-ray pulsations, suggestive of active accretion onto the neutron star surface at very low luminosities (~10^33 erg/s). Using these pulsations we have found that in the X-ray state the pulsar is spinning down 25% faster than in the radio state. We propose to extend our timing solution with NICER through an impending state transition in the near future, which would be immensely helpful for understanding how tMSPs undergo sudden state transitions and enable us to constrain accretion models.

Proposal	PI Last Name	Title	Abstract
2015	BORGHESE	TESTING THE MAGNETAR MODEL VIA TIMING OBSERVATIONS OF 1E 1547-5408	Magnetar emission is powered by the instability and/or decay of their huge magnetic fields. They emit outbursts, where the X-ray luminosity rises up to 3 orders of magnitude, and subsequently decays back to the quiescent value on different timescales. The mechanism responsible for the activation and the long-term evolution of these outbursts is still poorly understood. We propose a timing campaign of the magnetar 1E 1547-5408 to assess its current rotational properties while recovering from its last major outburst about a decade ago, and test the theoretical models proposed to explain magnetar outbursts. The proposed observations will be crucial to understand the driver of the prolonged, sustained emission of this source and, ultimately, the physical mechanisms behind magnetar outbursts.
2084	BULT	MONITORING THE ACCRETING MILLISECOND PULSAR SAX J1808.4-3658	We propose to observe the next outburst of SAX J1808.4-3658 with NICER for a total exposure of 150 ks. Such an observation campaign will allow us to: 1) extend the pulsar timing baseline for this source to over 2 decades, giving the most precise measure yet of the long term spin and binary orbit evolution in an AMXP; 2) establish, for the first time, the systematic evolution of spectral and temporal variability in the soft emission over the course of an AMXP outburst; 3) achieve a high probability of observing type-I X-ray bursts and their potential interaction with the neutron star environment.
2101	BULT	MEASURING THE SPIN-EVOLUTION OF THE AMXP IGR J17062-6143	We propose to observe the AMXP J17062 for a total exposure of 50 ks during the NICER cycle-1 AO. Such observations will allow us to obtain the first multi-year phase coherent pulsar timing analysis for an accreting millisecond pulsar in outburst. This analysis will allow us to study the pulsar spin evolution due to accretion at unprecedented detail, and will yield important constraints on the accretion torques active in LMXBs. NICER is currently the only instrument capable of performing these measurements. Hence our proposed research represent an opportunity for unique science at little to no risk.

Proposal	PI Last Name	Title	Abstract
2102	CACKETT	SOLVING THE X-RAY - OPTICAL ACCRETION DISK REPROCESSING PUZZLE WITH TIME-RESOLVED NICER X-RAY SPECTROSCOPY OF MRK 876	X-ray/UV/optical AGN monitoring shows consistent behavior within the UV/optical but a disconnect between X-ray and UV/optical broadband flux variations that challenges the standard reprocessing model. Mrk 876 lies in the TESS continuous viewng zone providing a high S/N light curve sampled every 30 minutes for ~1 year. During this period we will obtain simultaneous monitoring from the ground (approved) and Swift (pending), but Swift only provides a low S/N X-ray light curve. As NICER is a factor of ~20 more sensitive, it allows monitoring of individual components in the complex X-ray spectrum. By correlating these components (instead of broadband X-ray fluxes) with the UV/optical, NICER can break this degeneracy and allow us to determine which X-ray component drives the disk variability.
2112	CORCORAN	NICER MONITORING OF ETA CARINAE THROUGH THE 2020 PERIASTRON PASSAGE	During Cycle 1, the two stars in Eta Car, the superluminous, long-period, highly eccentric colliding-wind binary system will go through periastron passage. The X-ray emission will increase by about a factor of four then plunge to a minimum near inferior conjunction of the primary star. \nicer\ monitoring spectrometry (80 ksec total) is critical to measure variations in X-ray emission measure and column densities to measure changes in the shocked and un-shocked stellar winds as a function of orbital phase and time, and to help constrain the mechanism which causes X-ray flaring seen in previous cycles. These monitoring observations will also provide context our four high-resolution Chandra grating observations which will occur during the Cycle 1 interval.

