

# Astrophysics Research Projects

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See [astro.swarthmore.edu/~cohen/students.html](http://astro.swarthmore.edu/~cohen/students.html) for more information.

## Two projects

1. Analysis of unusually strong X-ray emission from a pair of young, very massive stars.
2. Modeling and analysis of high energy density plasma physics experiments that attempt to reproduce an X-ray nebula in the laboratory.



Unusually strong X-rays from Massive stars:

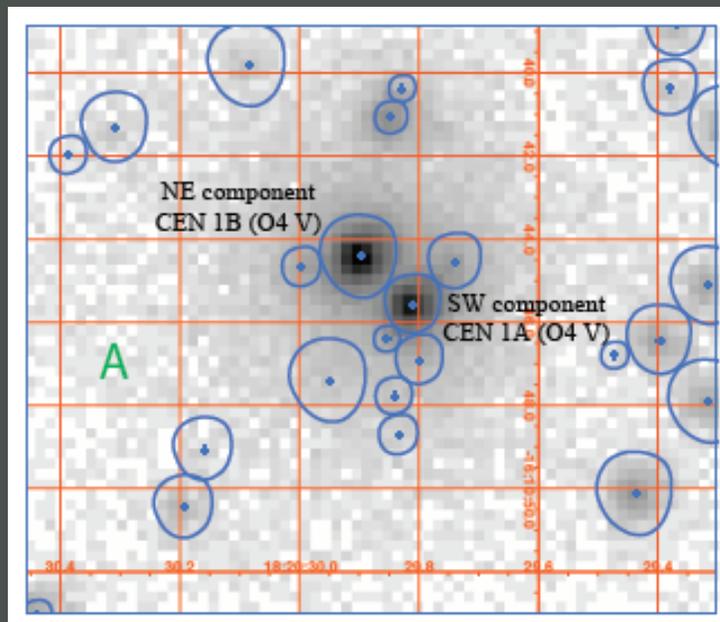
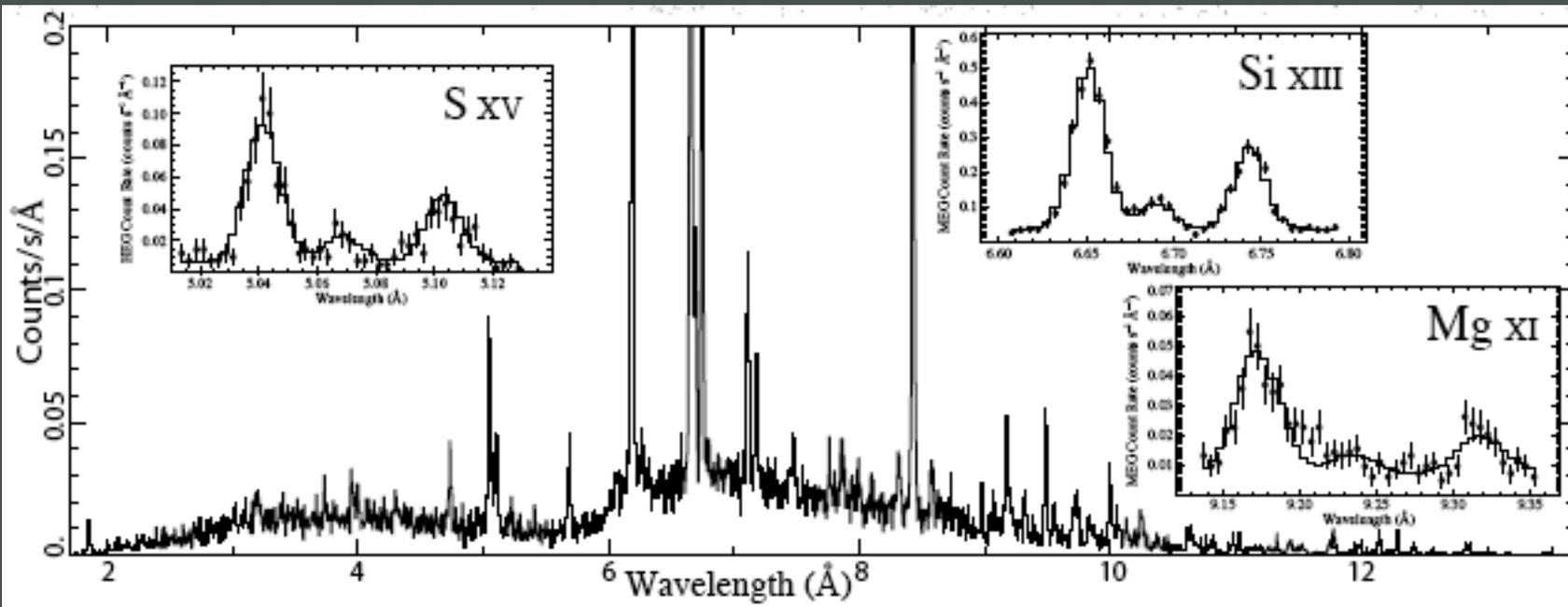
Colliding winds or  
magnetically channeled winds?

