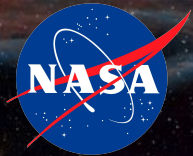


# Probing Intrabinary Material in a New Spider Millisecond Pulsar

Rebecca Kyer (they/them)

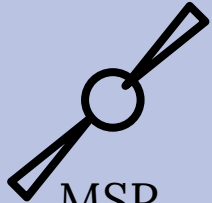
([rkyer@msu.edu](mailto:rkyer@msu.edu))

with Jay Strader, Subhroja Roy, Peter Craig,  
Ryan Urquhart, Thomas Do, Bella Molina, Laura Chomiuk



AAS248 Press Conference | 15 June 2026

# Spider Millisecond Pulsar (MSP) Binaries



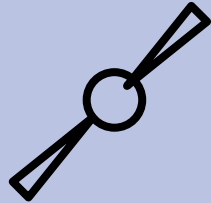
MSP

Companion

Tiny companion star ~3%  
the mass of the Sun ( $M_{\odot}$ )

## Black widow

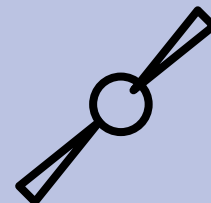
> 50 known in Galactic field



Small companion star  
~10-80%  $M_{\odot}$

## Redback

> 30 known in Galactic field

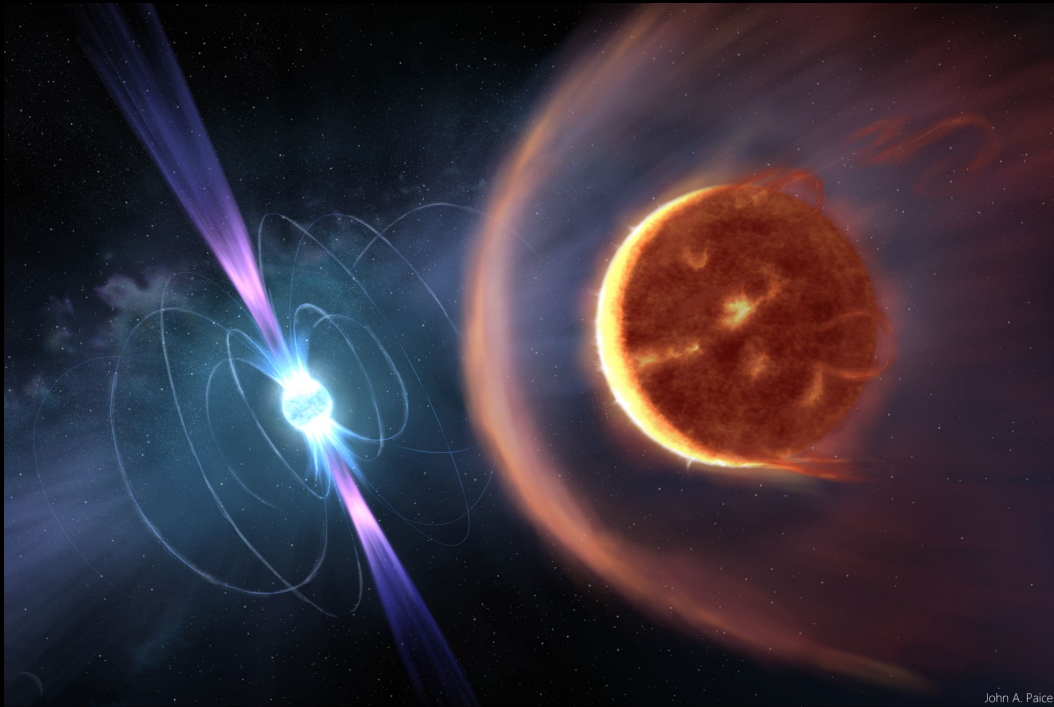


Evolved, puffed-up  
companion ~20-30%  $M_{\odot}$

## Huntsman

2 currently known!