Proposal	PI Last Name	Title	Abstract
2126	CORCORAN	NICER OBSERVATIONS OF THE X-RAY COLLIDING WIND LABORATORY, WR 140	Colliding wind binaries are unique laboratories to study of the behavior of shocked plasmas. In eccentric binaries, these conditions predictably vary with orbital phase and stellar separation, which allows sensitive tests as shock conditions change. The best example of a colliding wind binary shock laboratory is WR 140, a long-period, highly eccentric massive evolved binary in which wind-wind interactions generate variable emission from the X-ray to radio bands. We propose weekly monitoring of WR 140 with NICER through Cycle 1 to understand the changes in the shock as it recovers from the most recent periastron passage in December 2016 as the stars head toward apastron.
2055	DE MARCO	THE EVOLUTION OF THE X-RAY REVERBERATION LAG IN GX 339-4 DURING STATE TRANSITION	We propose a ToO monitoring program (1 visit per day for 13 days, each visit having an on-source exposure of 6 ks during the first 10 days and 20 ks during the last 3 days) of the black hole X-ray binary GX 339-4, to study the evolution of the X-ray reverberation lag during the hard-to-soft state transition, and map variations of disc geometry. With this monitoring we aim to test predictions of truncated-disc models, whereby the lag should decrease throughout the transition, reaching the minimum value when the inner disc settles at the ISCO. The latest radio observations of GX 339-4 have shown increased activity associated with a possible new outburst. If so, NICER will be able to monitor the transition during the upcoming GO cycle 1 program.

Proposal	PI Last Name	Title	Abstract
2109	DECESAR	THE EMISSION GEOMETRY OF A RADIO-LOUD ANALOG TO THE MAGNIFICENT SEVEN	PSR J0726-2612 has been identified as a younger, radio-loud analog to the thermal-X-ray-emitting Magnificent Seven (M7). The emission geometry of PSR J0726, found from absolute X-ray/radio phase alignment, conflicts with that of emission models that include detailed properties of magnetized neutron star atmospheres. Because our X-ray and radio data were taken months apart, we cannot rule out a phase shift from an undetected glitch-like event. With the proposed observations, we will determine the X-ray/radio phase alignment with concurrent radio data; confirm a glitch-like event or else revise the atmosphere models; search for persistent or variable absorption features in the NICER spectrum; and search for timing irregularities and associated spectral changes over a 2-yr timing baseline.
2110	ENGLE	A NICER VIEW OF THE HYADES (DA2+DK2) ECLIPSING BINARY V471 TAURI: AN ASTROPHYSICAL LABORATORY FOR STELLAR PHYSICS	We request 40ksec to secure NICER observations of the Hyades (DAZ+K2V) 12.5-hr eclipsing binary V471 Tau. V471 Tau is an astrophysical lab for testing theories of binary star evolution, stellar physics as well as hosting a probable brown dwarf. We propose to capitalize on NICER s unique X-ray capabilities to secure rapid X-ray observations, crucial for characterizing the 9.25-min X-ray flux modulations seen previously that are theorized to arise from wind accretion on the WD s displaced magnetic poles relative to its rotation poles. The WD s rotation period also serves as an independent clock to search for the Light Travel Time Effect from the movement of the EB s barycenter by a brown dwarf. A 15.5-yr X-ray cycle will also be studied.

