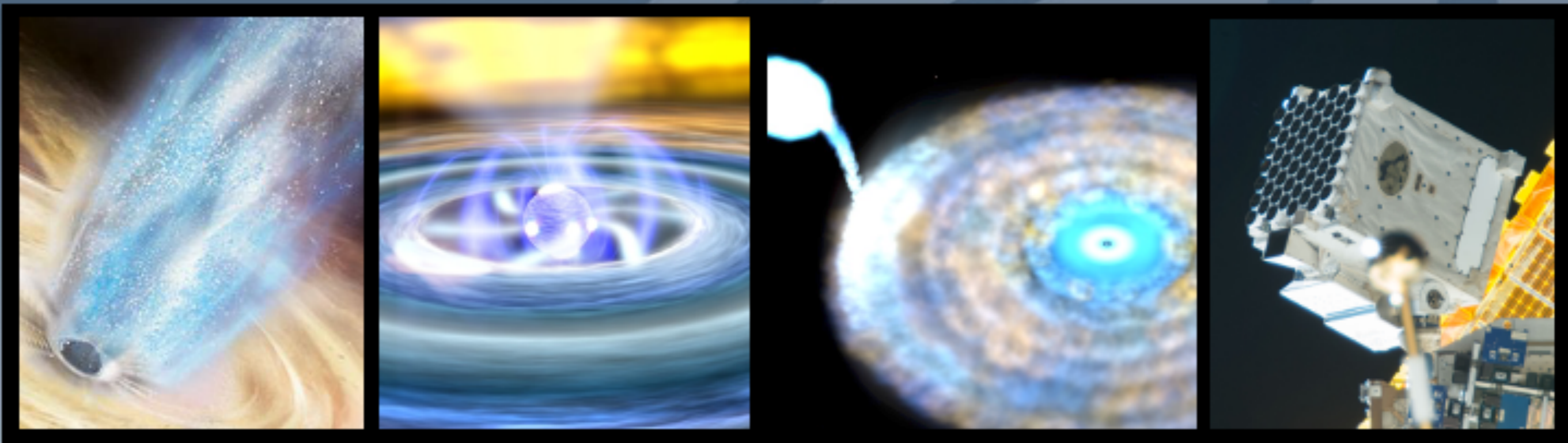




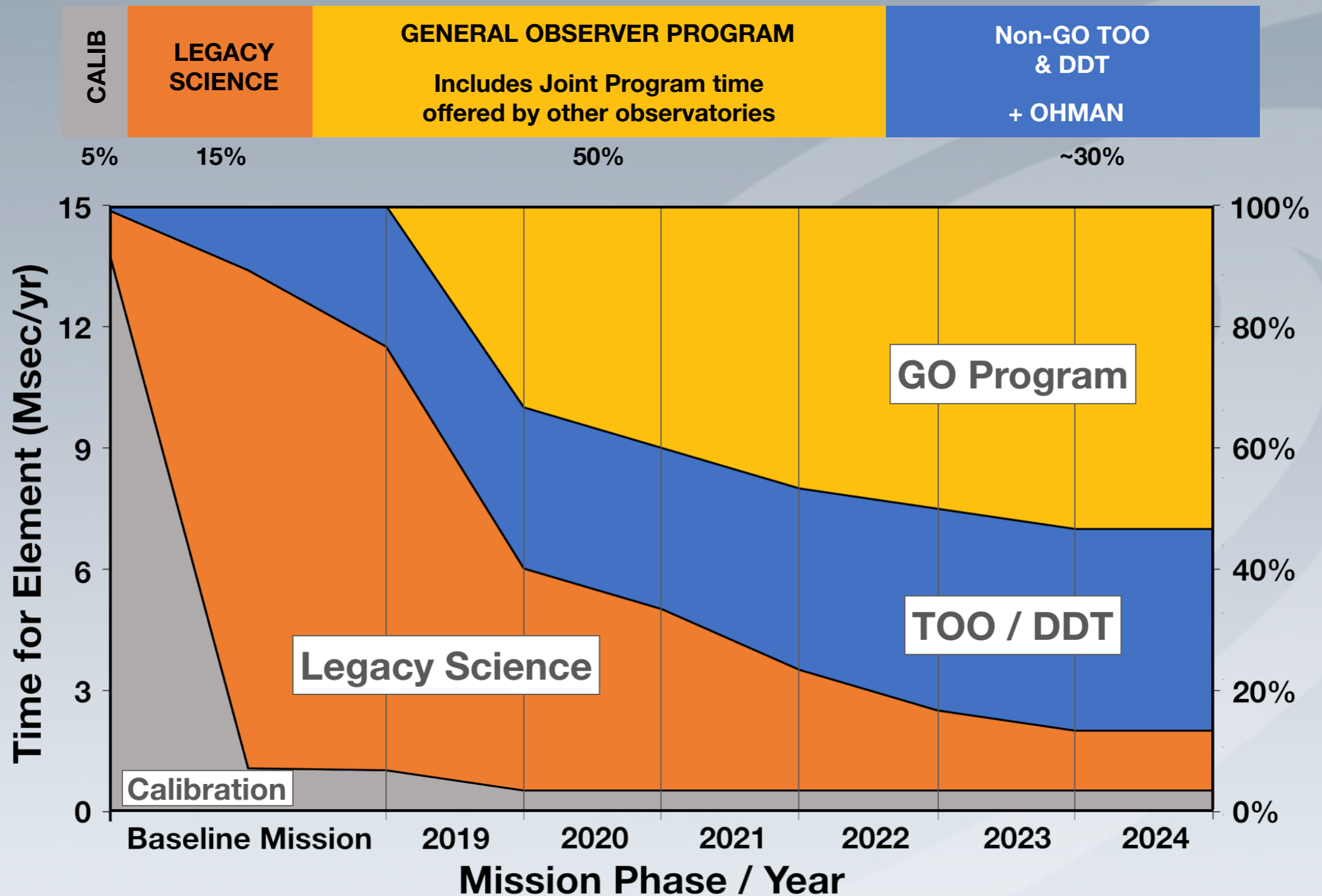
# Proposing for NICER's General Observer Program



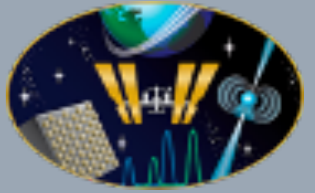
Elizabeth Ferrara, NICER GOF Lead

29-July-2024

# NICER Science Program Elements



# GO Proposals



## What can you propose for?

- NICER only allows proposals for **OBSERVATIONS**
  - Demonstrate support for NASA's goals (in Science Justification)
- Requested targets must **potentially** emit X-rays that can be detected by NICER
  - Detectability analysis required (Feasibility section)
- Multi-cycle observations: Proposers may request observations that extend across two cycles
- Observations through joint programs
  - Cannot request time on other observatories without including NICER
  - Demonstrate that joint observations support NICER science

# NICER Joint Programs



- NuSTAR
  - Up to 400 ks of NuSTAR time available for coordinated programs
  - Minimum NuSTAR observation is 20 ks



- Swift
  - Up to 200 ks of Swift time available for coordinated programs
  - Requires submission of a separate Swift joint program form as part of your proposal

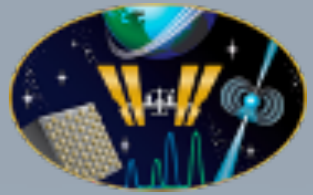


- TESS
  - Up to 300 2-minute and 50 20-sec cadence windows available
  - Desired sector should be provided in justification.



