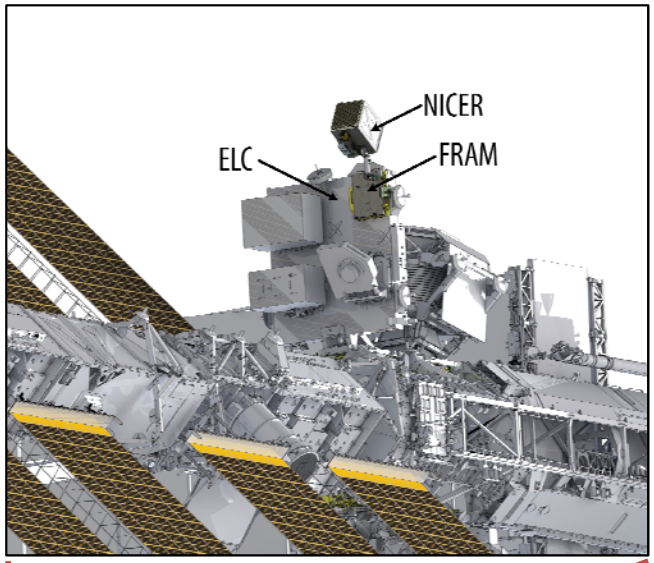
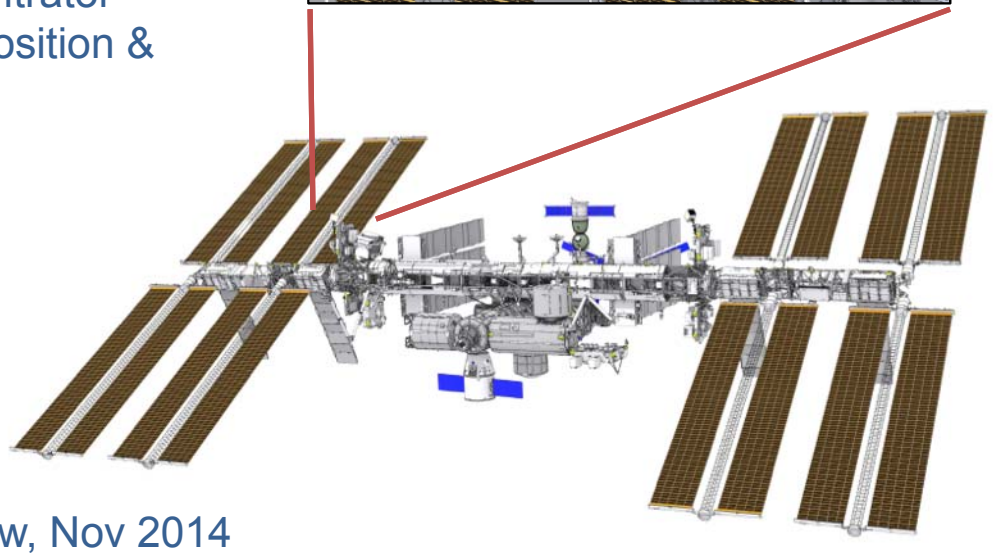
Astrophysics Mission of Opportunity on the International Space Station

- ***Science:*** Understanding ultra-dense matter through soft X-ray timing of neutron stars
- ***Launch***: August 2016, SpaceX-12 resupply
- ***Platform:*** ISS ExPRESS Logistics Carrier (ELC), with active pointing over nearly a full hemisphere
- ***Duration:*** 24 months, including Guest Observer program in Year 2
- ***Instrument:*** X-ray (0.2–12 keV) "concentrator" optics and silicon-drift detectors; GPS position & absolute time tagging
- ***Enhancements:***
  - Guest Observer program
  - Demonstration of pulsar-based navigation
- ***Status:***
  - Passed CDR, Sep 2014
  - Passed ISS Phase 2 Safety Review, Nov 2014