Proposal	PI Last Name	Title	Abstract
2105	ENOTO	SOLAR-LIKE PERIODIC ACTIVITIES AND STELLAR FLARES FROM THE CLOSEST NEIGHBOUR PROXIMA CENTAURI	Habitability of the Earth-like planet in the closest neighborhood Proxima Centauri is greatly affected by central stellar activities. A 83-day rotational period of Proxima Centauri was recently detected by optical monitoring. Interestingly, there is a signature for X-ray variation to be anti-correlated with this optical periodic modulation, suggesting sunspot activities. However, this anti-correlation has yet to be confirmed due to poor X-ray photon statistics and uncertainties of contamination from stellar flares. Here we propose two-month NICER monitoring (5 ks x 20 visits) of Proxima Centauri from April to June simultaneous with a planned optical survey by a new satellite TESS to find a conclusive evidence for the anti-correlation.
2043	GOODWIN	RADIUS EXPANSION BURSTS FROM MILLISECOND PULSARS	We request a 60 ks NICER ToO observation of up to two of 3 known bursting accretion powered millisecond pulsars (AMSPs). The main goal is to observe the brightest known photospheric radius expansion bursts, from our highest priority target, SAX J1808.4-3658. NICER will uniquely provide information at low (0.2-3 keV) energies where the PRE burst spectra peak, which will allow us to probe the radius expansion dynamics and neutron star properties. We will trigger our proposal simultaneously with approved INTEGRAL, NuSTAR and XMM-Newton observations. These observations will also provide insight into the mechanism behind burst oscillations, pulsations, the thermal conditions in the crust during and leading up to a burst, and the formation and evolution of AMSPs.
2006	GOTTHELF	THE EXTRAORDINARY GLITCH BEHAVIOR OF CCO PULSAR 1E 1207.4-5209	We have recently detected a glitch in the spin of 1E 1207.4-5209, the compact central object (CCO) in SNR PKS 1209-51/52. This is entirely unexpected for a pulsar with a spin-down rate as small as those found for CCOs. Even more remarkable is the extreme change in its spin-down rate, which rivals those found for magnetars, NSs with surface magnetic fields 10,000 times greater than the dipole fields inferred for CCOs. The detection of a glitch therefore supports a recent conjecture that they could be triggered by the diffusion of a buried internal field. We propose to continue timing 1E 1207.4-5209, to verify the unexpected large change in its post-glitch spin-down rate.

Proposal	PI Last Name	Title	Abstract
2118	GOTTHELF	THE REANIMATION OF XTE J1810-197: 2018 OUTBURST AND DECLINE	Following the report of an intense radio flare and MAXI detection of XTE J1810-197 in December 2018, we characterized the magnetar's X-ray outburst properties using a NuSTAR DDT observation. Thus, 15 years after the 2003 discovery of this, the first known transient and radio AXP, it is possible to study the origin and decay of magnetar emission in exquisite detail from the beginning of the outburst in a uniquely accessible source. We propose here to monitor its early X-ray spectral and pulsed evolution, measuring the surface thermal hot spots and magnetic field configuration, and comparing with the original outburst.
2016	HARDING	TIMING OF MEV PULSARS PSR J1846-0258 AND J1838-0655	We are proposing continued timing of pulsars PSR J1846-0258 and J1838-0655 for a total of 110 ks to maintain phase-connected timing solutions. These pulsars are members of a group of young and energetic rotation-powered pulsars that are both radio and GeV quiet, and therefore must be monitored in X-rays to understand their high-energy spectrum and enigmatic nature. Both have shown large glitches and J1846-0258 had a magnetar-like outburst in 2006. Timing with NICER will to establish a multi-year ephemeris and allow us to improve the significance of our detections of emission with Fermi GBM and LAT, to discriminate between pair creation models in pulsar magnetospheres, to understand weak particle acceleration and glitches in MeV pulsars and to probe the pulsar-magnetar connection.
2116	HEMPHILL	CONSTRAINING THE ORBIT AND CHARACTERIZING THE ACCRETION STRUCTURE OF 4U 1626-67	The unique ultracompact X-ray binary (UCXB) 4U 1626-67 is the only known UCXB hosting a strongly-magnetized, slowly-rotating accreting neutron star. This system has a plethora of interesting properties, with a short (~42 min) orbital period, strong and disk-broadened emission lines of neon and oxygen, an unusually weak and possibly variable iron fluorescence line, a cyclotron resonance scattering feature (CRSF), and variability on short and long timescales. The X-ray variability in particular is essential both for proper interpretation of the spectral lines and for constraining the binary orbit. We are requesting a 40 ks NICER observation, which will give us the opportunity to carry out the most detailed study of variability to date in this source.