- NRAO
  - Up to 5% of "open skies time" on VLA, VLBA, and GBT facilities.

- Joint programs also receive **reciprocal time** from NICER taken from GO allocation
- Multi-cycle proposals may only request joint observations for the first cycle

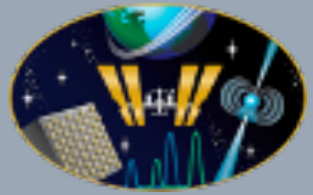


# GO Science Program

## NICER's GO time allocation comprises:

- Observations of targets with guaranteed time:
  - From NICER GO proposals
  - From joint programs (NICER GO and reciprocal)
  - From multi-cycle proposals (~few each cycle)
- Proposed TOO observations (expect ~50% trigger rate)
  - Targets may be predefined or defined at trigger time.
  - TOO request form (via ARK) is required to start observations, but observing profile follows the proposal.
  - Triggered GO monitoring campaigns may extend past the end date of the cycle in which they are triggered.
- NICER's science program is balanced across various science areas.
  - Broad scope of topics is built into the proposal selection process.

# GO Cycle timeline



## Year 1

<b>Jan</b>	<b>Jul</b>
<b>Feb</b> AO Released	<b>Aug</b>
<b>Mar</b>	<b>Sep</b> Proposal Deadline
<b>Apr</b>	<b>Oct</b>
<b>May</b>	<b>Nov</b> Proposal Review
<b>Jun</b> Amendment Released	<b>Dec</b> Selection Notifications

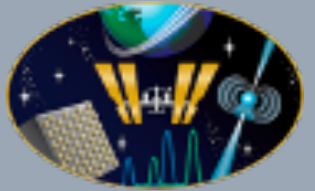
## Year 2

<b>Jan</b> Create Long-term Timeline	<b>Jul</b>
<b>Feb</b> Budget Deadline	<b>Aug</b>
<b>Mar</b> Observations Begin	<b>Sep</b>
<b>Apr</b>	<b>Oct</b>
<b>May</b> Grants Awarded	<b>Nov</b>
<b>Jun</b> Grants Awarded	<b>Dec</b>

## Year 3

<b>Jan</b>	<b>Jul</b>
<b>Feb</b> Observations End	<b>Aug</b> Research Reports Due
<b>Mar</b>	<b>Sep</b>
<b>Apr</b>	<b>Oct</b>
<b>May</b>	<b>Nov</b>
<b>Jun</b>	<b>Dec</b>

# Inputs



**NSPIRES - ROSES:  
Announcement of Opportunity**



**D.11 NICER General Observer - Cycle 7**

Number: NNH22ZDA001N-NICER | Directorate: Science Mission Directorate

Specific details for this call for proposals.  
Used for Phase-2 Budget submission.

## Proposer's Guide



**NICER Proposers Guide - Cycle 7**

Overview	Deadline	Proposal Elements and Submission Method	Some Key Details of the Proposal Form
Constraints and Category Designations	Targets of Opportunity	Scientific Justification	Dual-Anonymous Review

Additional information to assist proposers in preparing their submissions.

## NICER Proposal Tools



can be used to support the preparation of NICER observing proposals:

### Proposal Tools:

Visibility, detectability, spectral and background modeling, and data analysis tips and caveats



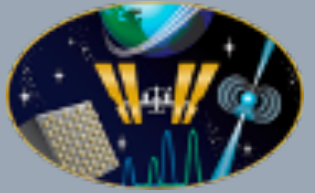
### ARK / RPS:

Phase-1 proposal submission portal for documents and forms required to answer the AO. (requires account)



# Phase 1

## Science Proposal



Three components:

1. Science Justification document (4-6 pgs): PDF, **Anonymized**
    - References may be on a separate page
    - Joint program details and justification may be on a separate page
  2. Expertise & Resources document (1 pg): PDF, non-anonymized
  3. ARK RPS Forms: Details of team membership, requested targets, monitoring cadence, TOO trigger criteria, etc.
- Reviewers will have access to #1 and to a **redacted** version of #3, to ensure dual-anonymous framework is followed.
  - All components must be submitted via ARK/RPS **by the deadline** to be considered complete.
  - If you have a submission issue, contact the helpdesk immediately via the HEASARC Helpdesk Form at: <https://heasarc.gsfc.nasa.gov/cgi-bin/Feedback>

**RPS help file  
really does  
help!**





# Science Proposal

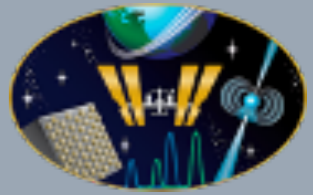
## Includes (at minimum):

- Title
- Introduction
  - Brief overview of the topic
- Science Justification
  - Why are the requested observations important?
- Observing Program
  - What specifically will NICER (and NuSTAR/Swift/TESS/NRAO) need to do to meet the science objectives?
- Technical Feasibility
  - How do you know these observations can meet the needs of the science?
- References

Style requirements  
(font size, margins, etc.)  
controlled by the  
corresponding ROSES CfP

**Important! Text MUST maintain anonymity of all team members!**

# Expertise & Resources

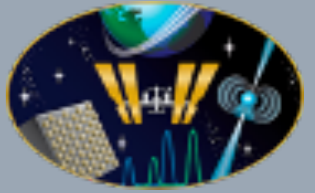


## May include:

- Critical team members and their relevant expertise
- Details of pre-approved access to facilities necessary for the investigation
- References to related works previously published by the team

This document will be reviewed after proposal ranking is **finalized**.

# ARK / RPS Forms

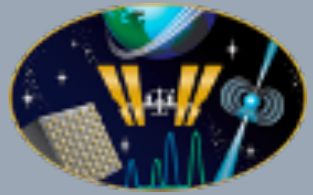


Two types of inputs:

- Proposal-specific: PI/Co-I info, abstract, exclusive use request, joint program request, Student Use flag, etc.
  - Exclusive Use **MUST** be justified scientifically!!
- Target-Specific: Target parameters, exposure, expected count rate, observation type, time constraints, observation constraints, observing plan details, TOO details, joint program details
  - Observing plan details are **CRITICAL** in the forms!
    - ➡ Used by science planners to implement observations

ARK/RPS Forms can take a long time.

