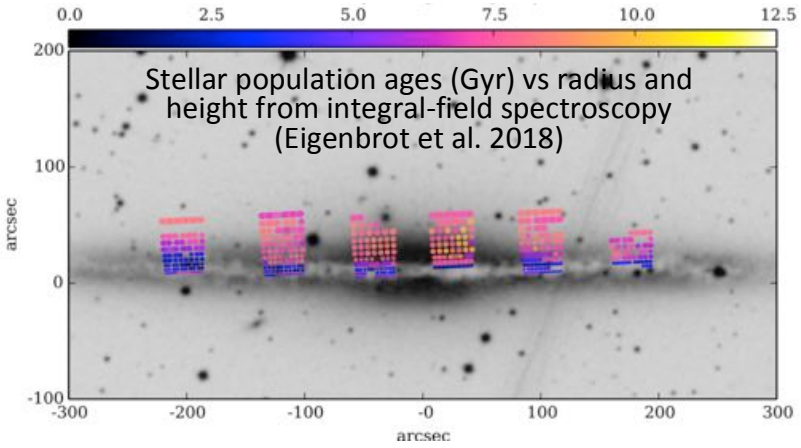
FIVE FUNDED* RESEARCH POSITIONS - 2019

http://www.saao.ac.za/~matthew/

OBSERVATION Sub-GROUP:

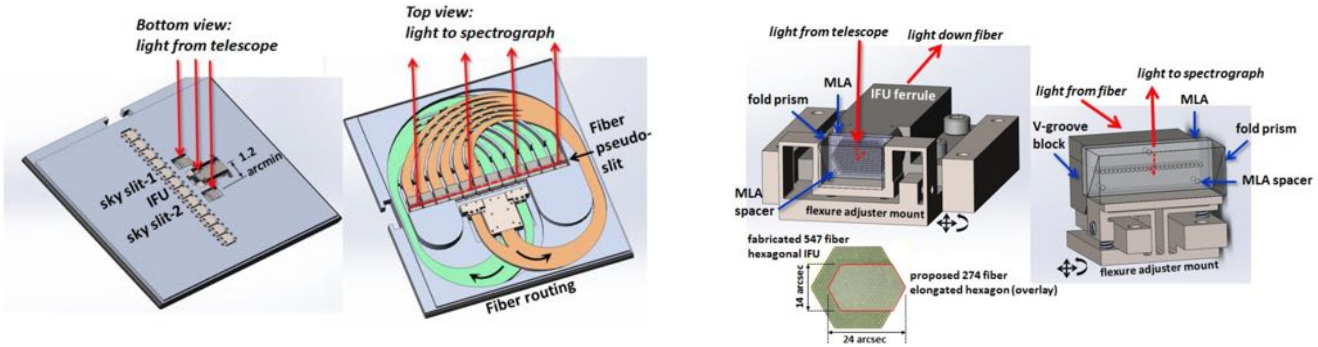
1. Masters (MSc, 1 year): *Exploring extreme star-forming galaxies for SALT in the Sloan Digital Sky Survey*
2. Masters (MSc,1 year): *HI masses of extreme star-forming galaxies in HI deep-fields*
3. Ph.D. (3 years): *Vertical structure evolution of spiral galaxy disks using optical and near-infrared integral field spectroscopy*



Stellar population ages (Gyr) vs radius and height from integral-field spectroscopy (Eigenbrot et al. 2018)

INSTRUMENT Sub-GROUP:

4. Masters (1 year) (MSc or MTech): *Design and development of fibre-optic test facility*
5. Ph.D. (3 years): *Design, development and commissioning of a fibre slit-mask integral-field unit for SALT prime-focus spectrograph*



Fibre slit-mask IFU for SALT (Smith et al. 2016)

*__Professor Bershady__ is a South African Research Chair (__SARChI__) located at SAAO, and cross-appointed at the University of Cape Town and the University of Wisconsin-Madison. **Inquiries and applications should be sent to mab@saao.az.za**.

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ASTRO-OBSERVATION projects

Masters Position-1:

Exploring extreme star-forming galaxies for SALT in the Sloan Digital Sky Survey

Funding Period: 2019

Funding Amount: R120 000pa

Requirement: Degree (BSc) in astronomy, astrophysics, or physics.

Closing Date: 22 February 2019

***key words**: galaxy evolution; extreme star-forming galaxies; co-moving star-formation rate*

Description: We seek applicants to undertake a Honors project to identify a rare and enigmatic class of star-forming galaxies that contribute substantially to the evolution of the moving star-formation rate. These galaxies – called Luminous Compact Blue Galaxies (LCBGs) – will be found based on their colors, luminosity and size in the deep multi-epoch imaging in Stripe 82 of the Sloan Digital Sky Survey. The outcome of the project will be a publishable catalog of targets suitable for future follow-up with the Southern African Large Telescope.