Proposal	PI Last Name	Title	Abstract
2079	HO	MONITORING PULSARS TO ENABLE GRAVITATIONAL WAVE SEARCHES	We propose to perform monitoring campaigns for pulsars PSR J0537-6910, J1412+7922, J1813-1749, J1849-0001, and J2229+6114, four of which can only be done via X-ray observations. These data will allow us to compute accurate phase-connected timing models for each pulsar, which will enable LIGO/Virgo to perform searches of gravitational waves from these mostly young and potentially stronger gravitational-wave emitting pulsars. Our proposed observations will occur contemporaneously with LIGO/Virgo's next, most sensitive, observing run, which begins in spring 2019. In addition, our high cadence observations of J0537-6910 will provide an opportunity to further pin-down and test this pulsar's unique glitch predictability and to measure potential X-ray signatures associated with glitches.
2057	HOMAN	JET LAUNCHING IN SCO X-1	We have organized a large multi-wavelength campaign to study disc-jet coupling in the well-known X-ray binary Sco X-1. This campaign is centered around ~3 days of radio coverage with the VLBI. NICER will provide the essential X-ray timing component for this campaign. Combined with other X-ray observations and radio coverage this will provide the clearest view to date of possible connections between different kinds of discrete ejections and various noise/QPO types in an X-ray binary. Establishing direct connections will tremendously improve our understanding of the accretion 'engine' that powers the discrete jet ejections. We aim to cover as much of the ~3-day campaign as possible with NICER and request a total 100 ks spread over ~50 individual pointings.

Proposal	PI Last Name	Title	Abstract
2125	HOMAN	A SPECTRAL/TIMING STUDY OF GX 5-1	We propose a short, optimized observing campaign of the super-Eddington neutron-star LMXB GX 5-1, to cover its entire Z track. Such coverage would allow us to study and compare the X-ray variability and spectral properties of the GX 5-1 in the context of the entire Z source ensemble. Our main goals are to study the emission mechanism of the low-frequency QPOs (for which GX 5-1 is a prime NICER target), through phase-resolved spectroscopy, and to investigate the properties of accretion discs at very high luminosities. We request a set of four 20 ks NICER observations, each separated by 1 day, an observing strategy that has proven to be very efficient for GX 5-1.
2060	IN 'T ZAND	SEARCHING FOR ABSORPTION EDGES IN THE SPECTRUM OF A BRIGHT EDDINGTON-LIMITED X-RAY BURST	Our plan is to detect for the first time with a high-sensitive instrument a thermonuclear X-ray burst from the nearby ultracompact X-ray binary 4U 1812-12, from which it is known that all bursts are Eddington-limited and have a high level of convection to dredge up heavy ashes, and search for absorption edges in the burst spectrum. As a bonus, we can search for burst oscillations for the first time in this persistent burster.
2071	JIANG	A NICER VIEW OF BLACK HOLE X-RAY BINARY OUTBURSTS IN THE SOFT X-RAY BAND	We request a monitoring program of one of six black hole transients with low Galactic reddening when in outburst, consisting of 20 observations each with 6 ks exposure. With our proposed observations, we will be able to study the inner accretion process during an outburst, such as the inner radius and the temperature of the disk. In particular, we will measure the inner disk density and compare the densities in different states. Previous tests for the high density disk model focused on sources with moderate Galactic column density. No soft X-ray observations without pile-up effects for our proposed transients are available in the archive. Our observations will be triggered by the MAXI and Swift-BAT monitoring program.

Proposal	PI Last Name	Title	Abstract
2117	KALLMAN	NICER OBSERVATIONS OF 4U1700-37	High mass X-ray binaries (HMXBs) consist of an early type star (companion) in orbit with a compact X-ray source. Their properties are largely determined by the interaction between the strong stellar wind from the companion and the gravity and radiation from the compact object. The compact object gravity focusses the wind and accretes. X-rays from the compact object heat and ionize the wind. In the case where the wind is strong and the X-rays are weak, then the X-ray heating effects are minimal, and the X-rays from the compact object serve as a passive probe of the structure of the wind. We propose to use Nicer to observe 4U1700-37, the HMXB with the most extreme known ratio of wind strength to X-ray luminosity.
2073	KARA	SIMULTANEOUS DISC AND CORONA REVERBERATION MAPPING IN AGN MRK 335	Reverberation light echoes from optical up to hard X-rays map out the accretion flows of AGN from the broad line region down (BLR) to the innermost stable circular orbit (ISCO) of the black hole. Swift measures X-ray/UV/optical time lags that map out the accretion disc, which appear to suggest a departure from the standard picture of a compact X-ray corona irradiating a thin disc. This is in tension with X-ray reverberation mapping results, which prefer a compact corona within 10 gravitational radii irradiating a disc that extends down to or near the ISCO. To resolve this tension, we have requested a 100-day multi-wavelength reverberation mapping campaign with Swift and Las Cumbres Observatory (3x per day; Swift proposal pending), accompanied by 4 days of observations by XMM-Newton and Nu
2023	LI	NICER OBSERVATIONS FOR WISER TARGETS	With the excellent timing ability, high collecting area in soft X-ray band, and relatively low background below 1 keV, NICER is an ideal telescope for supersoft X-ray sources. We therefore propose 3x50 ksec NICER observations for three supersoft X-ray systems. These observations can be useful in searching for the spin period of the white dwarfs, studying the atmospheric emission, and understanding the supersoft X-ray orbital modulation.