**Don't wait until the last minute!**



# Observation Details

## For ARK/RPS Forms

- Single Observations
  - Can be long-duration for faint sources (100+ ks)
  - May be targeted to observe a particular event (specific time range)
- Monitoring Observations
  - Request multiple observations of a source with a particular cadence.
  - Typically, each visit is the same duration, and the cadence is regular.
- Target of Opportunity Observations
  - List of potential targets or an undefined target
  - Requires trigger criteria, maximum number of triggers, maximum requested time, trigger probability, response urgency, and an observing plan
    - Generally, observing plan should be target-independent.
    - Max TOO time is the **total** NICER observing time being requested



# Technical Feasibility

- Details depend on the type of observations being requested
  - Single Observation
    - Visibility windows no longer than  $\sim 2.5$  ks
    - Long exposures are collected in snapshots taken over time with varying background conditions.
    - Required combining multiple observations together for spectral analysis of faint targets.
  - Monitoring Campaigns
    - Visibility windows change due to sun and earth angles, ISS structure impingement, and changes in ISS orientation
    - Only the first two are firmly predictable more than 14 days ahead
    - Varying conditions should be considered in science justification.
  - Targets of Opportunity
    - Complexity depends on when the observing request is triggered.
  - Joint Observations
    - Combines above concerns with constraints of other observatory.
    - Considerations must be included in ARK RPS forms.

# Visibility Tools



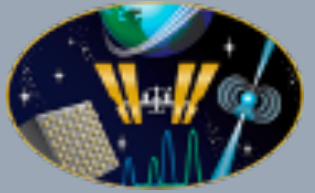
- Coarse visibility provided by the HEASARC's **Viewing** tool
  - Sun constraints with  $45^\circ$  (required) or  $60^\circ$  (preferred) exclusion angle
  - Moon constraints
- Mid-level visibility analysis can be provided by science team if necessary
  - Uses long-term ISS predicted ephemeris
  - Does not include ISS structure blockages
- Detailed visibility analysis only available within a few weeks of the observation time
  - Incorporates ISS structure predictions
  - Available with NICER's **Enhanced Visibility Tool**



Keep in mind...

...visibility windows range from 2500 sec per orbit to **zero** sec per orbit.

# Feasibility Tools



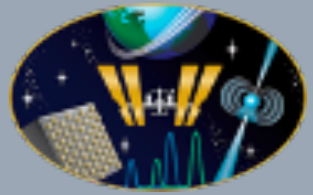
- Expected source counts can be estimated with **WebPIMMS**
  - Uses simple model and observational parameters
  - For unknown sources, use plausible values



- Background estimator tools
  - Require input files in order to run
  - Best with data from an observation of a source with similar spectrum and flux

- Simulated source spectra can be generated with **WebSpec**
  - Combine with background estimation to see if detailed spectral analysis is feasible





# Observing Constraints

## For ARK/RPS Forms

Some science requires the use of data acquisition constraints:

- Minimize Particle Background
  - Observe outside the polar horn region and away from the South Atlantic Anomaly. Reduces available observing time by ~45%
- Minimize Optical Loading
  - Requires that observations be performed when source is unlikely to be affected by sunlight. Reduces available observing time by ~50%.
- Compact or Uninterrupted
  - “Compact” requests that the full exposure for each visit be obtained in as little time as possible.
  - “Uninterrupted” asks for maximal contiguous visibility windows. Reduces the opportunity for interleaved observations of other targets.





# Time Constraints

## For ARK/RPS Forms

Certain requests create additional scheduling complications:

- Phase-dependent requests
  - If both orbital and super-orbital periods must be considered, scheduling may become intractable when combined with NICER's viewing constraints.
- Specific time requests, requests for a precise cadence (logarithmic sequence)
- Coordinated Observations
  - Adds varying levels of complexity, depending on the coordinating observatory
  - “Simultaneous” is more difficult than “contemporaneous”
- Target of Opportunity Observations
  - Always considered time-constrained



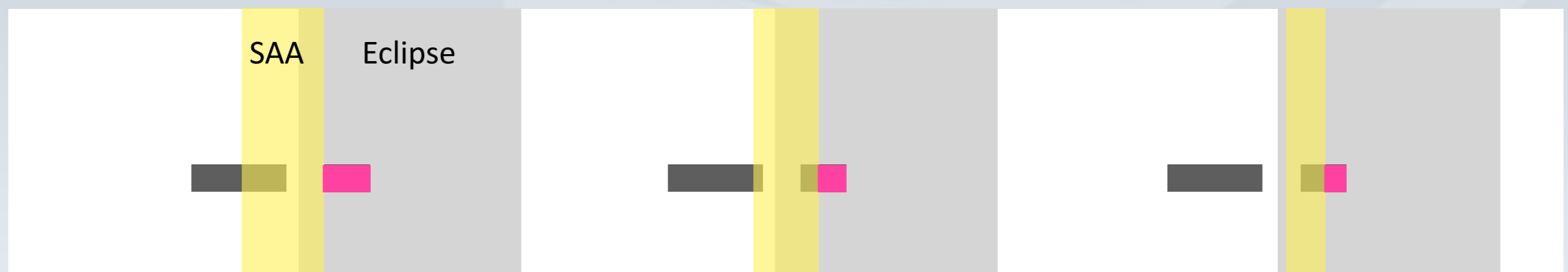
# Combining Constraints

NICER recommends using the **minimum number of constraints** needed to meet your science goals.

- Each additional constraint will reduce the amount of time we can use to schedule your target.

Example:

An observation of a binary, with specific **PHASE** constraints, that also requests **COMPACT** observations, and wishes to **MINIMIZE PARTICLE BACKGROUND AND OPTICAL LOADING**.





# Joint Program Information

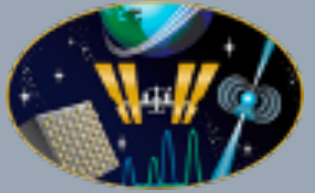
## For ARK/RPS Forms

Different joint programs have different requirements:

- Phase-dependent requests
  - If both orbital and super-orbital periods must be considered, scheduling may become intractable when combined with NICER's viewing constraints.
- Specific time requests, requests for a precise cadence (logarithmic sequence)
- Coordinated Observations
  - Adds varying levels of complexity, depending on the coordinating observatory
  - “Simultaneous” is more difficult than “contemporaneous”
- Target of Opportunity Observations
  - Always considered time-constrained

# Phase 2

## Budget Proposal



Only US-based PIs will be invited to submit Phase-2 proposals

Four components:

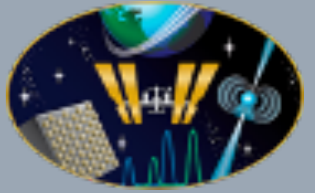
1. NSPIRES Forms: PI & Institutional information, required questions, budget cost category assignments, indirect costs, etc.
2. Budget Justification document: PDF, explain the details of specific cost categories like fringe costs, indirect costs, and **travel estimate** ← **Important!**
3. Current & Pending: PDF, details of PI support that will be active over the grant period of performance
4. PI Curriculum Vitae: PDF, required

All 3 PDFs should be combined into a single document and loaded through the NSPIRES submission portal.