# M 17: The Omega Nebula



## The *Chandra* X-ray Observatory (artist's conception)



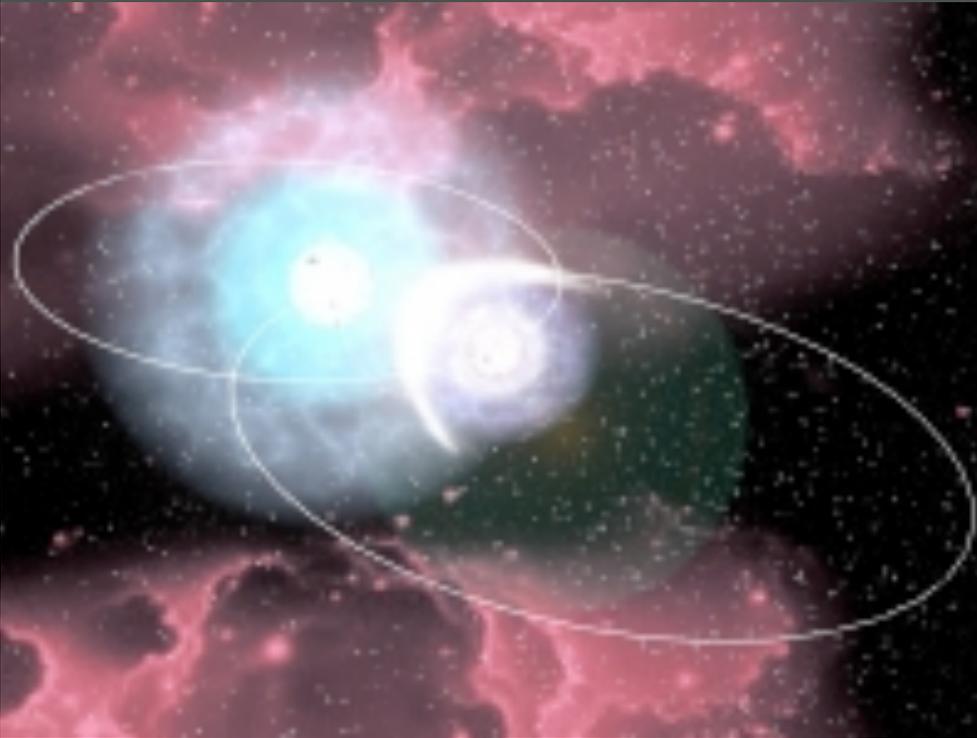


Simulated Chandra spectrum (above); Chandra imaging (left) shows that the star - *Kleinmann's Anonymous Star* - is a binary system.

