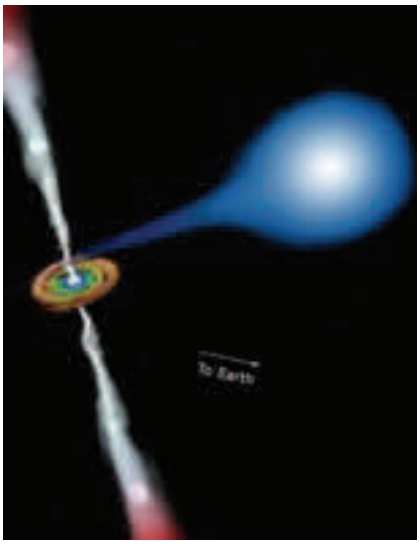
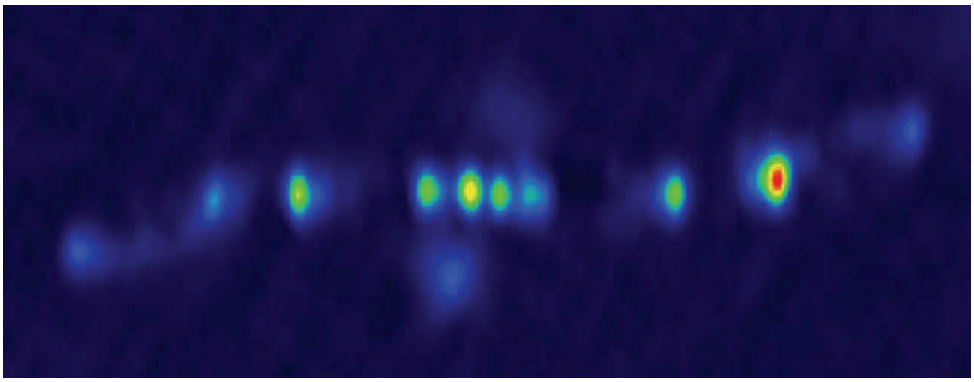
Physics & Space Sciences department presents:

Multiwavelength Observations of the SS 433 Jets





SS 433 is still the only source that is known to have emission lines from ionized gas in a highly collimated jet from a compact object. Thus, it is an important member of the ``microquasar'' class of X-ray binaries. The so-called ``kinematic model'' describes the Doppler shifts of the blue- and redshifted Hα lines as a pair of oppositely directed, precessing jets with speed, $v_j = 0.26c$. We present observations of the SS 433 jets using the Chandra High Energy Transmission Grating Spectrometer (HETGS) with contemporaneous optical and VLBA observations. The X-ray and optical emission line regions are found to be related but not coincident as the optical line emission persists for days while the X-ray emission lines fade in less than 5000 s. The line Doppler shifts from the optical and X-ray lines match well, limiting the time delay between the X-ray emission and optical emission to less than 0.4 days, or less than 3×10^{14} cm apart. While line strengths and continuum levels hardly change, the jet Doppler shifts show aperiodic variations that could result from shocks in interactions with the local environment. These perturbations are consistent with a change in jet direction but not jet speed. The proper motions of the radio knots match the kinematic model in direction but not amplitude if the distance to SS 433 is 5.5 kpc, indicating that its distance should be 4.5 ± 0.2 kpc.the blueshifted jet spectrum is modeled as a multi-temperature thin thermal plasma. We derive constraints on the jet density, finding it to be in the range $10^{10\text{-}13}$ cm^{-3}. Furthermore, there is a clear overabundance of Ni by a factor of about 10 relative to the solar value. This overabundance may have resulted from an unusual supernova that formed the compact object.

Friday, May, 10th 4:00pm

OPS Room 140

Dr. Hermann Marshall

MIT