Budget details should be provided by the proposer's institution, and entered by the PI. Grants are award to the **institution**, not to the researcher.

- Proposers about to change institutions should contact the helpdesk before submitting!

# Proposal Review Output



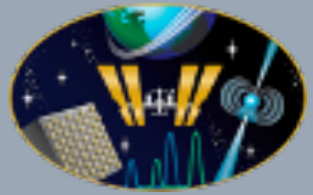
NICER's Proposal Reviews are VIRTUAL and DUAL-ANONYMOUS. **Join Us!!**

Review panels (organized by broad science theme) provide four products:

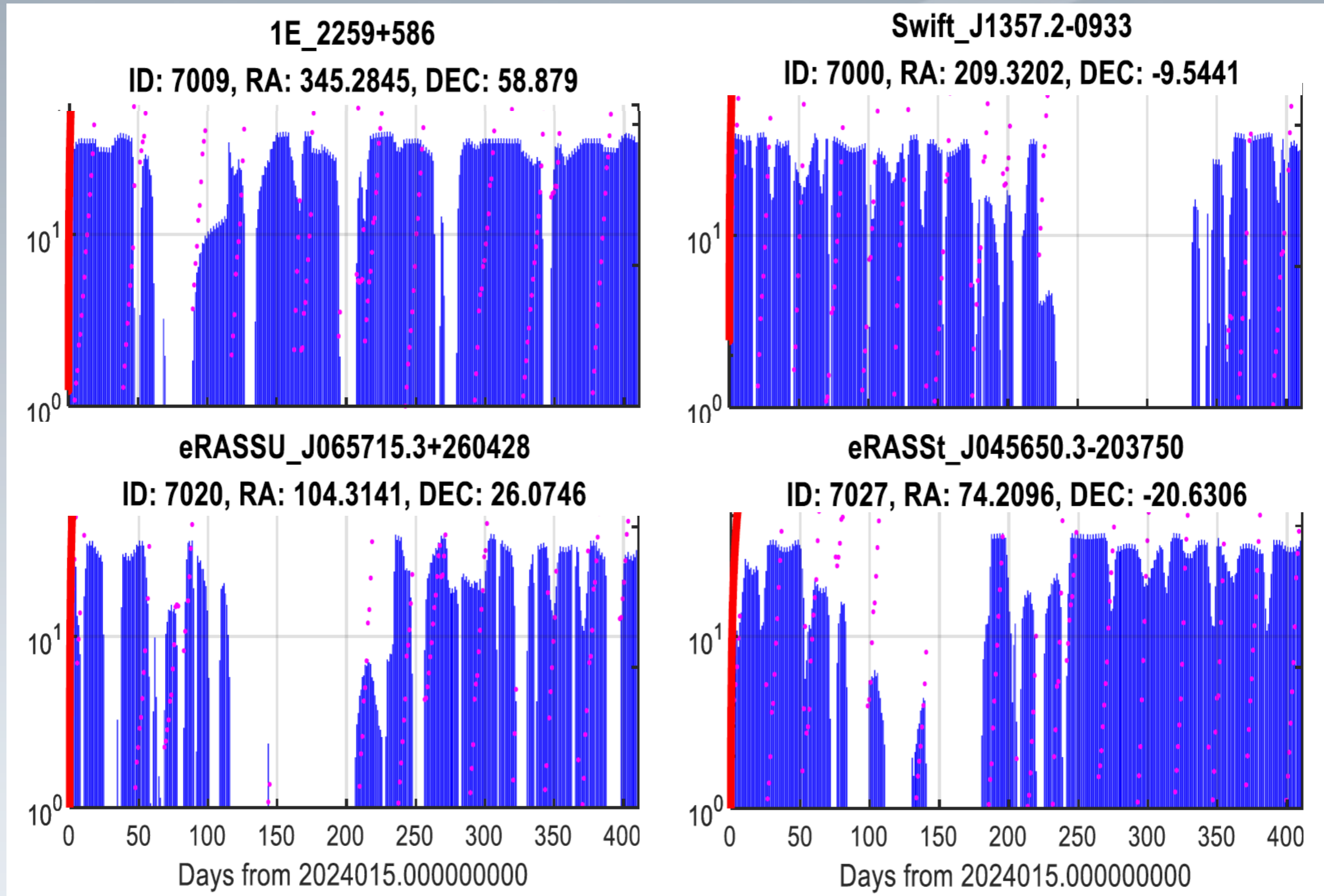
1. Rank ordered list of proposals
  2. Recommendations for exclusive use of data
  3. Recommendations for joint program time
  4. Category for each target (A, B, or C)
    - A-priority: Necessary for the science (guaranteed observations)
    - B-priority: Useful for the science (only guaranteed if not time-constrained)
    - C-priority: Not necessary (best-effort)
- Selections are made across all panels **by rank**, until all time has been allotted
    - Proposals above the cutoff may not be selected if they rely on joint observations and there is no joint time remaining to allocate

**Selection process guarantees a broad science program.**

# Long-Term Planning

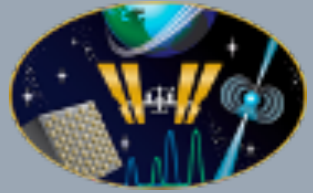


Long-term plan based on the 1-year visibility predicts



# Complications

## the best laid plans...



Selected non-TOO proposals → NICER's long-term plan

- Satisfy observing plan criteria based on the mid-level (1 year) visibility analysis

But plans can change:

- Detailed visibility analysis shows an structure blocking visibility
- ISS orbit changes after a reboost, attitude changes for vehicle arrival/departure, operations for other ISS payloads may require NICER to stow
- “Vital TOO target” directly overlaps with other planned targets
- An OHMAN trigger may disrupt a planned observation
- NICER's operations plan is constantly being revised. Please be understanding!
- Check the **schedule page** to see what's coming up. Updates at midnight daily!

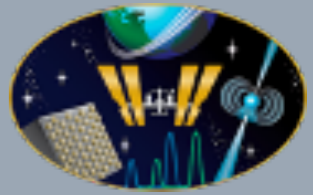
### NICER Recent and Planned Schedule

The schedule is updated from both planning and operator console information, typically at UTC midnight. It contains recently observed targets, planned target timelines, as well as any recent operator-commanded targets such as Targets of Opportunity (TOOs).

Currently Scheduled Target:

1A\_1744-361 (from 2022-09-01T01:01:38 to 2022-09-01T01:18:16 UTC)





# Other ways to request NICER observations

NICER offers reciprocal time through the joint programs:

- Some investigations may fit better as a NuSTAR, TESS, Swift, or NRAO proposal, but with a NICER component.
- Those proposal calls have access to some NICER time that they can award.

IXPE General Observer program:

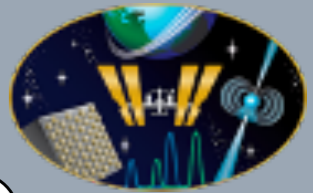
- NICER makes some time available to IXPE GO proposers, to support the unique synergy between the two missions.