Proposal	PI Last Name	Title	Abstract
2025	MACCARONE	FAST MULTI-WAVELENGTH VARIABILITY FROM A BH	We propose 12 observations of a black hole transient of 3.6 ksec each with NICER to be made simultaneously with VLT fast-timing measurements in the infrared. These data will be used to understand the evolution of the IR/X-ray cross-correlation function, the lags in which give fundamental information about the speed of the relativistic jets in these systems. NICER will allow high throughput and access both to the geometrically thin and geometrically thick spectral components in the accretion flow. By observing the evolution of this cross-correlation function we will be able to make the first observational study of the evolution of the jet speed in X-ray binaries.
2011	MARSHALL	THE EVOLUTION OF AN EXTRAORDINARY PULSAR	PSR B0540-69 recently transitioned to a previously unknown state with a 36% increase in spin-down rate and a large change in the braking index from 2.1 to near 0, a rare value for any pulsar. On-going Swift/XRT observations show that the pulsar remains in this new state. With its large effective area, low background, rapid readout, and accurate timing, NICER is by far the most efficient instrument for extending the ephemeris. We propose 12 short (200 s), monthly observations to maintain a phase-connected ephemeris; to search for a possible return to its old spin-down state; to measure the evolution in the braking index; to search for a change in the gamma-ray flux or pulse profile; and to improve our understanding of this extraordinary pulsar.

Proposal	PI Last Name	Title	Abstract
2053	MIDDLETON	JET LAUNCHING AT SUPER-CRITICAL ACCRETION RATES	The launching of jets from accreting systems is an established (albeit poorly understood) phenomenon. Whilst typically studied at sub-Eddington rates of accretion, jet ejections are known to occur in our Galactic super-critical source, SS433 and the ULX, Ho II X-1. We are proposing a series of NICER snaphots, coordinated with pre-approved observations using the JVLA and AMI radio telescopes to reveal how the properties of the accretion flow (i.e. the continuum X-ray emission and atomic features associated with a wind) change with respect to jet ejections. Based on recently discovered variability in the ejections from Ho II X-1, we are proposing an observing cadence of one every 1-2 months. NICER is crucial to our science goals as it combines high throughput with dynamic observing.
2035	MUKAI	THE SOFT X-RAY ECLIPSE OF THE INTERMEDIATE POLAR EX HYA: A STUDY OF SPIN PHASE AND ENERGY DEPENDENCES	EX Hya is one of the soft X-ray brightest cataclysmic variables (CVs), and belongs to the intermiedate polar (IP) class, in which the accretion disk is disrupted by the magnetic field of the white dwarf (WD) and the subsequent accretion flow is channeled onto the magnetic pole regions. A strong shock forms, and the observed X-rays are emitted in the post-shock region. EX Hya is the prototype of low-luminosity IPs whose shock temperature is lower than expected from its WD mass. It is vigorously debated whether this is caused by a small inner radius of the disk, or by a tall shock. Here we propose to use the well-known partial X-ray eclipse of EX Hya to constrain the size and physical properties of its post-shock region.

