Jets from Accreting White Dwarfs

Jeno Sokoloski

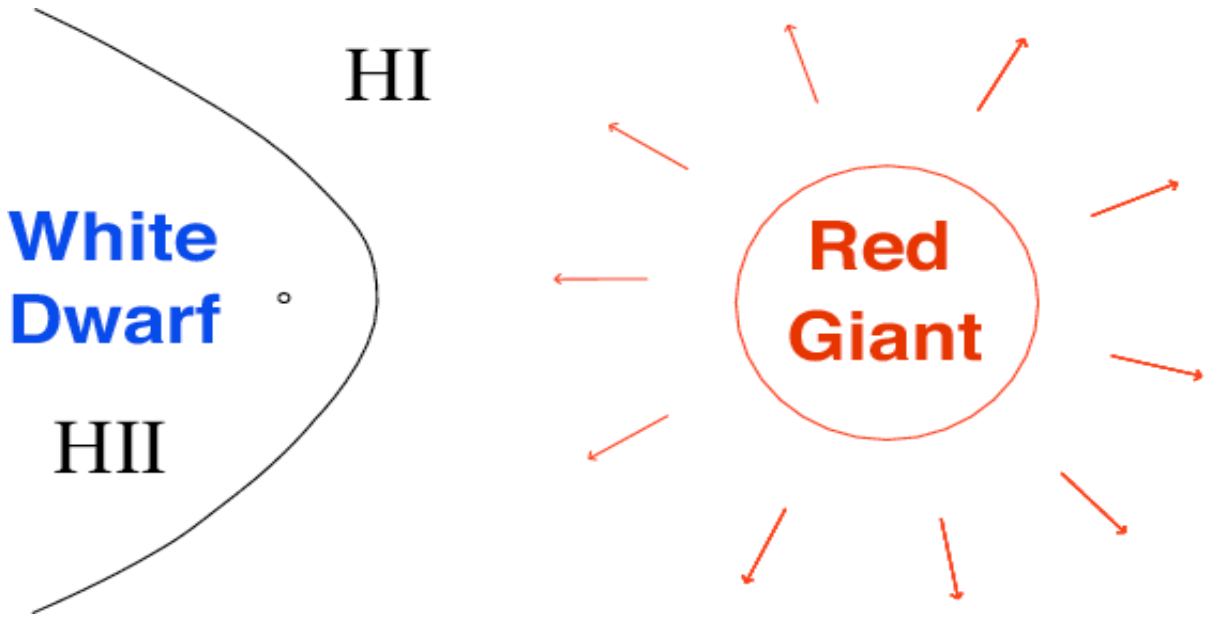
Harvard-Smithsonian CfA

Collaborators include: S. Kenyon, E. Kellogg (CfA), C. Brocksopp (MSSL), C. Kaiser (U. Southampton)

Main Points

1) White Dwarfs can produce jets.
2) White-dwarf jets have a potentially important role to play in the general quest to understand the collimation and acceleration of astrophysical jets.
3) Amateurs, including students, can participate in research on white-dwarf jets.