Director's Discretionary Time / Targets of Opportunity

- Submit short science justification via the website for rapid turn-around observations.
- Be sure to check visibility!!!



# TOO Requests



## Requesting Targets of Opportunity (ToOs) with NICER

NICER is capable of following up on Targets of Opportunity (ToO) within 4 hours (depending on source visibility). TOO requests should be submitted via the ARK/RPS [NICER Target of Opportunity/Director's Discretionary Time Request](#) form.

The NICER team recommends that PIs use the [NICER Enhanced Visibility Calculator](#) to check the near term (~2 weeks) visibility for their source. This tool is especially useful for planning coordinated observations.

The NICER team monitors the [Gamma-ray Coordination Network \(GCN\)/Transient Astronomy Network \(TAN\)](#).

Details of previously submitted TOO/DDT requests are available at the [TOO Summary page](#). Please review the [NICER ToO Policy](#). Any questions regarding how to make TOO requests should be sent to the NICER Helpdesk via the HEASARC's [Feedback Form](#).



ID	Request Time UTC	PI (Last, First)	Target	Category	Target No.	RA (J2000)	Dec (J2000)	Exp (ks)	Disposition	
<a href="#">51200</a>	2024-07-28 17:37:33	BERTEAUD, JOANNA	2CXOJ175502.4-292227	OC		268.76035	-29.37432	5	Pending	Received
<a href="#">51199</a>	2024-07-28 17:31:00	BERTEAUD, JOANNA	2CXOJ175448.2-291940	OC		268.70118	-29.32781	5	Pending	Received
<a href="#">51198</a>	2024-07-28 17:13:14	BERTEAUD, JOANNA	2CXOJ173802.7-283126	OC		264.51138	-28.52401	10	Pending	Received
<a href="#">51197</a>	2024-07-28 17:06:08	BERTEAUD, JOANNA	2CXOJ175253.0-292209	OC		268.22091	-29.36921	5	Pending	Received
<a href="#">51196</a>	2024-07-28 16:57:12	BERTEAUD, JOANNA	2CXOJ174646.2-255216	OC		266.69258	-25.87117	5	Pending	Received
<a href="#">51195</a>	2024-07-28 07:55:44	HUANG, SHIFENG	AT2023LLI	AGN_QSO		344.41449	40.54464	20	Pending	Received
<a href="#">51191</a>	2024-07-24 18:35:59	WOLFF, MICHAEL	PSR_B1259-63	XB	1790	195.69856	-63.83573	35	Accepted	Executing
<a href="#">51190</a>	2024-07-24 16:15:46	CAKETT, EDWARD	NGC 7469	AGN_QSO		345.81510	8.87390	1	Pending	Received
<a href="#">51189</a>	2024-07-24 08:01:20	BORGHESE, ALICE	FRB 20240114A	MAG_RPP	5416	321.91620	4.35010	8	Accepted	Executing
<a href="#">51188</a>	2024-07-24 07:20:41	PASHAM, DHEERAJ	AT2023QQP	AGN_QSO	5466	354.74000	23.69850	5	Accepted	Executing