Proposal	PI Last Name	Title	Abstract
2104	MUKAI	RAPID X-RAY OSCILLATIONS OF THE DWARF NOVA, WZ SAGITTAE	WZ Sge is the prototype of a subclass of dwarf novae with extremely long recurrence periods. It is also a unique and puzzling source exhibiting 27.87 s and 28.97 s periods in the optical data. In the X-rays, the former was seen in the ASCA data while the latter was seen in the XMM-Newton data. The 27.87 s period has often been interpreted as the spin period of a magnetic white dwarf, but then we do not have a satisfactory explanation of the 28.97 s period. If it is a magnetic system, that could lengthen the recurrence period between successive dwarf nova outbursts, but there are other long recurrence period systems that are almost certainly nonmagnetic. Here we propose a NICER observation to investigate the X-ray periods of WZ Sge, and to investigate their possible origins.
2096	NEILSEN	A NICER CATALOG OF WINDS AND VARIABILITY IN GRS 1915+105	GRS 1915+105 is a black hole binary displaying unique variability, strong winds, jets, and BH spin. The source was extensively monitored with RXTE; NICER provides improved constraints on the disk and lines owing to its soft X-ray sensitivity and resolution. Even after two decades of monitoring, critical questions remain unanswered. What is the relationship between winds, jets, and rapid variability in this system? NICER is the only mission capable of building a legacy catalog of observations to answer this question, but a broader sample is required. We propose 35 weekly exposures of 2.7 ks in Cycle 1, enabling the first measurement of intra-state wind variability, a more nuanced view of accretion/ejection physics around black holes, and a legacy archive of variability in GRS 1915+105.

Proposal	PI Last Name	Title	Abstract
2042	NOWAK	4U 1957+11: A RAPIDLY SPINNING BLACK HOLE IN (THE HALO OF) THE GALAXY?	4U 1957+11 is one of the few persistently active black hole candidates. Although we do not know its mass, distance, or inclination, the fact that it is apparently always in a thermal-dominated state with extremely high disk temperature, yet very low normalization, suggests a very rapidly rotating black hole. Furthermore, it has an extremely low column, allowing an extremely good view of the soft X-ray spectrum accessible to NICER. Its high disk temperature also places the peak of the disk spectrum in the bandpass of both NICER and NuSTAR. Thus, it becomes an ideal test bed of modern disk atmosphere models. We propose a series of joint NICER/NuSTAR observations that we will analyze as a whole, in order to measure this system's unknown black hole parameters.
2122	NYNKA	LONG-TERM NICER MONITORING OF MAGNETAR X-RAY OUTBURSTS	We propose a monitoring program using the soft X-ray instrument NICER to monitorthe evolution of magnetar outbursts, two ToO triggers of 80ks each. With a coordinated NuSTAR observations (40ks), we will monitor the evolution of the pulse profile and spectrum over the decay phase of a magnetar outburstto provide crucial insight into the magnetic energy dissipation process in magnetars
2111	ORIO	TIMING PERSISTENT SUPERSOFT X-RAY SOURCES	We propose observing CAL 83 and MR Vel, two supersoft X-ray binaries, one in the Large Magellanic Cloud and one in the Galaxy. We will measure possible spectral changes over a period of many years since the last X-ray observations, and periodic modulations with time scales of tens of seconds or tens of minutes. The high luminosity and the not-exceedingly-supersoft spectrum of these two targets makes them ideal candidates for NICER, both from the point of view of feasibility and scientific interest and return. We will monitor the evolution and the amplitude changes of a 67 s period of CAL 83, search for short periodicities in the light curve of MR Vel, and measure again other, longer periods, of 38 minutes and 1 hour respectively, observed several years ago in each the two sources.

Proposal	PI Last Name	Title	Abstract
2041	PAICE	THE ORIGIN OF SUB-SECOND X-RAY/OPTICAL VARIABILITY IN BLACK HOLE BINARIES	Over the past few years, very successful campaigns on several Galactic black hole (BH) X-ray binaries have revealed tantalising sub-second variations arising in the first acceleration zone at the base of a compact, relativistic jet. But what drives these variations, and are they really as stable as they sometimes appear? We propose anticipated ToO observations of up to 2 hard state outbursts with NICER, strictly simultaneous with ground-based optical/infrared timing. We will probe rapid, sub-second photometric variations and search for inter-band time delays to disentangle the jet/disc/coronal components using spectral-timing, create spectral energy distributions, and probe these systems on theory-critical, unprecedented scales.
2052	POSSELT	DOES RXJ0806.4-4123 SPIN UP OR SPIN DOWN?	We propose a NICER observing sequence to determine a timing solution for the isolated neutron star RX J0806.4-4123. The previous XMM-Newton observations yielded a frequency derivative with a large uncertainty that is consistent with spin-up of the neutron star. A better constrained timing solution is needed because recent near-infrared observations discovered an extended source at the position of the neutron star which could indicate a circumpulsar disk. The proposed observations will allow us to test whether RX J0806.4-4123 has timing properties different from those of its siblings, the other six of the so-called Magnificent Seven.
2027	RAY	SEARCH FOR NON-THERMAL PULSATIONS FROM PSR J1555-2908	We propose to use NICER to search for non-thermal X-ray pulsations from PSR J1555-2908, the most energetic millisecond pulsar to be discovered in searches of Fermi LAT gamma-ray sources. We expect to add a new member to the small, but important, class of non-thermal emitting millisecond pulsars, which will help understand the emission region geometry, and what makes this class unique. It may also give us another pulsar useful for precise X-ray timing applications.