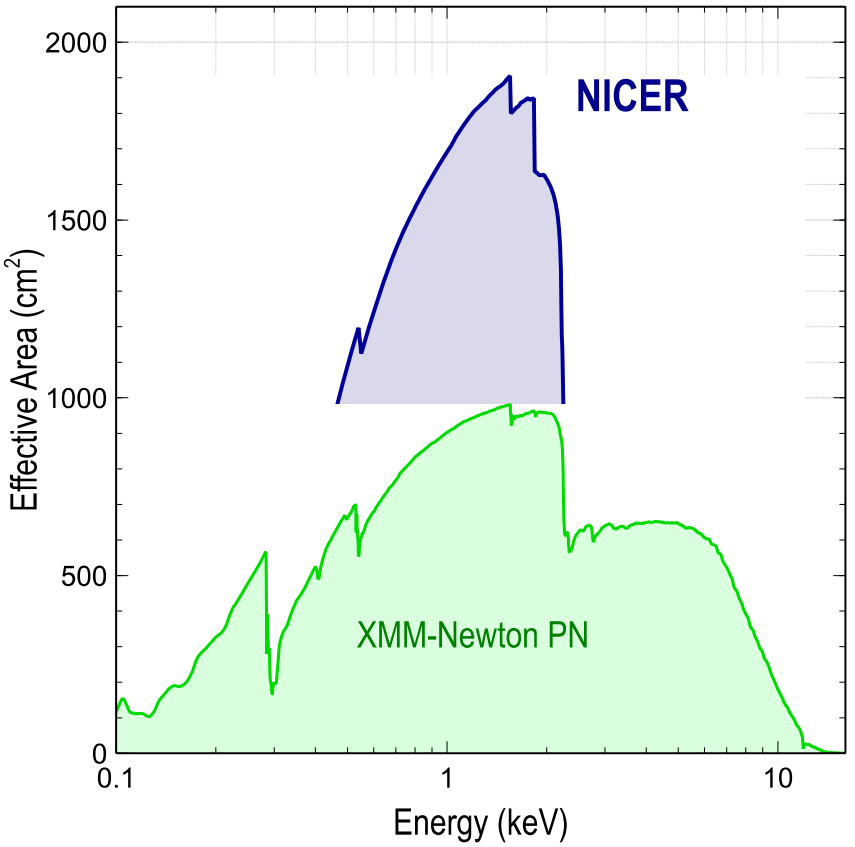




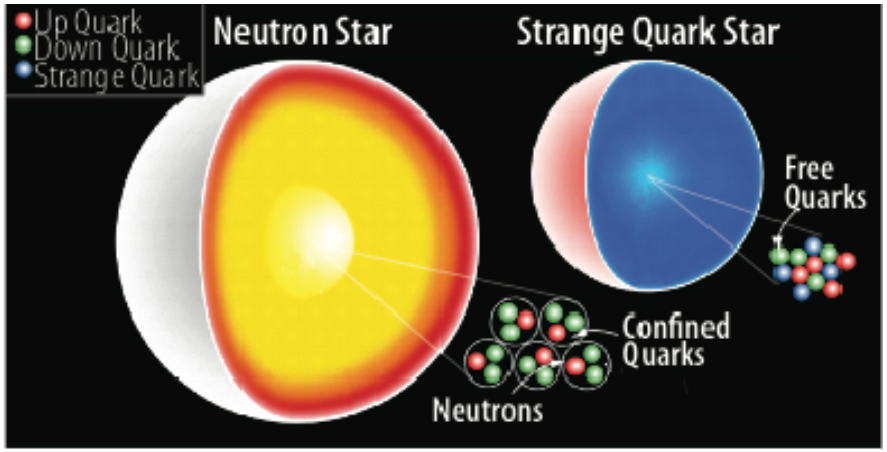
Unique Capabilities, New Discovery Space

An unprecedented combination of sensitivity, timing, and energy resolution

- Spectral band: 0.2–12 keV
  - Well matched to neutron stars
  - Overlaps RXTE and XMM-*Newton*
- Timing resolution: 100 nsec RMS absolute
  - 50x better than RXTE
  - 100x–1000x better than XMM-*Newton*
- Energy resolution: 2% @ 6 keV
  - 10x better than RXTE
- Non-imaging FOV: 6 arcmin
  - 10x better than RXTE
- Sensitivity, 5σ: 5.3 x 10^{-14} erg/s/cm^2
  - 0.5–10 keV in 10 ksec (Crab-like spectrum)
  - 20x better than RXTE
  - 3x better than XMM-*Newton*'s timing capability

