# SALT Slit-Mask IFU for Nearby Galaxy Studies: Design, development and commissioning of a fibre slit-mask integral-field unit for SALT prime-focus spectrograph

Type: PhD project (Instrumentation/Observational analysis)

Supervisor: Prof. M. Bershady

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Requirement: Masters degree in astronomy or a closely aligned field.

Key words: astronomical instrumentation; slit-mask integral-field unit lead.

*Description:* We seek applicants to undertake a three-year Ph.D. program with Prof. M. Bershady, co-leading the design, construction and commissioning of a two-dimensional fibre array (integral field unit, or IFU) for the Southern African Large Telescope prime-focus spectrograph. The IFU will be designed for mapping the stellar and ionized gas content and kinematics of galaxies; it will be ideally suited for follow-up of relatively nearby galaxies observed in HI-imaging surveys with MeerKAT for analyzing their stellar populations, dark-matter content, and dynamics. The instrument also will have broader application to nebular spectroscopy. The specific design will be driven by a science case developed by the Ph.D. candidate and Bershady. The instrumentation development will be carried out in parallel with an observational program using existing instruments (e.g., SpUpNic on the 1.9m or RSS on SALT) that motivates and informs the IFU development. This relatively simple and small instrument is perfect for candidates who wish to learn about instrumentation and who have plans for a career path in industry or a research institution.

*Project scope:* The Ph.D. project will include (1) high-level design of the fibre slit-mask IFU based on specific science requirements established by the candidate and their supervisor; (2) implementation of opto-mechanical assemblies, mounts and fixtures based on an existing design; (3) establishing and executing assembly and termination protocols for the fibre-optics and their bonding to micro-prisms; (5) assembling a fibre-optic test-facility and developing the software interface for data acquisition; (6) characterizing the IFU in the lab with this test-facility student and masters student on the development and calibration of the FTF; and (7) commissioning the instrument on-sky in the Robert Stobie Spectrograph on SALT to complete a pilot program demonstrating science performance. In parallel with the above the student also undertake an observational program using SAAO facilities in Sutherland. The completed dissertation will describe the instrument and its performance, the results of the observational program, and the results of pilot observations. The thesis will be suitable for publication in two or more peer-reviewed articles.

The student will work closely with Prof M. Bershady (SAAO SARChI), his research team of observers and instrumentalists, members of the SAAO Machine Shop, as well as other members of the SAAO technical and science staff. The student will

have the opportunity to travel to UWisc where the companion slit-mask IFU is being made and observe with existing IFUs.

*Detailed requirements:* Applicants need not have a background in astronomical instrumentation or fibre optics; knowledge of astronomy and geometric optics at the undergraduate level is required; completion of a Masters program in astronomy or a closely aligned field is required; an interest to learn laboratory skill with fibre-optics and opto-mechanics is required.