Proposal	PI Last Name	Title	Abstract
2106	SAZ PARKINSON	NICER STUDY OF THE VARIABLE GAMMA-RAY PULSAR PSR J2021+4026	PSR J2021+4026 is a radio-quiet gamma-ray pulsar in the Gamma Cygni SNR, discovered in a blind search of Fermi-LAT data. Its thermal X-ray pulsations make this one of the few pulsars that can be studied simultaneously in X-rays and gamma rays. In 2011, J2021 underwent a transition into a low gamma-ray flux state, accompanied by an increase in spindown rate (anti-glitch), and a change in pulse profile, making it the first variable gamma-ray pulsar. Deep XMM observations taken in the low flux state, and after its recovery reveal subtle changes in X-ray behavior. Recently, J2021 underwent another mode transition. We propose NICER monitoring observations to study the X-ray timing and spectral properties of J2021 as it evolves from its current low gamma-ray flux back to its normal state.
2131	STEVENS	COMPARING EMISSION MECHANISMS OF LOW-FREQUENCY QPOS IN BLACK HOLES AND NEUTRON STARS	The best laboratory for strong-field gravity is the inner 100s of kilometers around compact objects in low-mass X-ray binaries. The X-ray emission varies rapidly, notably in quasi-periodic oscillations (QPOs), which may be produced by general relativistic effects. Low-frequency QPOs from black holes and neutron stars share similar temporal and spectral properties, indicating that they have similar emission mechanisms, even though neutron stars have a surface and strong magnetic field in addition to general relativistic effects. With these proposed observations, we will use phase-resolved spectroscopy of two types of low-frequency QPOs to constrain and compare the emission mechanisms, to better understand accretion flows in the strong gravity regime.
2020	STROHMAYER	MEASURING THE ORBITAL EVOLUTION OF ULTRACOMPACT WHITE DWARF BINARIES	The ultracompact white dwarf systems HM Cnc and V407 Vul represent unique opportunities to probe binary evolution driven by gravitational radiation and mass transfer. Initial {\it NICER} observations have provided new, precise frequency measurements in both systems, and a first indication for a slowing of the spin-up in HM Cnc. We propose additional observations to extend the timing baselines for each source, enabling new, unique probes of their orbital evolution.

Proposal	PI Last Name	Title	Abstract
2029	TOMSICK	IS THE BRIGHTEST SERENDIPITOUS NUSTAR SOURCE AN UCXB AND AMXP?	NuSTAR J092418-3142.2 (J0924) is the brightest 3-24 keV source found in the NuSTAR serendipitous survey. Although its classification is unclear, it is a strong candidate for being an ultracompact X-ray binary (typically, a neutron star accreting from a white dwarf) based on the lack of hydrogen lines in its optical spectrum and its low optical to X-ray luminosity ratio. UCXBs are of great interest since they are strong gravitational wave sources due to their short orbital periods and also because they provide an opportunity to understand the effects of elemental abundances on accretion. Here, we propose for NICER observations to do a sensitive search for pulsations from J0924, which will also provide a determination of the orbital period for this potentially very compact binary.
2050	VAN DEN EIJNDEN	THE NATURE AND ACCRETION FLOW PROPERTIES OF SUB-LUMINOUS X-RAY BINARIES	Very-faint X-ray transients undergo outbursts of accretion with a peak X-ray luminosity much lower than that of other black hole and neutron star low-mass X-ray binaries. Studying these objects is of great interest because they trace a poorly understood accretion regime and may represent neutron stars with relatively strong magnetic fields or a missing population of short-period binaries. To study the outburst of a known very-faint X-ray transient in detail, we propose 40 ks of NICER ToO monitoring observations, divided into 20 observations of 2 ks spanning two months. These observations will allow us to i) perform the first dedicated, multi-epoch timing study of a VFXT outburst and ii) monitor the spectral and flux evolution of the target.