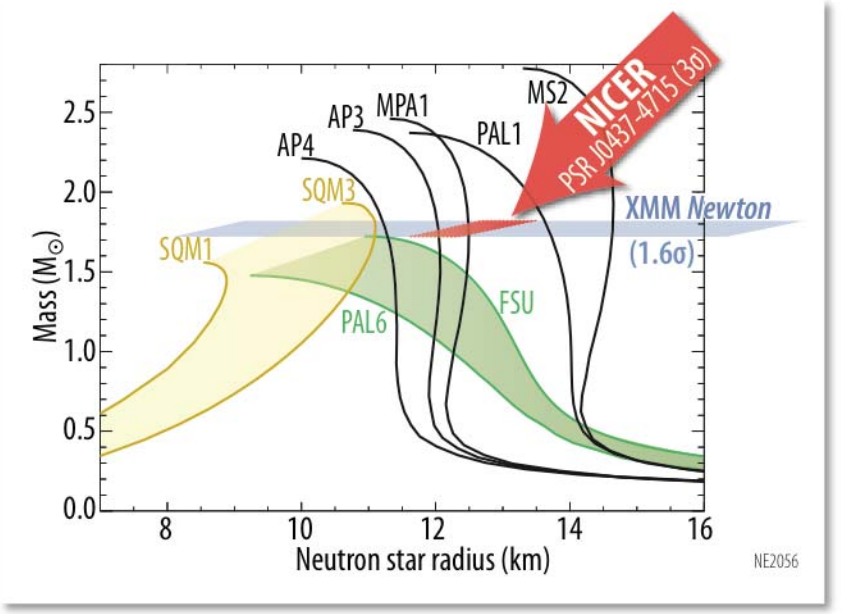


How big is a neutron star? Size reveals composition



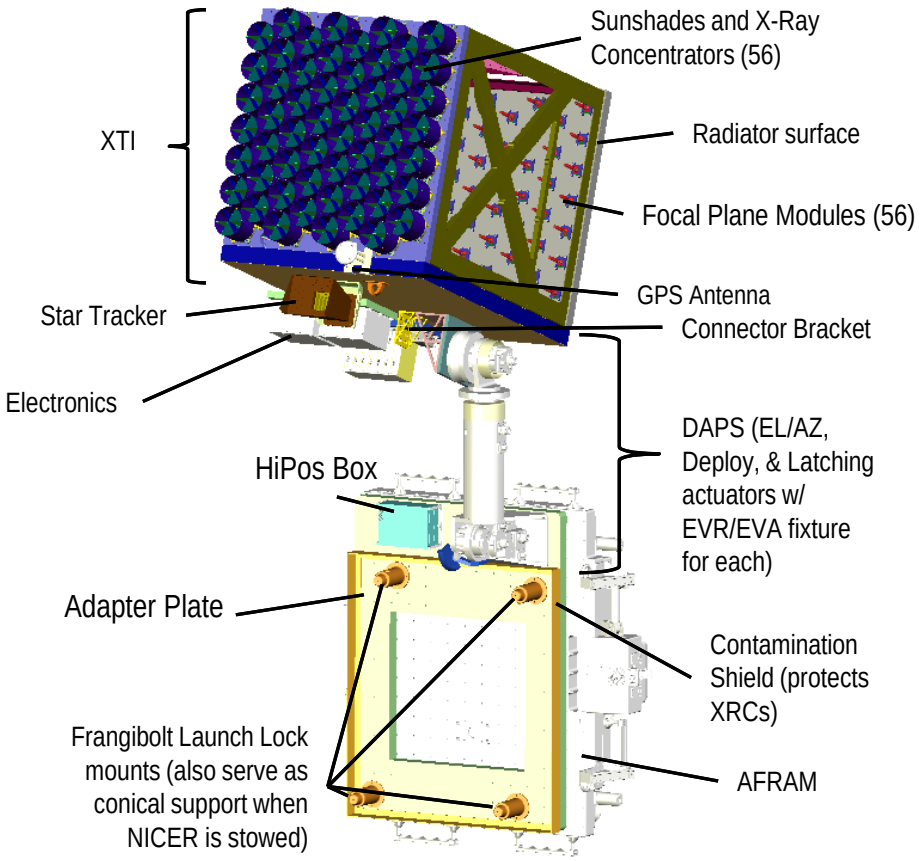
Credit: CXC

NICER's key science objective: determine the radii of several neutron stars to ±5%