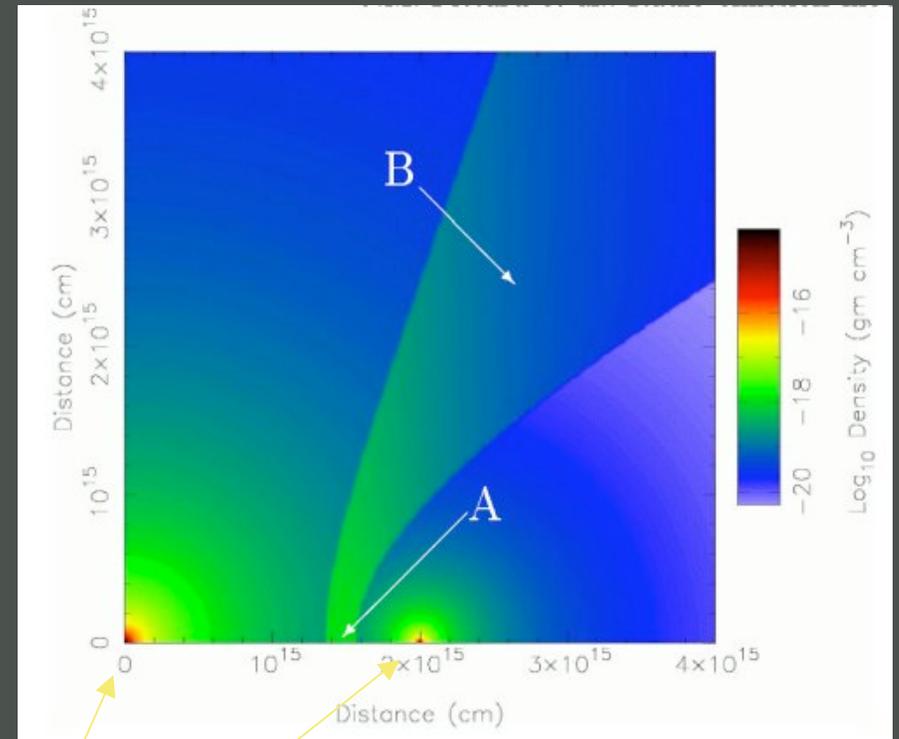
See students page on my website for the observing proposal, which describes this project.