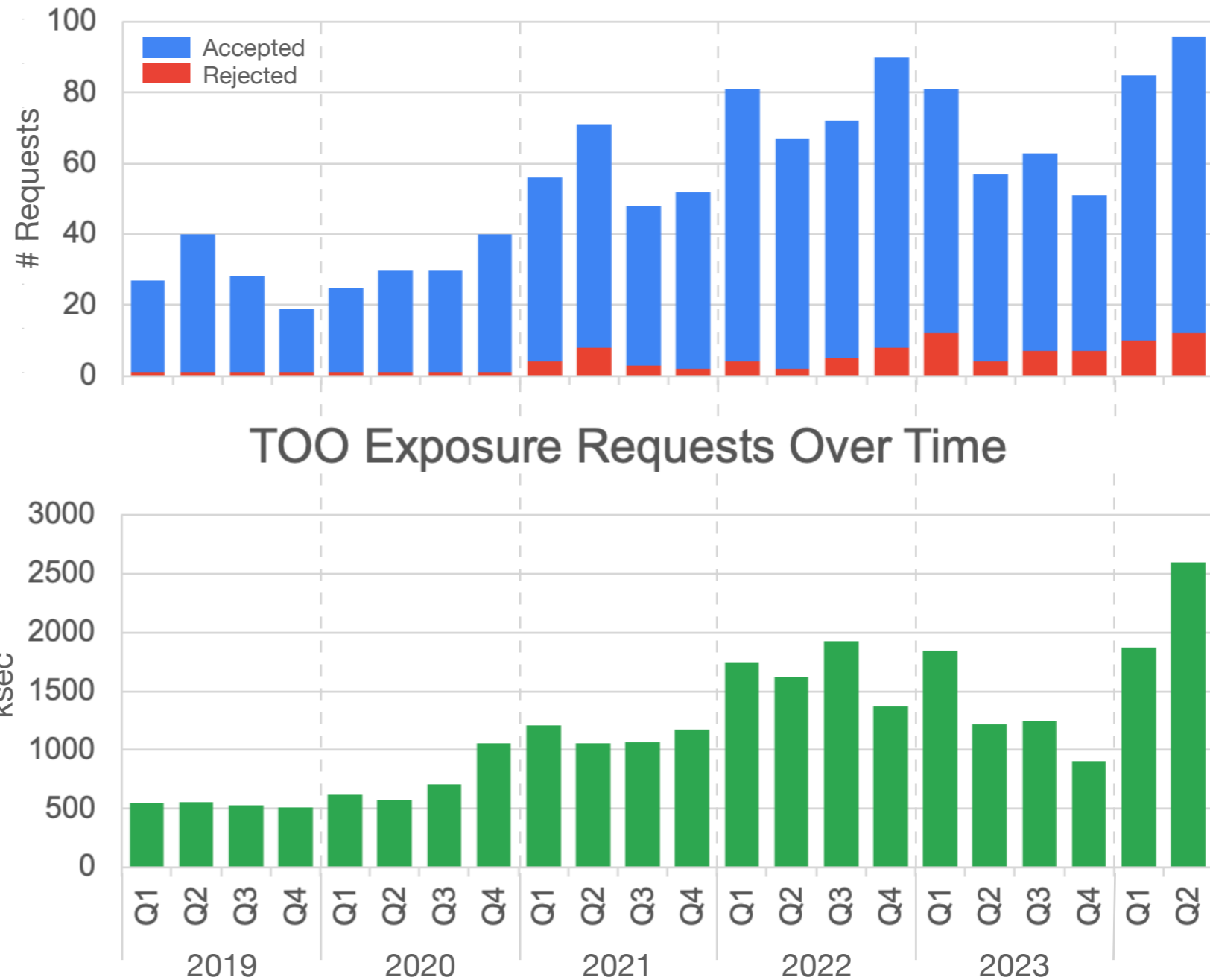
# TOO Statistics



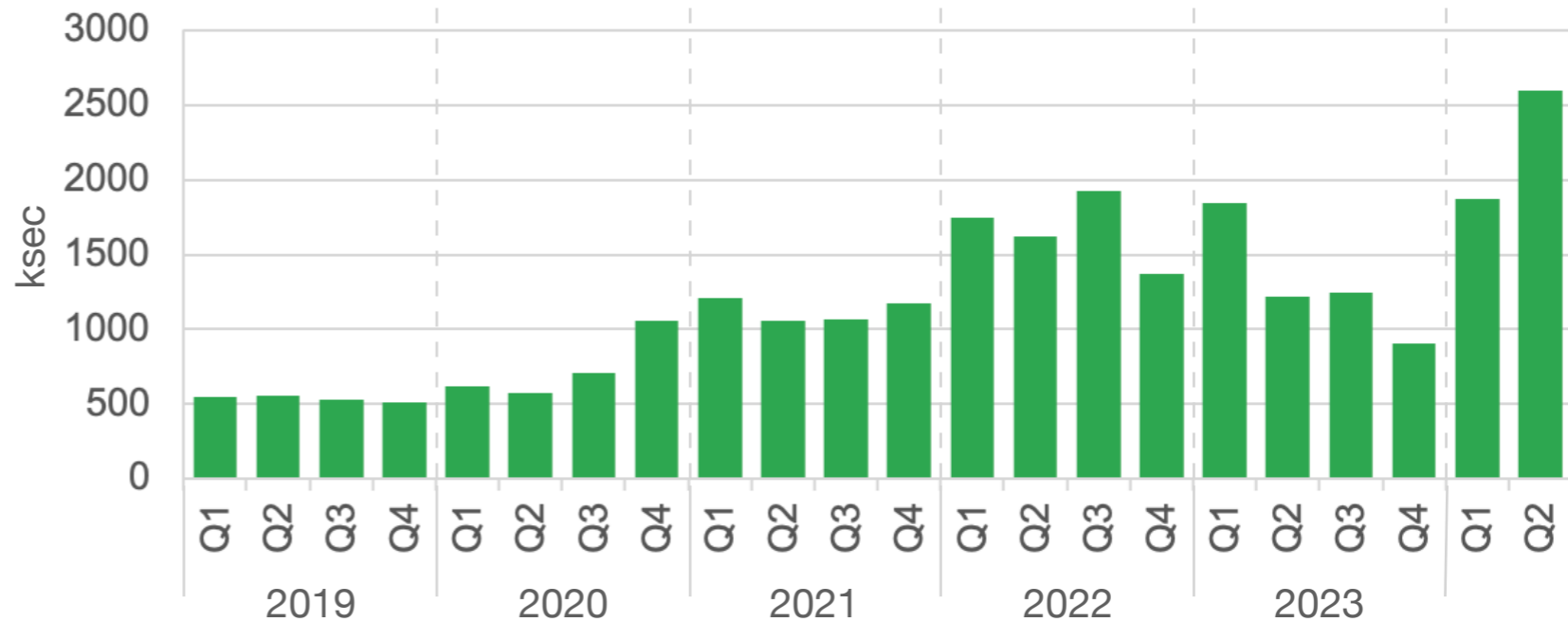
TOOs are an increasing amount of the science NICER performs.

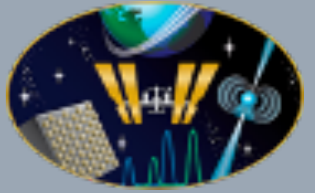
- Requests can range from a single quick look to a months-long monitoring effort.
- DDT should NOT replace GO proposals!

## TOO Requests Over Time



## TOO Exposure Requests Over Time





# NICER Proposal Deadline

in **SIX WEEKS!** (Sept 12th @ 4:30 pm ET)

Proposing is easy!

NICER is doing cutting edge science!

Broad applicability!

Want to propose? Let us know how we can help!

