Supervisor: Dr. Shazrene Mohamed (SAAO)

Stellar winds are ubiquitous and one of the primary channels through which stars lose mass and return nuclear enriched material to galaxies. For runaway stars moving supersonically through the interstellar medium (ISM), the collision of the stellar wind with the surrounding gas produces a bow shock. Stellar winds also play an important role in the mass exchange process for a wide range of binary systems, from symbiotic binaries that consist of a mass-losing giant and a white dwarf or neutron star, to high mass X-ray binaries where the donor is a massive star and the accretor is a black hole or neutron star.

In both single and binary systems, stellar winds produce complex circumstellar structures and in the majority of cases strongly effect the evolution of the system. In this project, the latest and most detailed hydrodynamic and radiative transfer codes will be used to investigate, e.g., the formation of chemically peculiar stars; the shaping of asymmetric planetary nebulae; and to understand the progenitors of type Ia supernovae.

Honours: Students will complete a literature review on stellar winds and the smoothed particle hydrodynamics method. They will then analyse and use plotting tools to visualize and make animations of the most recent supercomputer simulations of stellar wind interactions.

Masters: In addition to the above, students will combine hydro-code simulations with post-processing radiative transfer tools to compare the models to observations.

PhD: Students will run supercomputer simulations to investigate the formation of circumstellar structures around single and binary stars, and wind mass transfer in binaries.

For this project students must be comfortable with basic unix/linux commands, and python and/or C/Fortran programming experience will also be very useful. Please email me for further details and to make arrangements to discuss the project.

Email: shazrene@saao.ac.za
Office: SAAO, Main Building, west wing, ground floor : UCT, RW James 5.33