# Colliding Wind X-ray Emission?

artist's conception

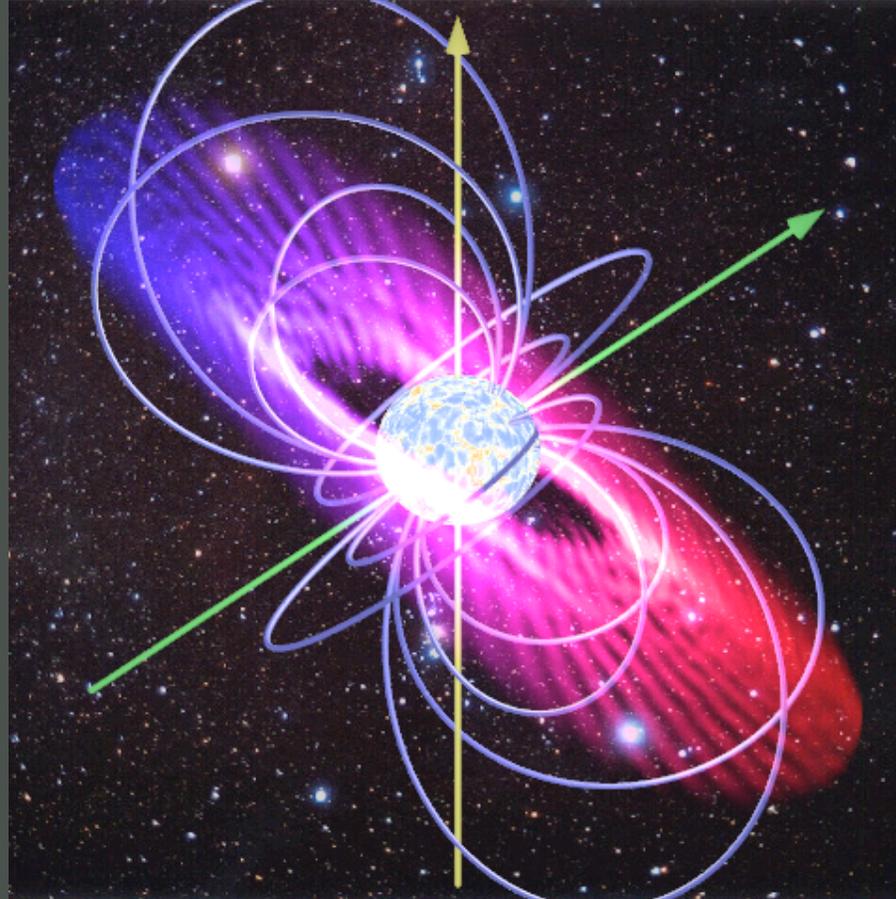


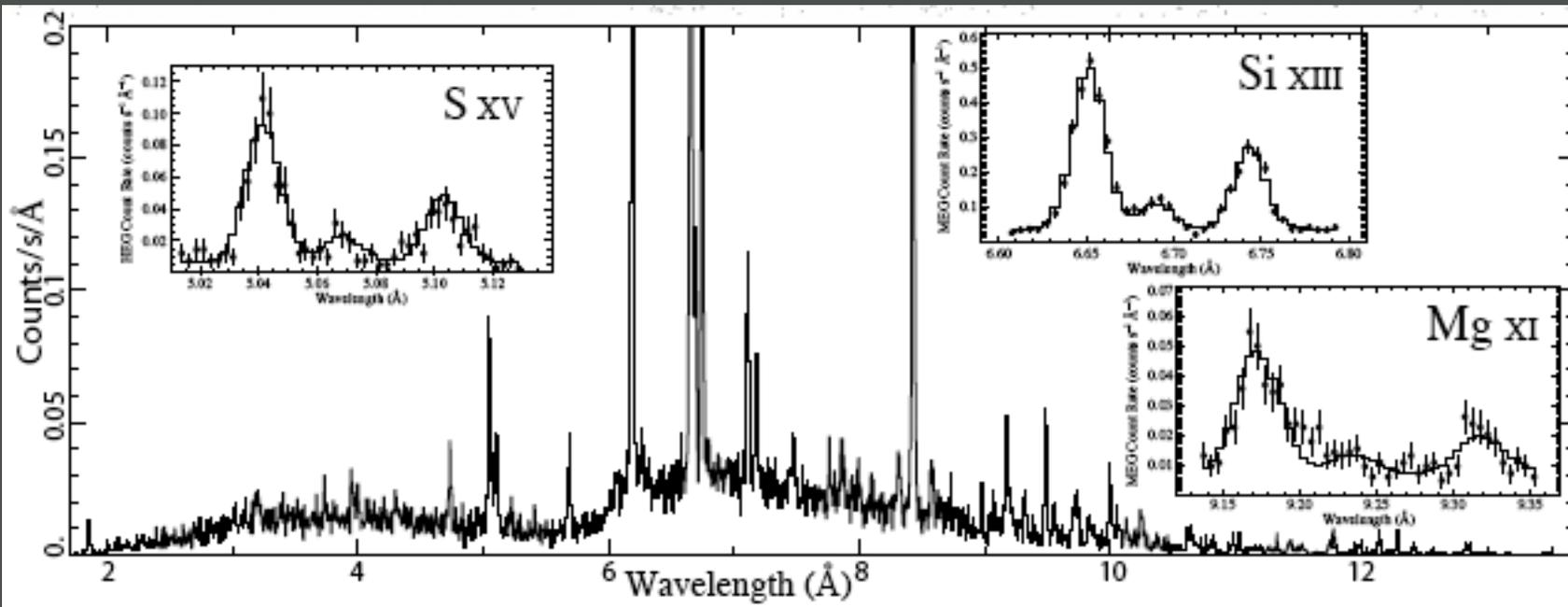
numerical simulation (density plotted)