The NICER Payload…

An innovative combination of high-heritage components



- **X-ray Timing Instrument (XTI)**
  - Detects individual X-ray photons, returns energy & time of arrival
  - 56 X-ray concentrators, detectors held in the Instrument Optical Bench
- **Thermal Control System**
  - Maintains thermal-mechanical alignment
- **Pointing System**
  - Composed of high-heritage components
  - Enables tracking of inertial targets
  - Slews XTI between targets
- **C&DH**
  - Digital int'face to ISS for commands, data
  - Supports pointing system
- **Flight Releasable Attachment Mechanism**
  - Electrical & mechanical interface to ISS and transfer vehicle
  - Provided by ISS program

… Coming Together for Flight …

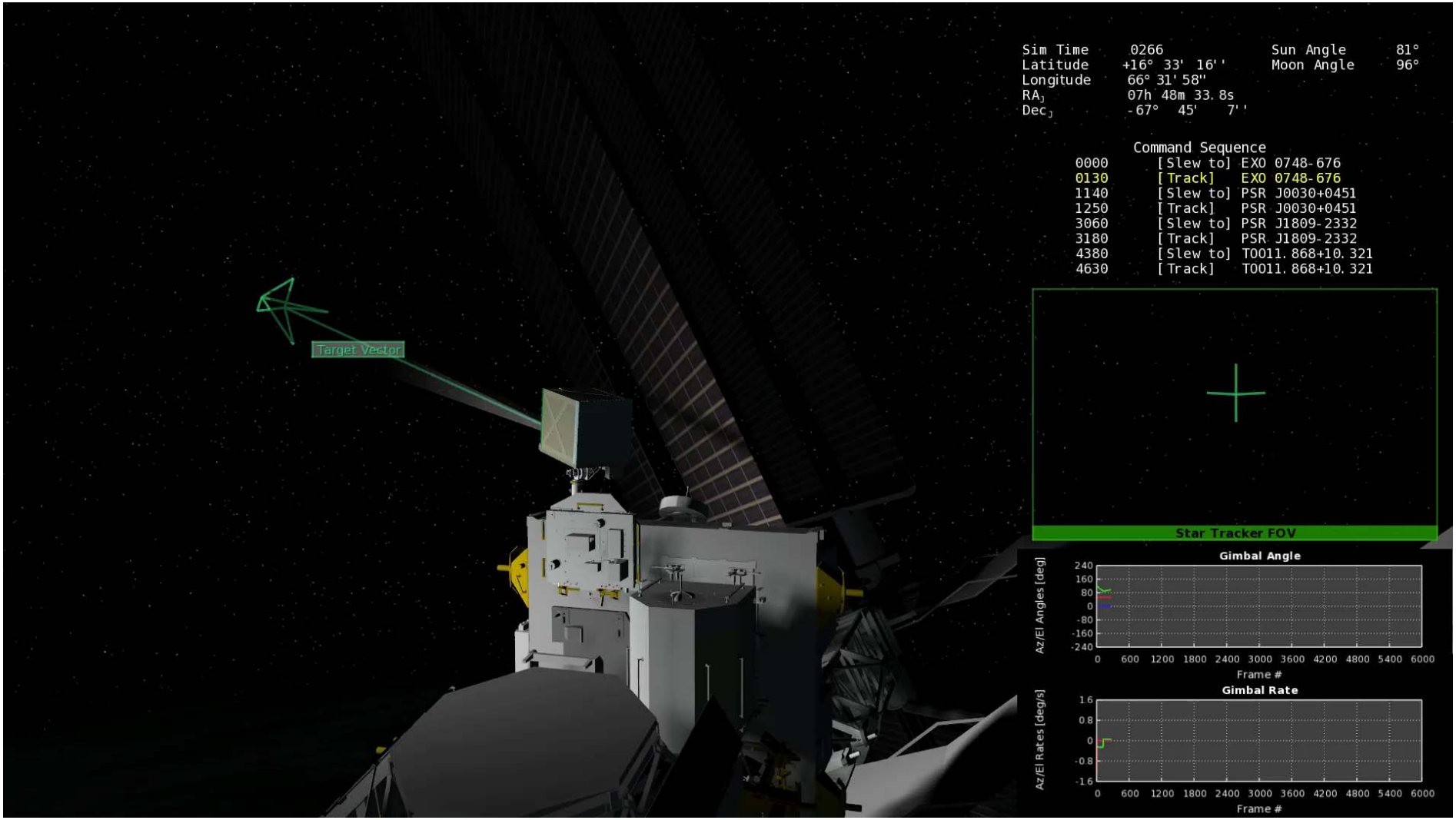
Detectors & Housing

Integration Facility

First 56 Optics!