Proposal	PI Last Name	Title	Abstract
2077	WOOD	USING NICER IN A CAMPAIGN TO SEARCH FOR PHOTON BUBBLE SIGNATURES IN ACCRETING PULSARS	NICER brings capability to resolve a longstanding question in hydrodynamics of accreting pulsars, namely whether there occurs the photohydrodynamic phenomenon known as photon bubbles wherein regions of high radiation density form in the accretion column and escape giving bursts of X-rays in a high-frequency quasi-periodic oscillation (QPO), as has been claimed in RXTE observations of two sources. Concerns have been raised that this could be RXTE systematics. NICER can address this by bringing both new observations of bright accreting pulsars and a different instrumental design with different characteristics for dead time and live time on bright sources. We propose observations and data analysis to accomplish a new survey search for the photon bubble signature.
2085	WOOD	USING NICER IN A CAMPAIGN TO OBSERVE POLAR-TYPE CATACLYSMIC VARIABLES	The launch of NICER brings unprecedented capabilities for observing magnetic cataclysmic variables (polars'). Quasi-periodic oscillations (QPOs) of 1-3 s have been observed with fast optical photometry. Existing hydrodynamic models of the accretion unify the source spectrum with predictions for a 2-channel (X-ray and optical) QPO. The X-ray QPO has never been detected, but observing capabilities have been limited. We propose NICER observations of the five polars that have exhibited optical QPOs, complemented by optical coverage from SAAO, both for cross correlation of variability and to understand source state changes. The campaign will compare both the spectral and temporal aspects with models. Detecting even one X-ray QPO would be an enormous advance.

Proposal	PI Last Name	Title	Abstract
2114	YONEYAMA	TOWARD DETERMINATION OF THE M-R RELATION OF AN ISOLATED NEUTRON STAR	X-ray Isolated Neutron Stars are nearby, thermally emitting objects. Their X-ray spectra have been considered to be reproduced simply by a single-temperature blackbody model.We found that all the XINSs exhibit another higher temerature blackbody emission at faint high-energy end. In the case of the brightest one, RX J1856.5-3754 (J1856), the emission radius is about 100 m, suggesting the emission region will be polar cap on its surface. If so, the high temperature emission should be responsible to pulsation. This suggestion allows us to derive mass-radius ratio of the star using the light-bending effect, analysing the energy resolved light curve. However, current available data do not have enough statistics. We thus need deep observation with NICER, although short pointings have been done.
2098	YOUNES	MONITORING MAGNETARS WITH NICER	We propose a yearly monitoring campaign of six magnetars, including, for the first time, a low luminosity magnetar, SGR 0501+4516. This campaign will identify the level of timing noise exhibited by these sources, establish their spin-up glitch rate, identify spin down glitch events, and reveal their burst and outburst activity. In the process, we will also refine our knowledge on magnetars variability and the correlations between the flux and temporal properties in quiescence and in outburst. The addition of SGR 0501+4516 represents a crucial step towards sampling a diverse population of magnetars, and will allow us to establish, for the first time, the long term timing properties of an ``outlier'', and compare it to the other bright, highly monitored sources.

Proposal	PI Last Name	Title	Abstract
2018	ZOGHBI	REVERBERATION MAPPING OF THE NARROW FE K-ALPHA LINE IN NGC 4151	AGN Reverberation mapping in is a well established technique in the optical/UV, where delays between the H-beta line and the continuum are used to probe the optical broad line region (BLR) and estimate the black hole mass. The techniques was applied recently in X-rays, obtaining an upper limit to the delay of the narrow Fe-K line in NGC 4151 relative to the continuum of ~6 days. This is a new powerful tool to probe the circumnuclear environment. We propose monitoring this source to constrain the delay instead of the upper limit. The unique flexibility and sensitivity of NICER will allow unprecedented view of the line emitting region, and of the location of the cold gas and its relation to the ionized BLR, guiding development of accretion and BLR formation models.