2 stars

## Magnetically Channeled Wind Shocks?





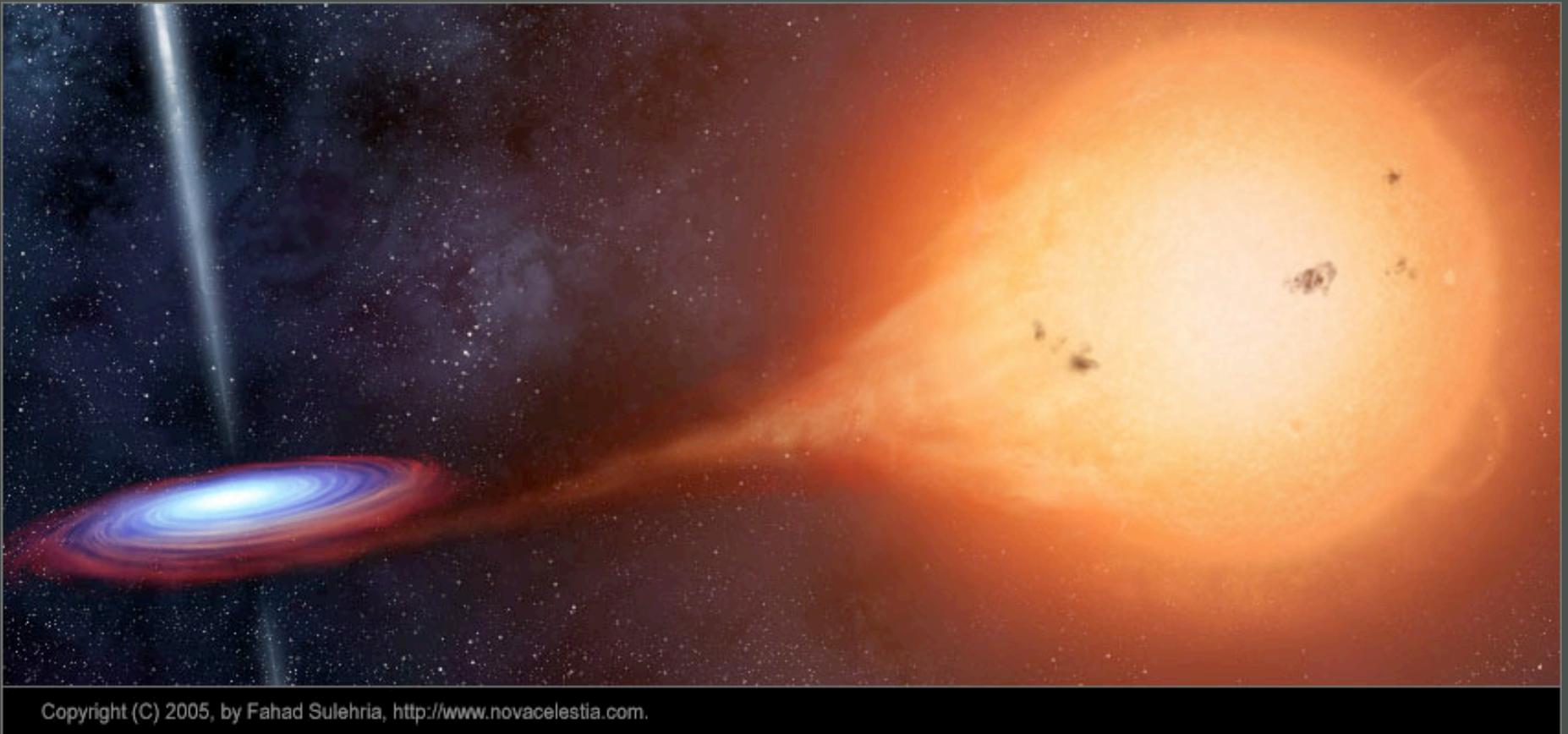
The X-ray spectrum will tell us:

1. Line *ratios* for location of the X-ray emitting plasma
2. Line *widths* for the plasma kinematics

## Laboratory Astrophysics:

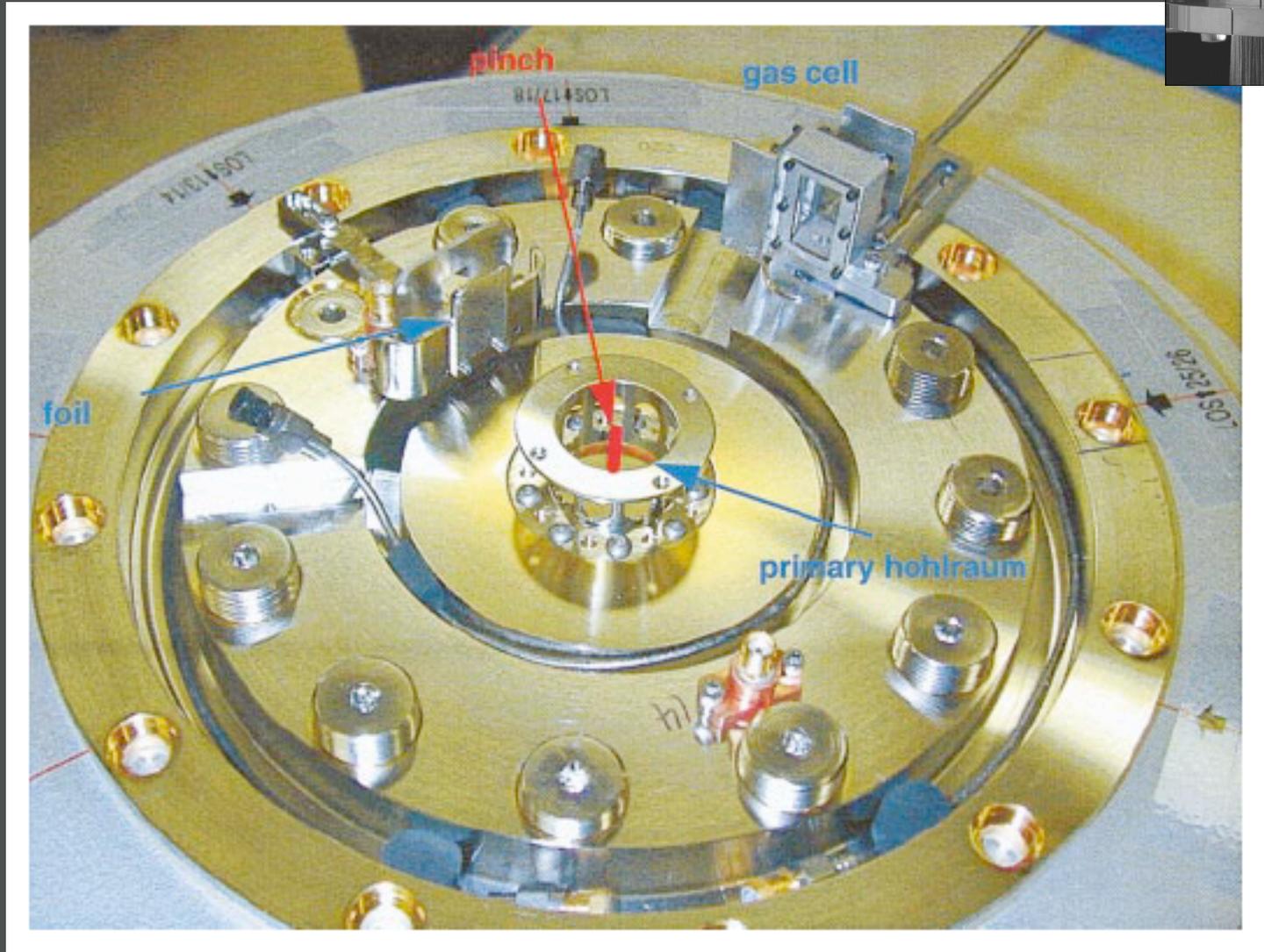
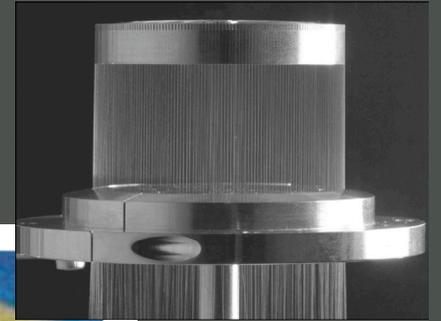
Photoionized plasma around black  
holes and neutron stars