Students wishing to take on this program at the Masters level will use this sample (a) to estimate the evolution of the LCBG co-moving space-density; and/or (b) co-write and submit a SALT observing proposal on which the student will be a Co-I to follow up these targets with the High Resolution Spectrograph (HRS). Students who wish to go on to do a Ph.D. program may apply in following years to build from this program to reduce and analyze the HRS data to characterize how their mass, stellar winds, and metallicity evolve with cosmic time.

The student will work with Prof M Bershady (SAAO SARChI), his research team of observers and instrumentalists, and collaborators around the world.

Requirements: Applicants need to have successfully completed an undergraduate degree (BSc) in astronomy, astrophysics, or physics. Basic programming skills, e.g., python, are needed.

Application: A statement of interest, curriculum vitae, and at least one letter of recommendation from a professional engineer, Ph.D. research scientist or faculty should be sent to mab@saao.ac.za (Matthew Bershady).

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ASTRO-OBSERVATION projects

Masters Position-2:

HI masses of extreme star-forming galaxies in HI deep-fields

Funding Period: 2019

Funding Amount: R120 000pa

Requirement: Degree (BSc) in astronomy, astrophysics, or physics.

Closing Date: 22 February 2019

key words: *galaxy evolution; extreme star-forming galaxies; neutral hydrogen mass*

Description: We seek applicants to undertake a one-year Masters program to stack radio data-cubes from the CHILES eVLA deep-field to detect neutral hydrogen (HI) emission from a rare, but enigmatic sample pf star-forming galaxies. These galaxies – called Luminous Compact Blue Galaxies (LCBGs) – contribute substantially to the evolution of the co-moving star-formation rate. This project will be the first attempt to measure their neutral hydrogen mass at intermediate redshifts.

Students who wish to go on to do a Ph.D. program may apply in following years to build from this program (a) to identify and stack HI data-cubes in the MeerKAT/LADUMA survey to extend the HI mass measurement to higher redshifts; and/or (b) to stack edge-on galaxies in either CHILES or LADUMA surveys to estimate neutral-hydrogen and dynamical masses.

The student will work with Prof M Bershady (SAAO SARChI), his research team of observers and instrumentalists, and collaborators around the world.

Requirements: Applicants need to have successfully completed an undergraduate degree (BSc) in astronomy, astrophysics, or physics. Basic programming skills, e.g., python, are needed.

Application: A statement of interest, curriculum vitae, and at least one letter of recommendation from a professional engineer, Ph.D. research scientist or faculty should be sent to mab@saao.ac.za (Matthew Bershady).

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ASTRO-OBSERVATION projects

Ph.D. Position-3:

Vertical structure evolution of spiral galaxy disks using optical and near-infrared integral field spectroscopy

Funding Period: (2019-2021)
Funding Amount: R180 000 pa
Requirement: Masters program (MSc) in astronomy or astrophysics.
Closing Date: 22 February 2019
key words*: galaxy structure and evolution; edge-on galaxies; Milky Way counterparts*

Description: We seek applicants to undertake a three-year Ph.D. program to measure the vertical stellar age gradients and kinematics in nearby, edge-on galaxy disks that look similar to the Milky Way. The observational component involves obtaining new integral-field spectroscopy (IFS) in the visible and near-infrared. Analysis includes applying simple dynamical models with different star-formation histories to match both the observed distribution of mass and the vertical stratification of stellar populations. The scientific aim of this program will be to determine if the Milky Way is a typical spiral galaxy, and provide constraints on the possible ways in which stars are formed and assembled in galaxy disks.

Project Scope: In the first year of the program the student will work with public integral-field spectroscopic data from SDSS-IV/MaNGA. In the second and third year of the program the student will take their own observations of very nearby galaxies using new integral-field units for the visible and near-infrared spectrographs on SALT and/or existing facilities at the WIYN 3.5m telescope. These data will be used to measure the gas and stellar velocities as a function of radius and height. Neutral hydrogen or molecular (CO) data, where available, will be used to supplement optical data in regions of high extinction. As time and launch-schedule permits, the student will propose for and analyze near- and mid-infrared spectroscopy from the James Webb Space Telescope to extend observations to higher redshift.

The student will work with Prof M Bershady (SAAO SARChI), his research team of observers and instrumentalists, and collaborators around the world. Bershady also serves as Project Scientist for SDSS-IV, and has access to the WIYN 3.5m telescope through the UWisc. The student will have the opportunity to travel to UWisc.