… On an Established Platform

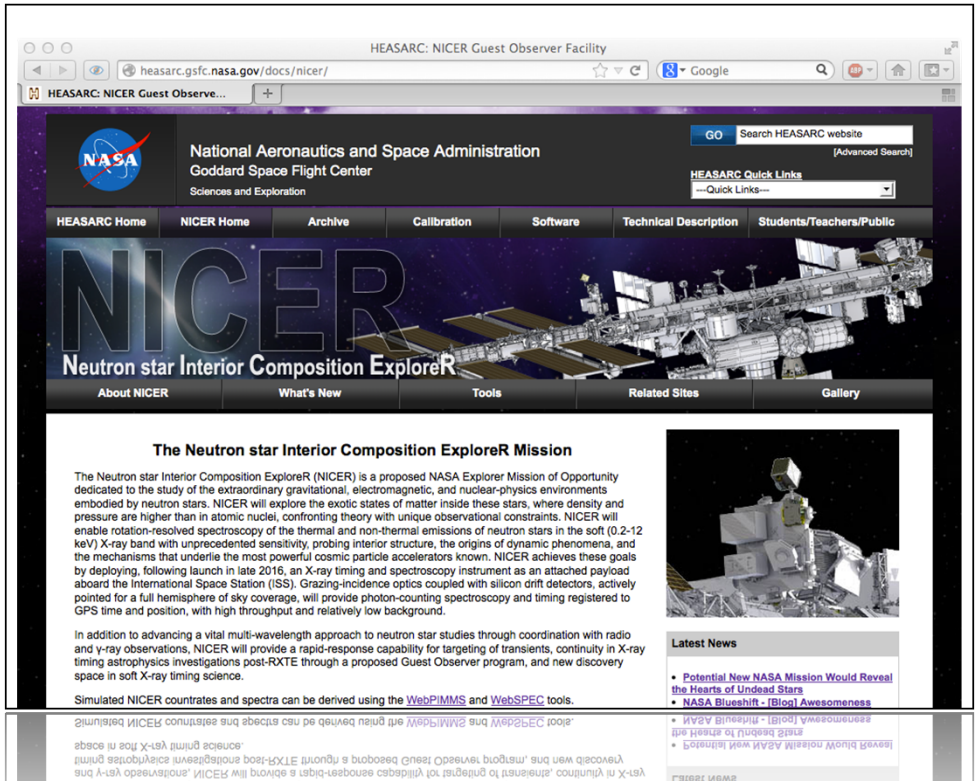
ISS is a great place to do NICER science!