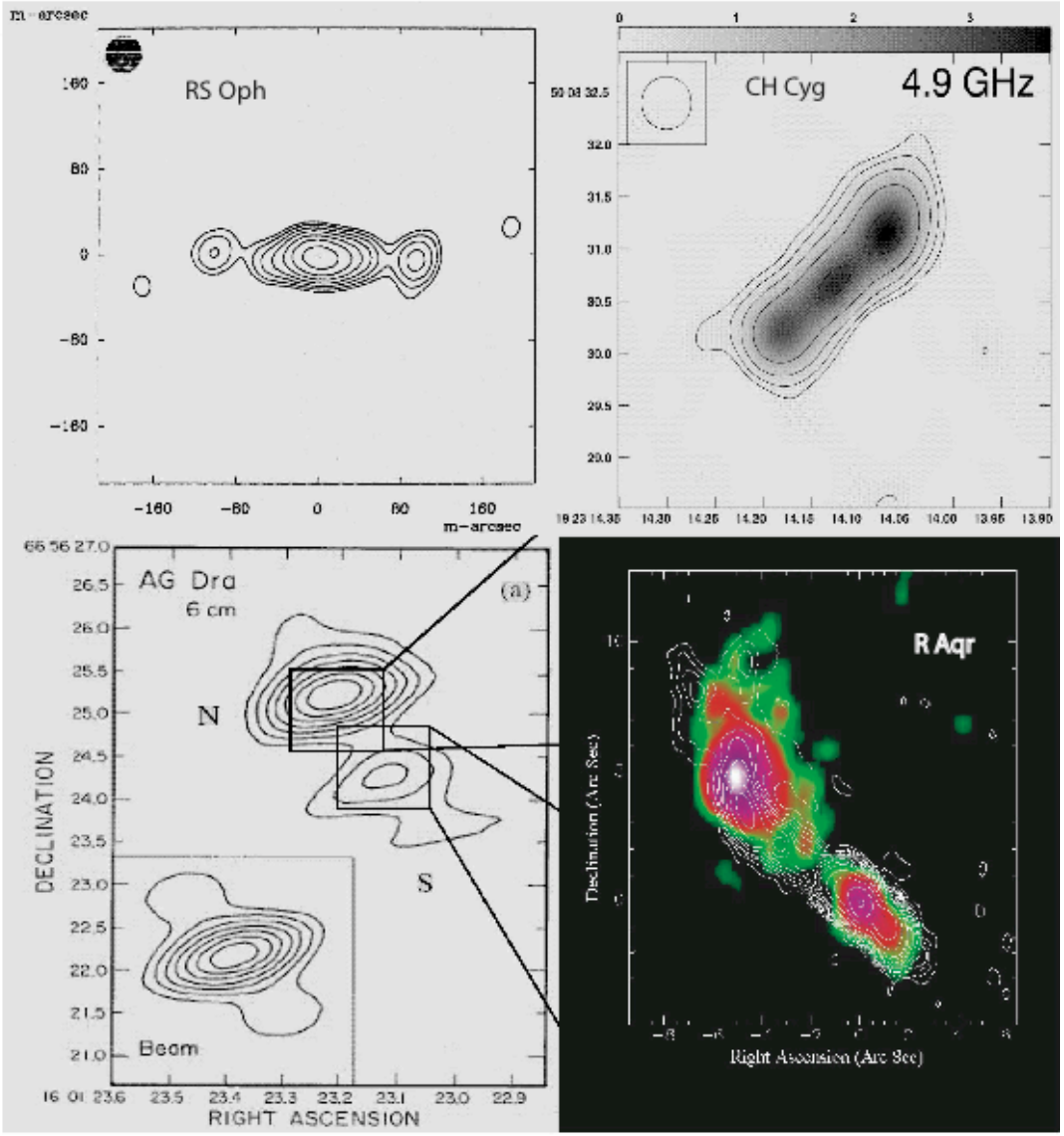
One Type of Accreting WD: Symbiotic Stars