Requirements: Applicants need to have successfully completed an undergraduate degree (BSc) and Masters program (MSc) in astronomy or astrophysics. Basic programming skills, e.g., python, are needed.

Application: A statement of interest, curriculum vitae, and at least two letters of recommendation from a professional engineer, Ph.D. research scientist, or faculty should be sent to mab@saao.ac.za (Matthew Bershady).

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ASTRO-INSTRUMENT projects

Masters Position-4:

Design and development of fibre-optic test facility

Funding Period: (2019)

Funding Amount: R120 000pa

Requirement: Degree in a related discipline and interest and ability to learn about relevant elements of these disciplines is required

Closing Date: 22 February 2019

key words: *astronomical instrumentation or mechanical engineering; fibre-optic test facility development and construction lead; slit-mask integral-field unit design.*

Description: We seek applicants to undertake a one-year Masters project on *co-leading* the design and construction of a fibre-optic test facility for next-generation, high-performance astronomical instruments for the Southern African Large Telescope and other telescopes at the South African Astronomical Observatory in Sutherland. The fibre-optic test facility will be a bench-top optical laboratory instrument assembled and used in Cape Town to evaluate a two-dimensional fibre array (integral field unit, or IFU) built for the Southern African Large Telescope prime-focus spectrograph.

Project scope: The Masters project will include high-level design and layout of the fibre-optic test facility; co-mentoring the honors/bursary student in custom-design of lens and fibre optical mounts and motion stages; co-mentoring the honors/bursary student in the integration and alignment of commercial and custom-designed mounts and stages into the fibre-optic test facility; and developing the commercial CCD/CMOS hardware and software interface. As time and funding permits, the project may include the design of micro-prism mounts and alignment jigs for the slit-mask IFU, and travel to the University of Wisconsin where an earlier-generation fibre-optic test facility exists.

The student will work with Prof M Bershady (SAAO SARChI), his research team of observers and instrumentalists (including a bursary student working on the same project, and Ph.D. student leading the development of the slit-mask IFU), members of the SAAO Machine Shop, as well as other members of the SAAO technical staff. The successful applicant will define the scope of their program in consultation with Bershady based on their expertise, interests and career goals, and the needs of the project.

Requirements: BSc or BTech degree in a related discipline and interest and ability to learn about relevant elements of these disciplines is required. Applicants need not have a background in astronomical instrumentation or fibre optics; basic knowledge of astronomy and geometric optics is preferred.

Application: A statement of interest, curriculum vitae, and at least one letter of recommendation from a professional engineer, Ph.D. research scientist or faculty should be sent to mab@saao.ac.za (Matthew Bershady).

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ASTRO-INSTRUMENT projects

Ph.D. Position-5:

Design, development and commissioning of a fibre slit-mask integral-field unit for SALT prime-focus spectrograph

Funding Period: (2019-2021)

Funding Amount: R180 000pa

Requirement: Masters program in astronomy a closely aligned field is required.

Closing Date: 22 February 2019

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

Description: We seek applicants to undertake a three-year Ph.D. program *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 to achieve the highest possible spectral resolution while delivering photon-limited performance for the mapping and study of galaxy kinematics traced by stars and ionized gas. The specific design will be driven by a science case developed by the Ph.D. candidate and Bershady. The instrument will be 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. This relatively simple and small instrument is ideal 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 and fabrication of opto-mechanical assemblies, mounts and fixtures based on an existing design for a companion IFU being built at the University of Wisconsin (UWisc); (3) establishing a fibre-polishing protocol to ensure high throughput and low focal-ratio degradation; (4) procurement, assembly and termination of fibres in the slit-mask, including their alignment and bonding fibres to micro-prisms; (5) designing the interface between the IFU and the fibre-optic test facility (FTF); (6) co-mentoring the honors/bursary student and masters student on the development and calibration of the FTF; (7) commissioning the instrument on-sky in the Robert Stobie Spectrograph on SALT to complete a pilot program demonstrating science performance; (8) completing a written dissertation describing both instrument and pilot observations suitable for publication.

The student will work closely with Prof M Bershady (SAAO SARChI), his research team of observers and instrumentalists (including bursary and Masters students building a fibre-optic test facility), 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.

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 a closely aligned field is required; and an interest to learn and undertake laboratory skill with fibre-optics and opto-mechanics is required.

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Application: A statement of interest, curriculum vitae, and at least two letters of recommendation from a professional engineer, Ph.D. research scientist, or faculty should be sent to mab@saao.ac.za (Matthew Bershady).

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