

Physics Department Seminar

Feb. 28, Friday at 2 PM in SCI 250

Bubble Bubble Toil and Trouble: Experimenting within the Cauldron of Mira Variable Atmospheres

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Mira variables are highly evolved, low-to-intermediate mass stars characterized by cool atmospheres and regular pulsations every 100-500 days that loft material into their surrounding circumstellar environments. Shocks generated from these pulsations continually perturb the enriched atmospheres, creating a cauldron of dust and molecules that serves as an excellent laboratory to study a plethora of astrophysical phenomena such as molecule formation, grain formation, dust production, shock chemistry, stellar winds, mass-loss, opacity driven pulsation, and shocks. This “bubble bubble” nature of Mira atmospheres that makes them so appealing to study, also introduces “toil and trouble” into designing observations and experiments within the cauldron. The dust and molecules are best studied at wavelengths that range from quite-difficult-to-impossible for ground-based



instruments, and their dynamic nature requires long-term monitoring to reveal time-dependent characteristics.

I will discuss 2 experiments that I am heavily involved in that were designed to study pulsation and how it affects the surrounding circumstellar environment. The Palomar Testbed Interferometer (PTI), monitored the angular diameters of ~ 100 Miras for a decade to reveal how the pulsation physically alters the size (and shape) of the star and surrounding layers (Figure 1). A subset of 25 of these Miras were also monitored for a year with the Spitzer Space Telescope’s Infrared Spectrograph (IRS) to spectroscopically study phase-dependent behavior in the dust and molecules (Figure 2). Combining both long-baseline interferometry and spectroscopy provides unprecedented access to regions of the atmosphere that are notoriously difficult to study.

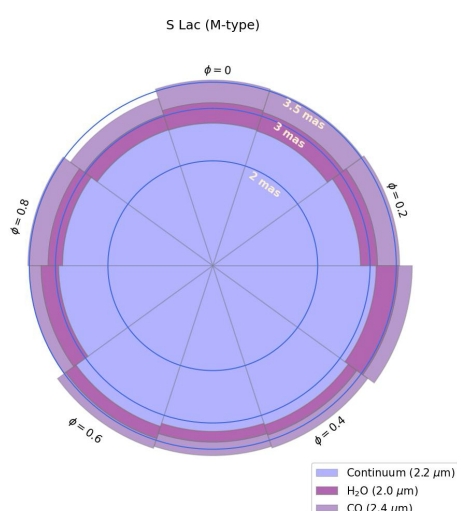


Figure 1.

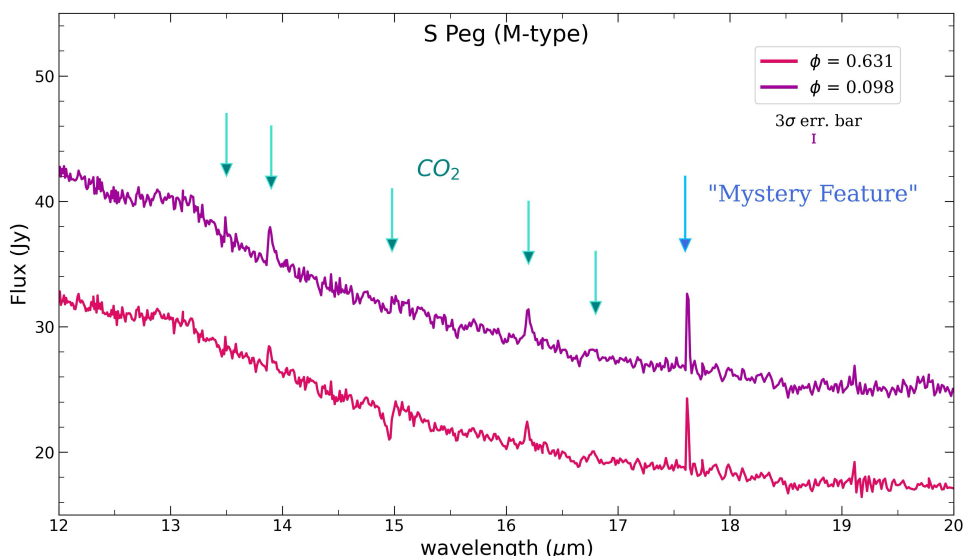


Figure 2.