**Don't wait until the last minute!**



# Backup Slides

# NICER Observation Glossary

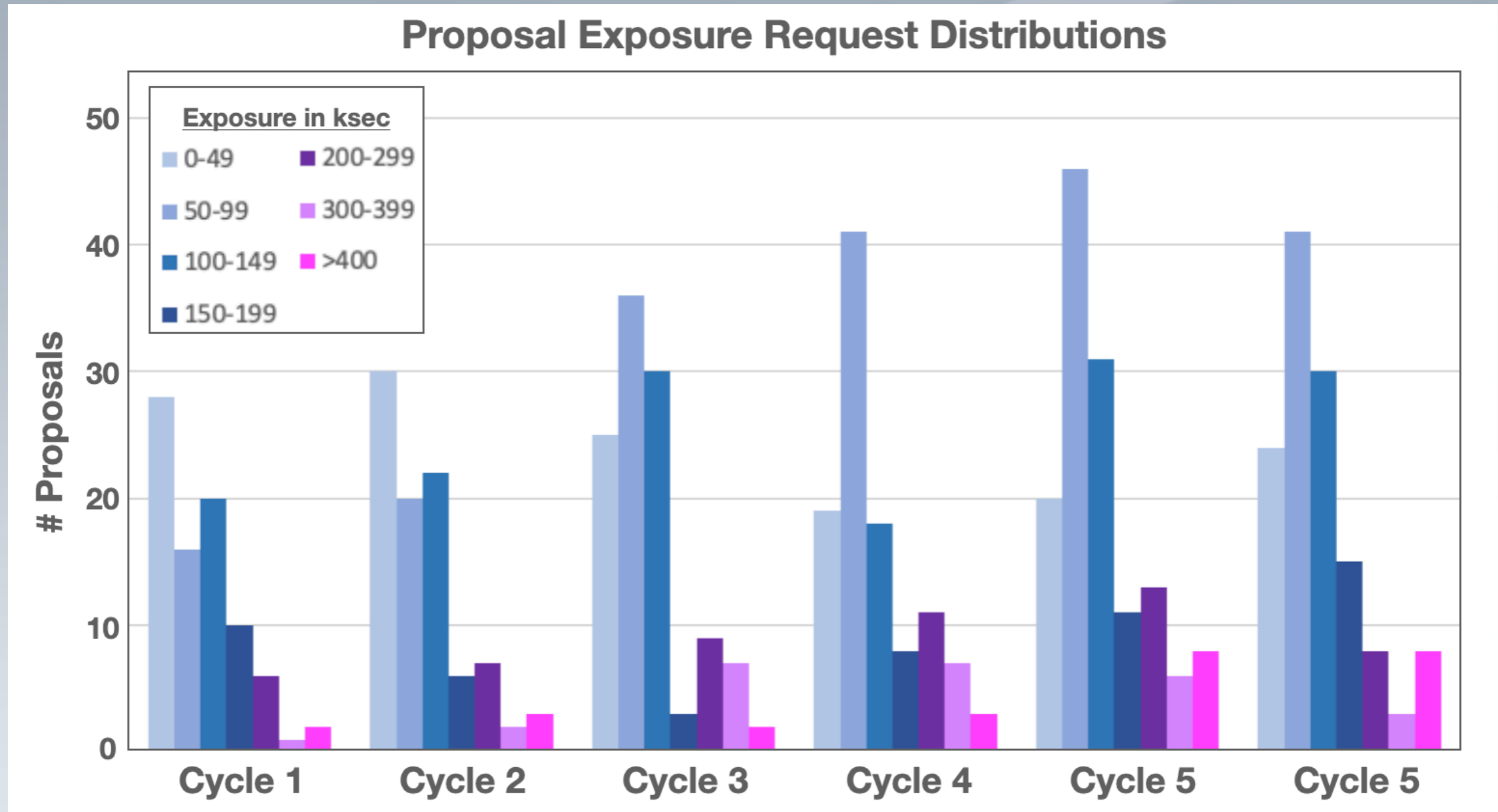


- **Visibility Window** - Maximum time NICER can see a source without interruption. (Ranges from 0 to 2500 sec)
- **Snapshot** - Exposure on target within a single visibility window.
- **Visit** - Exposure on target lasting no more than one calendar day (UT). May contain data from multiple snapshots.
- **Observation** - Exposure on target to meet specific science goals. May take multiple days to acquire.
- **Target of Opportunity (TOO)** - Observation added into the science plan on an interrupt basis. Displaces pre-planned scheduled targets.



# Selection Statistics

Selected proposals: Title, Abstract, PI name, and Approved Targets are released publicly after HQ approves the Science Program

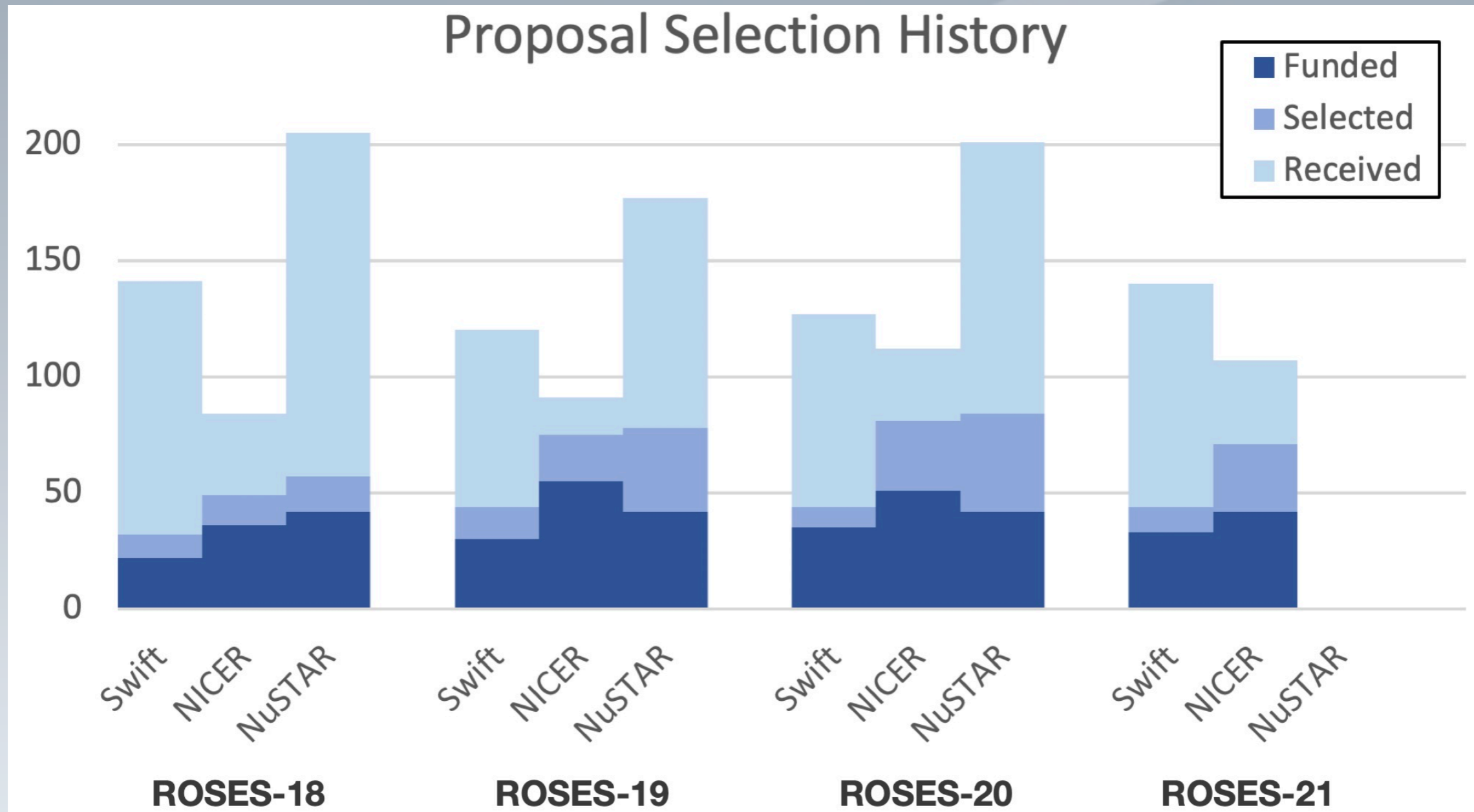


Large exposure requests are not a hindrance to a proposal during the selection process.

# Selection Statistics

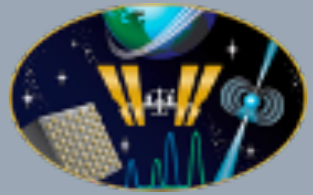


Selected proposals: Title, Abstract (from forms), PI name, and Approved Targets are released publicly after HQ approves the Science Program