# Intrabinary Shocks: The Chaotic Interaction Between the Pulsar and Stellar Winds



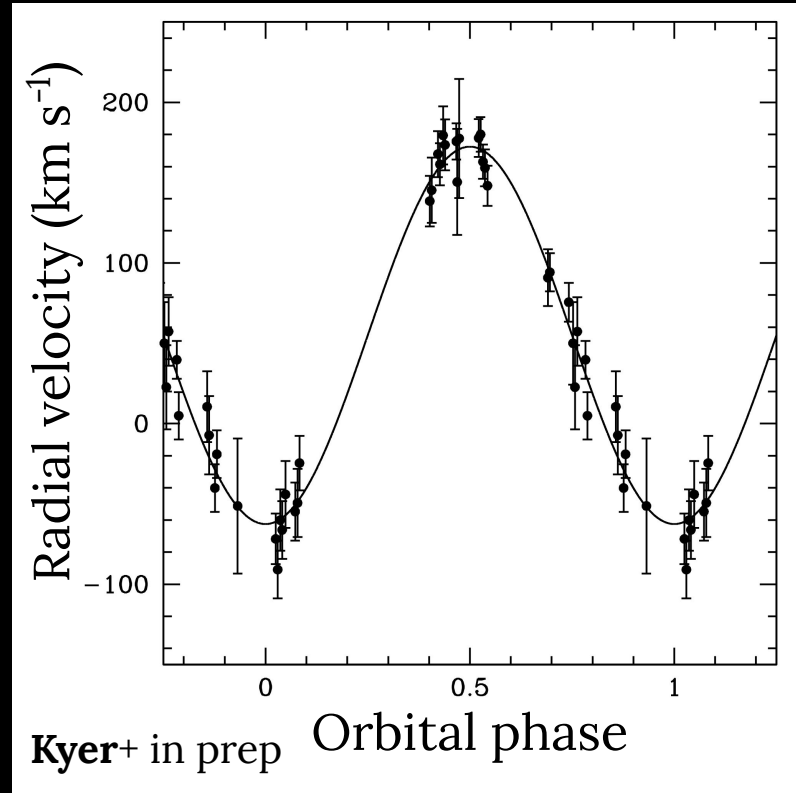
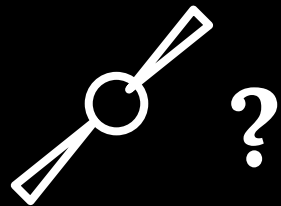
- Shocks accelerate particles to the highest energies observed in the Universe

In spiders:

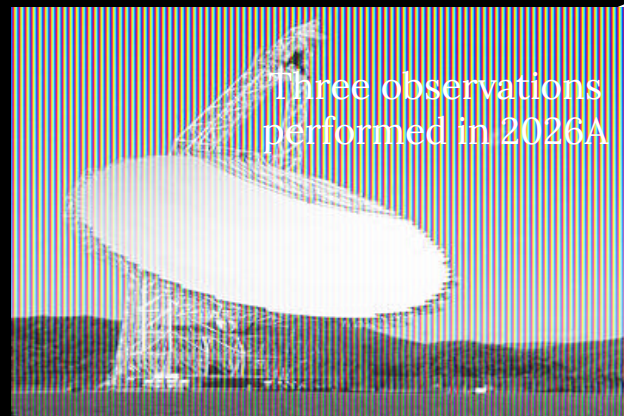
- Shocks produce high-energy X-ray photons
- Compress/heat gas → can produce bright optical emission lines
- Dense gas frequently blocks radio pulsar signal

# We Have Discovered a New Candidate Huntsman

- Faint X-ray source located in GeV  $\gamma$ -ray source
- 3.64 day orbital period confirmed with radial velocity curve
- K-type stellar spectrum with transient Hydrogen emission lines