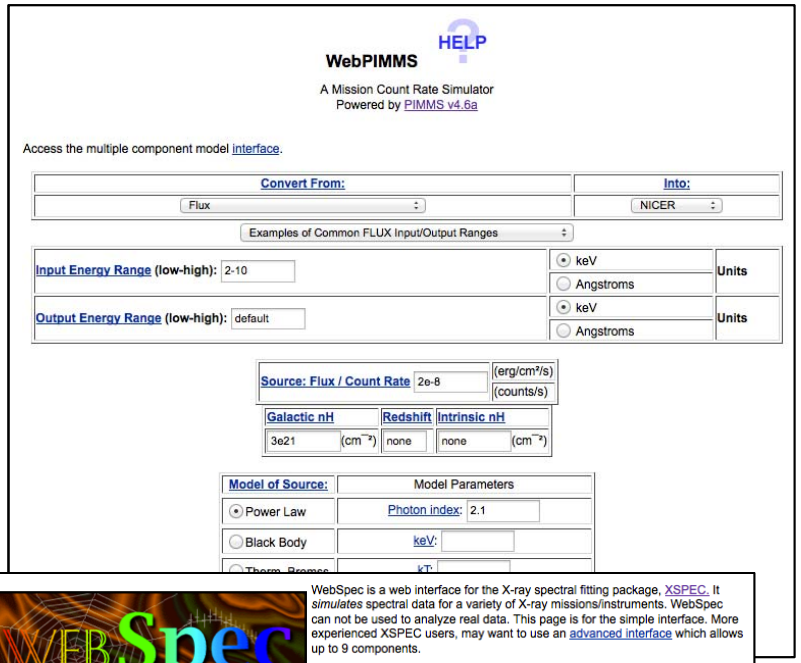


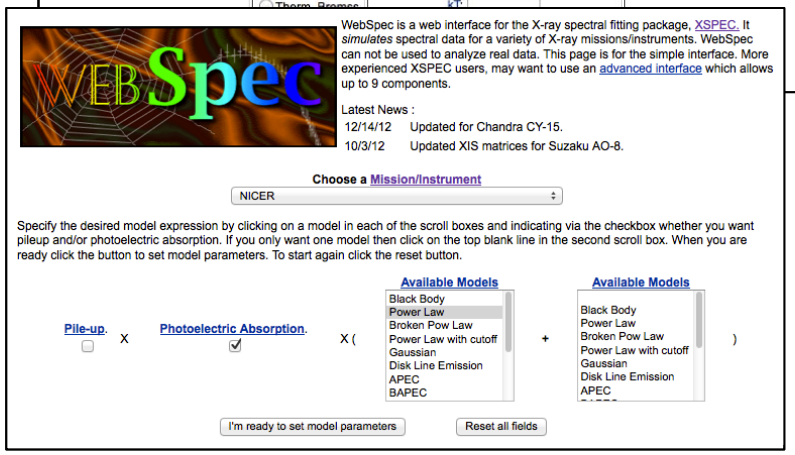
Guest Observer Program

NICER tools at HEASARC available to anticipate observations of your favorite targets

- Up to 7 Msec for general X-ray astrophysics
  - Timing-spectral studies of black holes
  - Coronal emission from stars
  - Highly redshifted iron lines
  - … and much more!

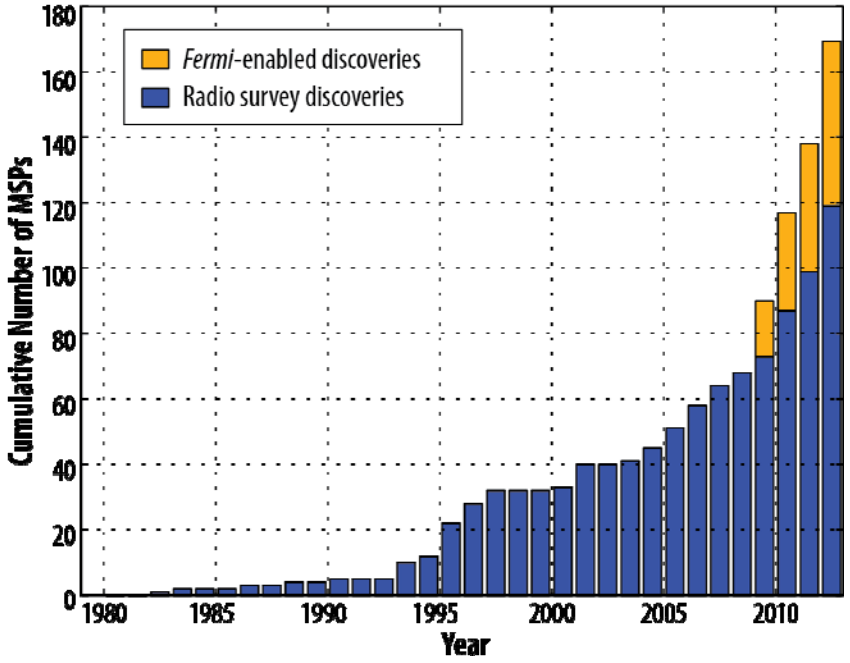






A Good Time for NICER

- Millisecond pulsar discovery rate is booming
- Overlap with many other missions— science synergies boost returns for all
- Community awaits follow-on to RXTE
- NICER technology is mature
- ISS is ready to support science experiments



http://heasarc.gsfc.nasa.gov/docs/nicer

NICER mailing list, image gallery, tools, etc. →