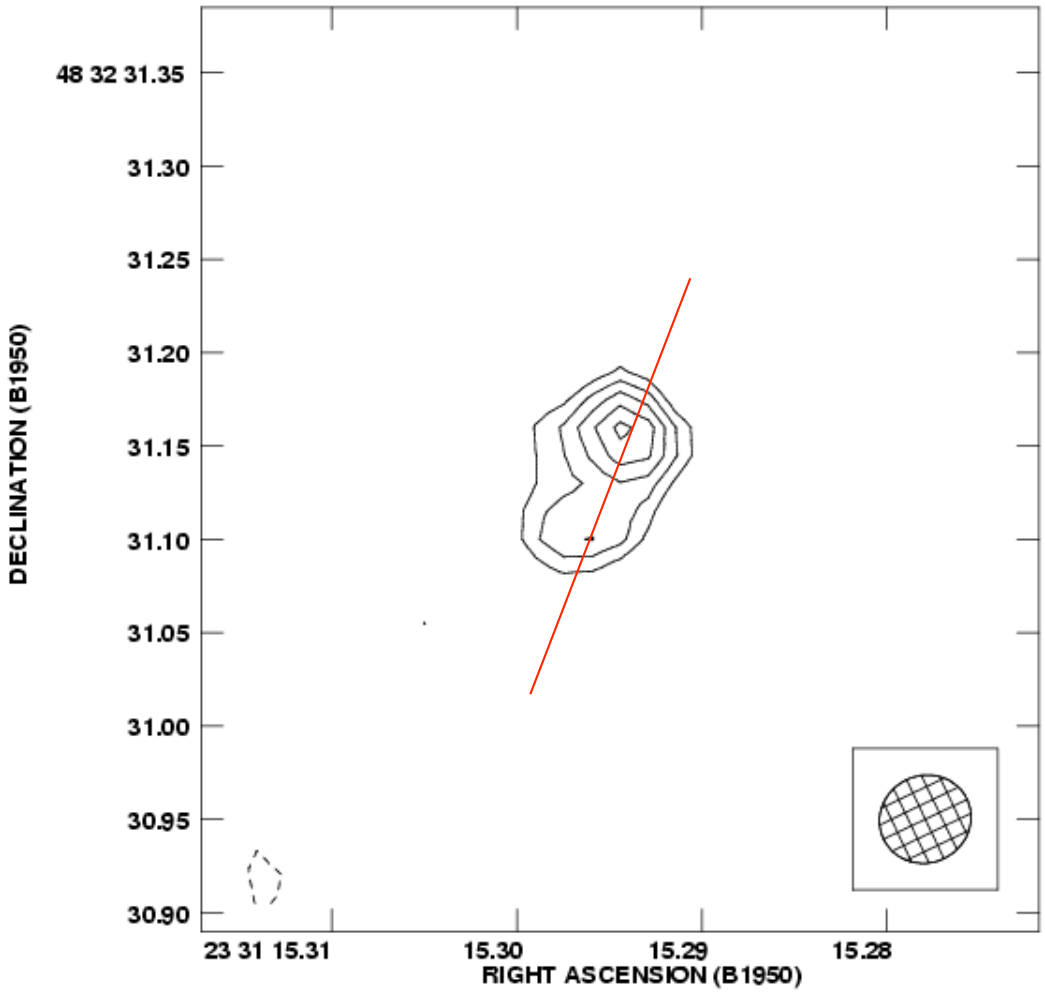
- Wide, Wind-Fed Binaries
- Partially Ionized Emission Nebula
- Quasi-Steady Shell Burning on the White Dwarf
- Outbursts every few years to decades.

Gallery of Symbiotic-Star Jets

- Angular sizes: tens of mas to tens of arcsec.
- Physical sizes: tens to thousands of AU.
- Inferred velocities: hundreds to thousands of km/s.
- Often transient.
- Wide variety of symbiotics represented.