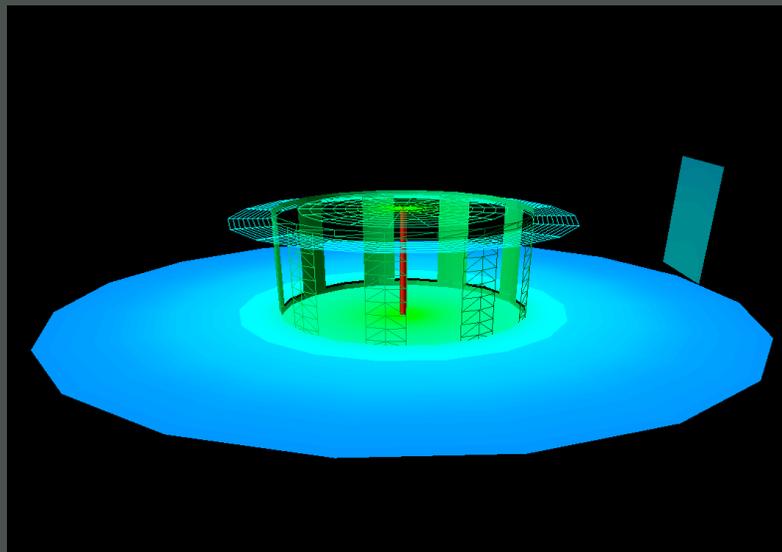
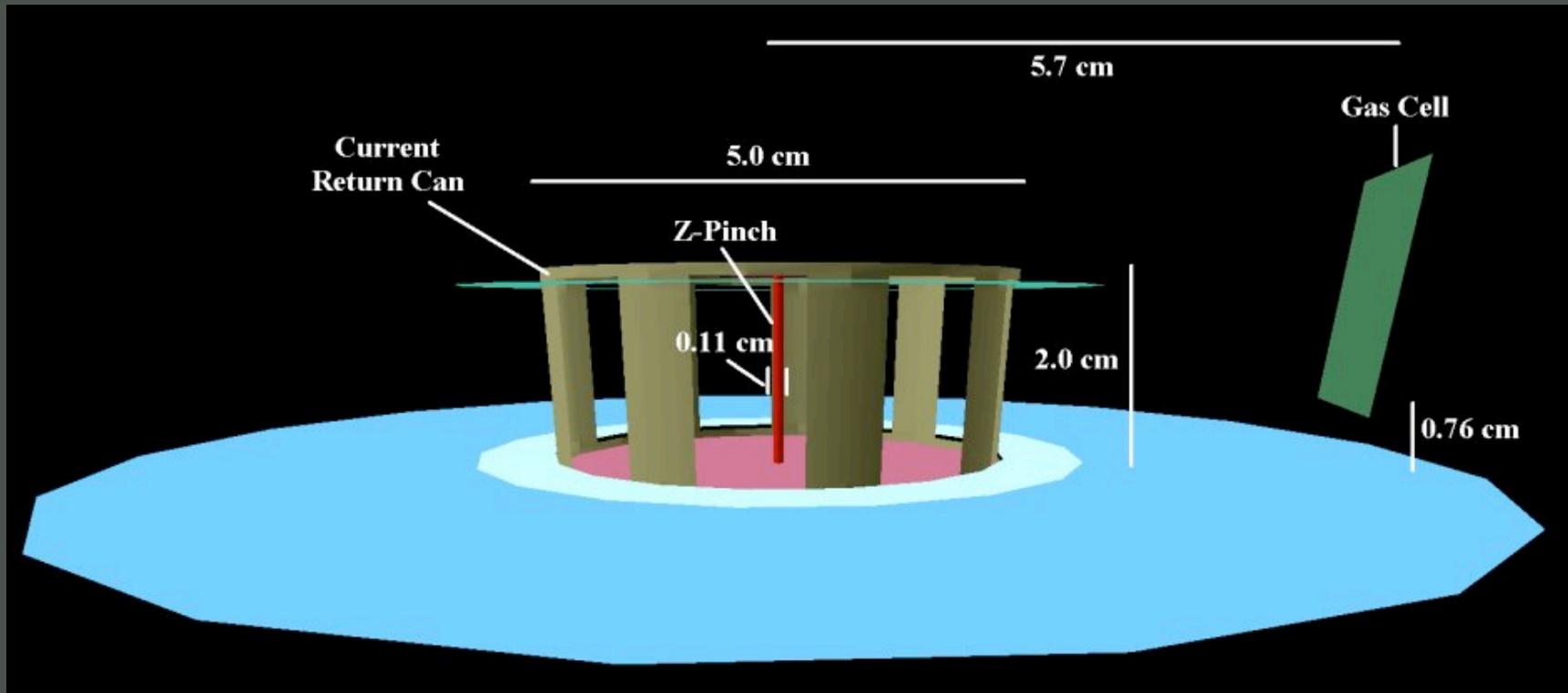
## Creating an X-ray photoionized nebula in the laboratory