# Radio Pulsar Search Observations with the Green Bank Telescope Underway to Detect the MSP



Credit: NRAO/GBO

$\phi = 0.24$

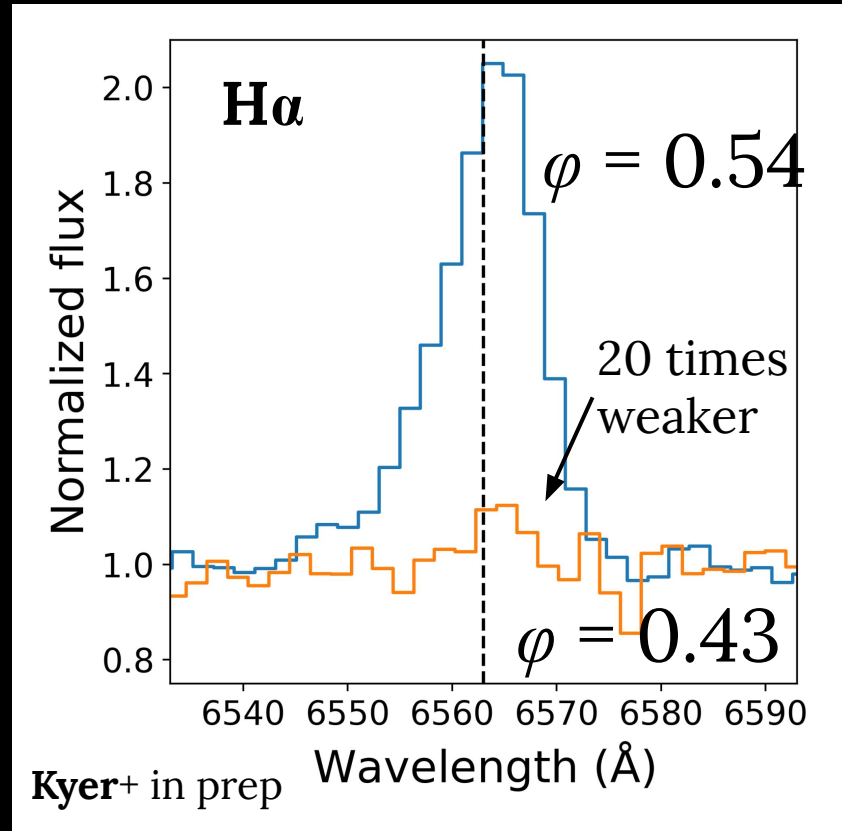
$\phi = 0.77$

$\phi = 0.95$

The first huntsman pulsar was eclipsed in 85% of radio observations (Camilo+2016)

# Probing Shocked/Heated Intrabinary Material

- Strongly variable H $\alpha$  emission in new huntsman
- Shortest orbital period (3.6 d) of the huntsman population
  - First huntsman: 5.4 d orbital period, double-peaked H $\alpha$
  - Second: 10.3 d orbital period, no optical emission lines observed



# Significance

- Many binary millisecond pulsars (MSPs) are observed in spiders, where the pulsar wind can strongly influence the companion
- We are combining optical spectroscopy and radio search data to form a picture of the intrabinary shock in a new huntsman binary MSP candidate
- With a growing huntsman population, we are discovering how pulsar winds interact with the winds of evolved low-mass stars
- Publication upcoming in Fall 2026

Rebecca Kyer | [rkyer@msu.edu](mailto:rkyer@msu.edu)

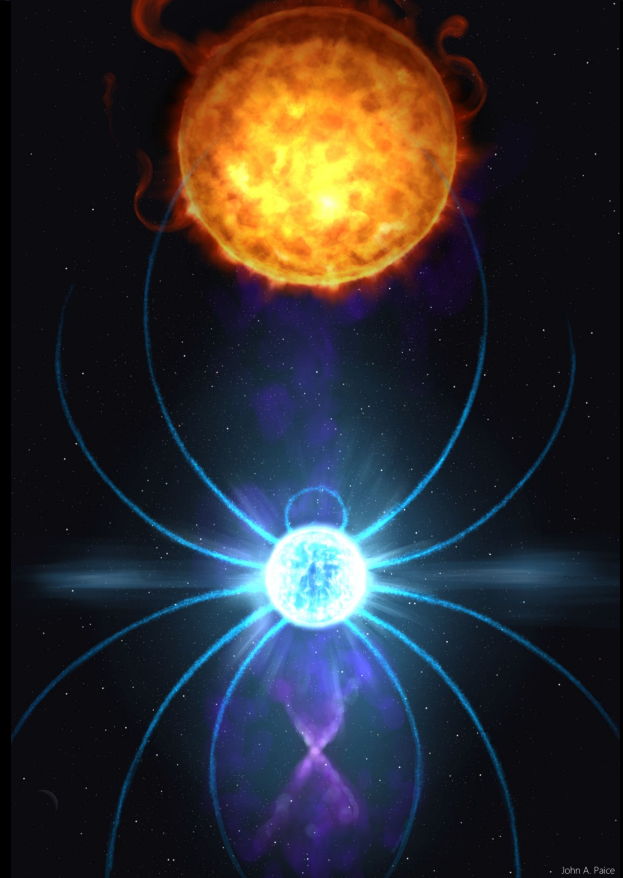


Image credit: Dr. John Paice ([www.johnpaice.com](http://www.johnpaice.com))