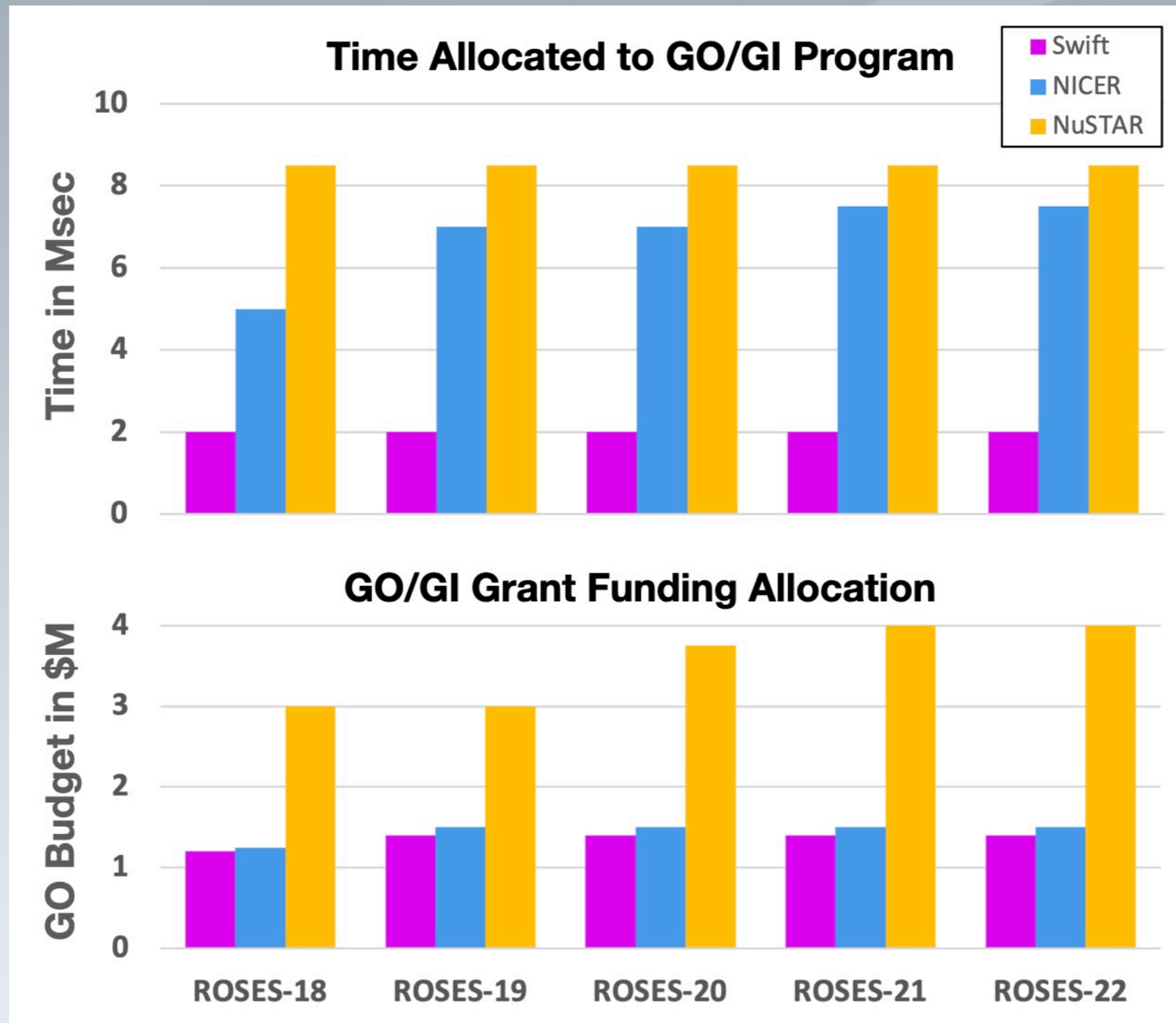


NICER's observing flexibility means we can select a large fraction of the proposals submitted each cycle.

# Grant Statistics



NICER grants award amounts are based on the total GO Budget as well as the number of proposals we are able to support.

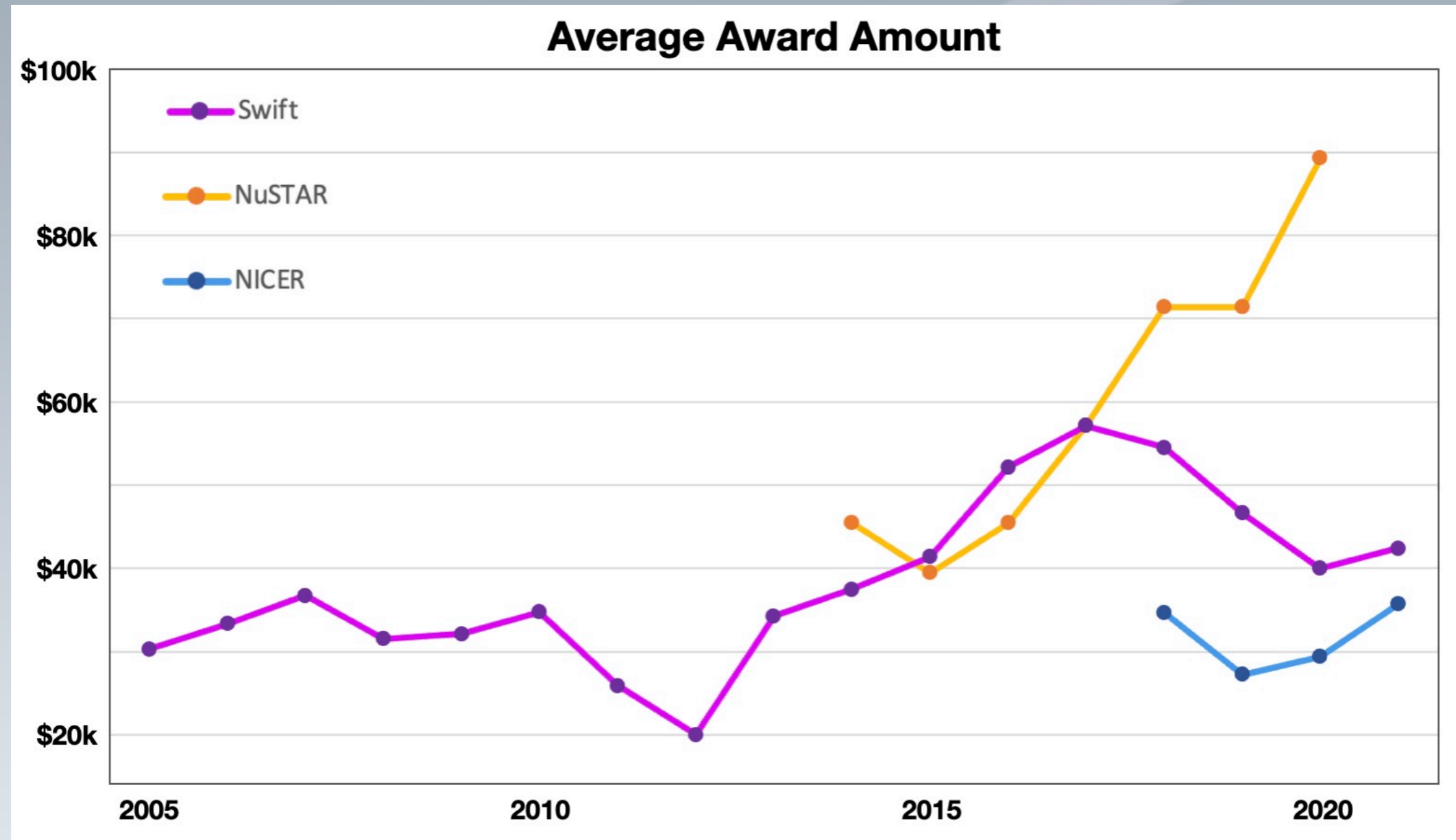




# Grant Statistics



NICER grants award amounts are based on the total GO Budget as well as the number of proposals we are able to support.



NuSTAR - Has more funding

Swift - Accepts fewer proposals