Title: Multi-wavelength Views of Stellar Energy Feedback

Abstract:

Stars are formed from the interstellar medium (ISM). Once formed, massive stars inject energies into the ISM via UV fluxes, fast stellar winds, and the ultimate supernova explosions. The stellar energy feedback not only ionizes and heats the ISM, but also dynamically structures the ISM. The physical condition changes of the ISM affect subsequent episodes of star formation. The interplay between star formation and energy feedback governs the evolution of a galaxy.

While star formation follows a simple recipe according to the criteria of gravitational instability in the ISM, energy feedback is a much more complex process, as the deposit of stellar energy into thermal or kinetic energy of the ISM depends on the physical conditions of the ISM resulted from previous star formation and energy feedback. On small scales (~10 pc), individual massive stars can photoionize HII regions, blow bubbles, and produce supernova remnants. On larger scales (~100 pc), clustered massive stars can blow superbubbles. On still larger scales (~1000 pc), multiple generations of star formation excavate the ISM into supergiant shells. Within the low-density interiors of these large shell structures, shocks generated by supernovae can remain powerful and accelerate cosmic rays and produce TeV gamma-ray emission.

Our Milky Way galaxy is not optimal for stellar energy feedback studies because of unfavorable viewing angles and large amounts of obscuration and confusion along the Galactic disk. These problems are mitigated in the Large Magellanic Cloud (LMC), a nearly face-on galaxy at a distance of ~50 kpc. In this talk, I will use multi-wavelength observations, from radio to gamma-ray, of the LMC to showcase stellar energy feedback processes and results. The observations were obtained with Hubble Space Telescope, Chandra X-ray Observatory, XMM-Newton X-ray Observatory, Fermi Gamma-Ray Observatory, Far UV Spectroscopic Explorer, and Cerro Tololo Inter-American Observatory.