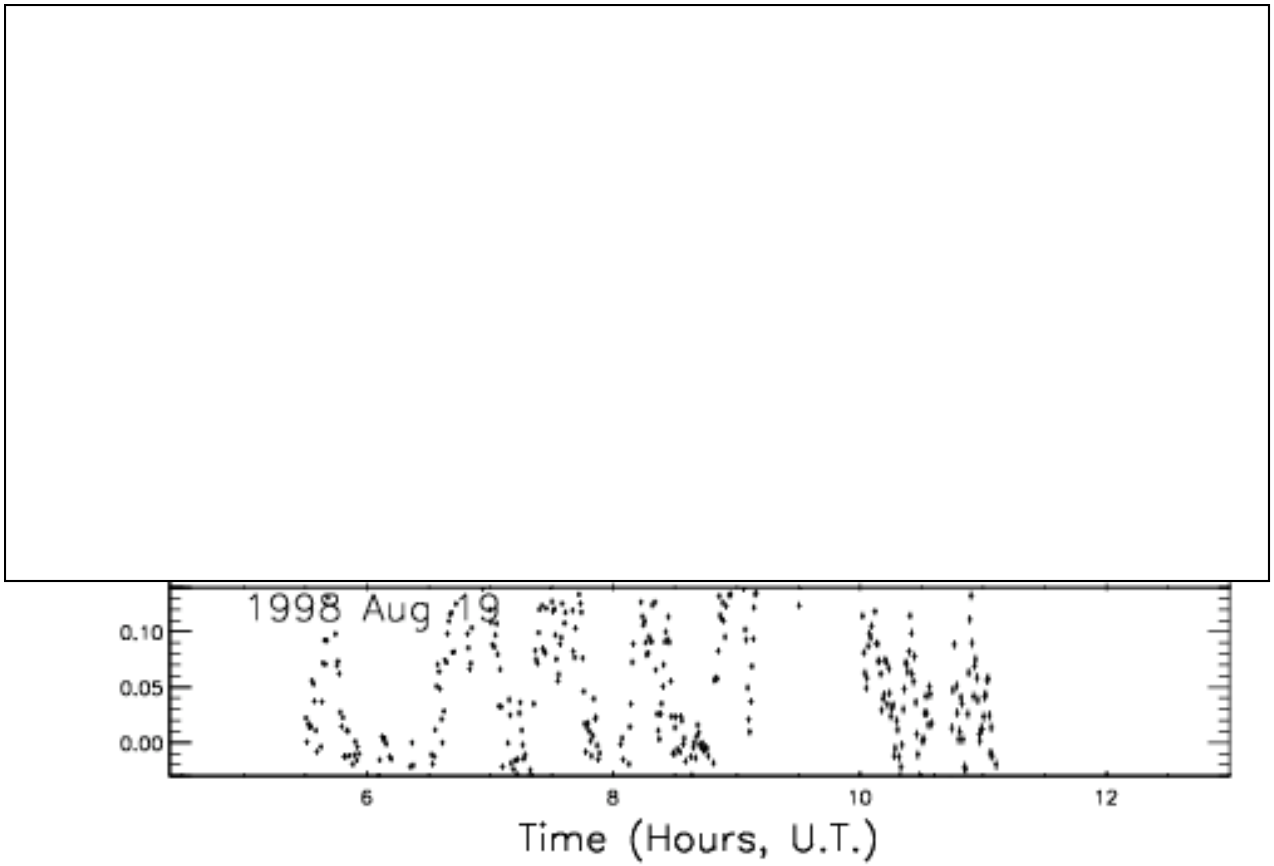
Z And Transient Radio Jet



- Z And: prototype, with strong B field
- Size: 60 mas
- Outflow perpendicular to orbital plane
- Duration: order of months
- Outflow vekocity: 400 km/s