Binary systems with accreting compact objects are very strong X-ray sources

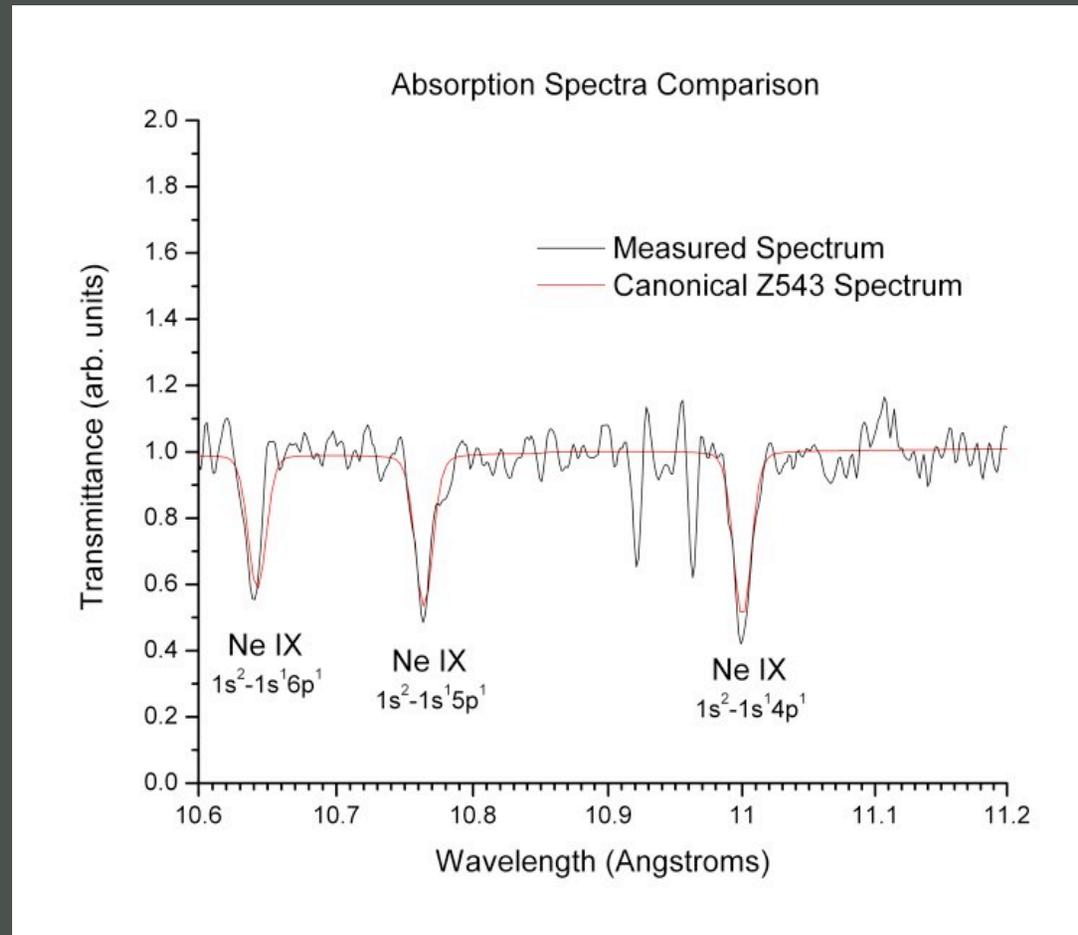
# Imploding wire array at the Z-machine at Sandia Nat'l Lab is a powerful X-ray source





Building a model of the experiment (above) - calculating the intensity on the gas cell (left).

# Model the spectrum of the neon in the gas cell to test predictions of the charge-state distribution



See the students page on my website for more details