Brocksopp et al. 2004

Disk-Jet Connection in CH Cyg

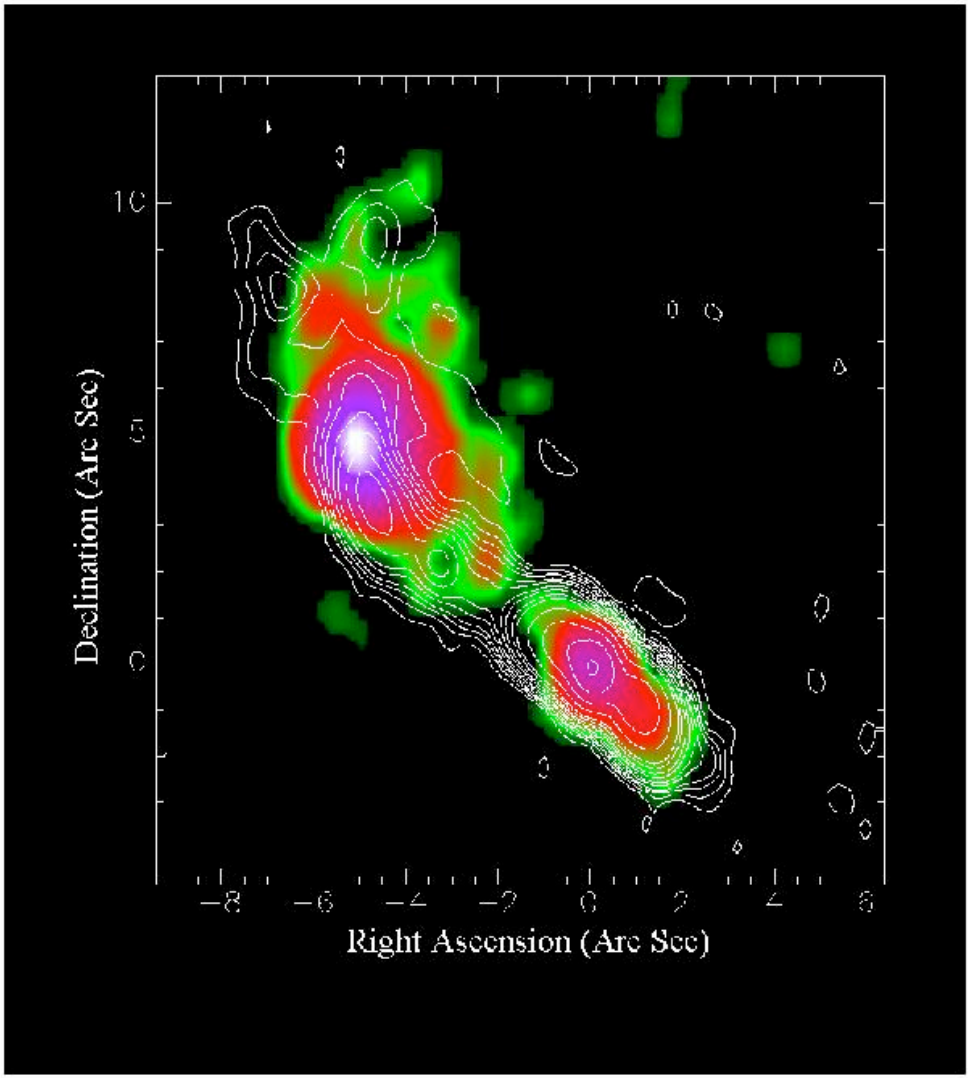


Smooth light curves → Inner disk disrupted when jet produced.

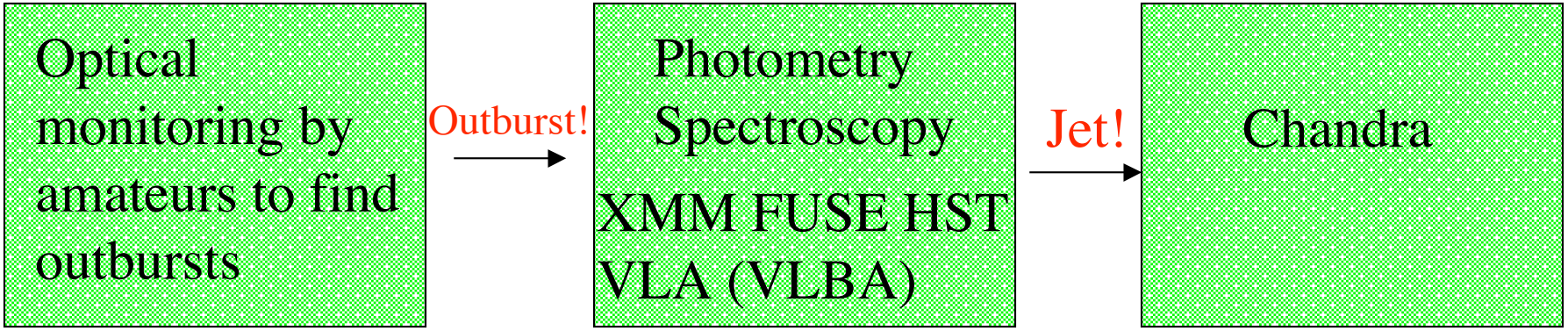
Sokoloski & Kenyon 2003

X-Ray Emission from a Symbiotic-Star Jet from Kellogg, Pedelty, & Lyon 2001

- Northeastern lobe of persistent jet.
- X-ray contours from Chandra shown in color.
- E<1 keV: central source + jets; E>1 keV: point source.
- Jet plasma shock-heated and not in thermal equilib.



Observational Approach: Multi-Wavelength TOO



Women in Science

Programs for Middle-School Girls:

- Eyes to the Future - Online mentorship
- Science Club for Girls - Science and Leadership

Acknowledgments

Thanks to Paul Maragakis, Jason Aufdenberg, Kelly Kourrek, and Andrea Dupree for assistance with the PowerPoint presentation.

Support for this work has been provided by the NSF, and NASA through grant NAG5-11207.

Properties of Accreting WDs with Jets

- Some have shell burning on the WD, and others do not (possibly some preference for no shell burning).
- Many jets clearly associated with outbursts, some are not.
- Z And has a strong WD surface field. Other jet sources have no evidence for such a field.
- Some have high mass-loss Mira donor stars. Others do not.

➡ One feature could be common to all is an accretion disk. The necessity of a disk should be testable with symbiotic stars (since some don't have disks)

➡ Disk accretion with accretion rate above some threshold?