

Two PhD Positions in Observational Astrophysics: Tracing Cometary Evolution with Next-Generation Surveys

Institution: Institute of Astronomy and NAO, Bulgarian Academy of Sciences

Research Group: CLIC – Cometary Life Cycle (Supported by the PROMYS component of the Swiss–Bulgarian Research Programme)

Employment: 100% FTE, fixed-term (3 years)

Start Date: 1st November 2026, or by mutual agreement

Location: Sofia, Bulgaria

The Institute of Astronomy at the Bulgarian Academy of Sciences invites applications for two PhD positions to investigate the evolution of cometary bodies. These positions are part of the CLIC project, funded by the PROMYS component of the Swiss–Bulgarian Research Programme. Our research group aims to build a comprehensive model of the changes experienced by comet nuclei from their formation, through re-entry into the inner solar system, until their gradual end.

Comets are considered fossils of planet formation, carrying invaluable information about the solar system's origins. As they migrate inward, comet nuclei undergo multiple stages of evolution - transitioning from trans-Neptunian objects to Centaurs, and finally to active comets. Throughout this life cycle, they are exposed to diverse evolutionary processes that leave distinct traces on their physical properties, surface characteristics, and composition. While individual evolutionary phases have been studied extensively, a unified model connecting these changes is still missing.

Currently, tracing cometary evolution relies on fragmented observations. Our group will utilize the upcoming wealth of data from the Vera Rubin Observatory's Legacy Survey of Space and Time (LSST), combined with targeted telescope observations, to test hypotheses on comet evolution on a population-wide scale. The PhD candidates will join a multi-disciplinary team, including international collaborators, and will have access to the National Observatory Rozhen, which hosts 2-meter and 1.5-meter optical telescopes.

Position 1: Internal Structure and Fast Rotators

Project Focus: Mining large observational datasets (including the upcoming LSST) to identify fast-rotating comets and Centaurs. Discovering these fast rotators provides strong constraints on the bulk physical properties of cometary nuclei, such as their density and tensile strength. By comparing these properties across different populations - from distant Centaurs to active Jupiter Family Comets (JFCs), the PhD student will help trace the physical changes driven by their ongoing evolution in the solar system.

Position 2: Extreme Shapes and Contact Binaries

Project Focus: Using large photometric datasets to identify objects with large lightcurve amplitudes, which indicate highly elongated or extreme shapes. By analyzing these lightcurves, the candidate will study how cometary shapes evolve as they migrate closer to the Sun. This project will also determine the fraction of contact binaries (bi-lobed objects) across different evolutionary stages, testing long-standing hypotheses about how and where these complex shapes form.

Candidate Profile

Master's degree (or equivalent) in Astrophysics, Physics, Data Science, or a related field.

Strong interest in observational astronomy, data analysis, and tackling large datasets. (Prior experience in planetary science is not required; we welcome applicants who have worked in other areas of astrophysics).

Experience with scientific programming (e.g., Python) and working in Linux/Unix environments.

Fluency in written and spoken English.

A proactive mindset, comfortable working independently while contributing to a collaborative international group.

What We Offer

A fully funded PhD position with a highly competitive academic salary for Bulgaria.

Access to the institute's observational and computing facilities.

A structured research environment with regular international workshops hosted in Bulgaria, providing excellent networking and career development opportunities.

Dedicated funding for travel, international conferences, and research visits with our Swiss and international partners.

Application Process

Please submit your application as a single PDF file to Dr. Rosita Kokotanekova at rkokotanekova@nao-rozhen.org. The application must include:

A brief motivation letter detailing your experience and interests (maximum 2 pages).

A CV, including any past research projects, internships, or publications.

Academic transcripts for your BSc and MSc degrees.

Contact information for two academic referees (to be included within your PDF application).

Important: In addition to the PDF application, two letters of recommendation must be sent directly by your referees to Dr. Rosita Kokotaneckova at rkokotaneckova@nao-rozhen.org before the deadline.

Qualifying applicants will be interviewed and sit an entrance exam (written and oral), which can be taken remotely.

Deadline: Applications will be evaluated on a rolling basis starting immediately. Complete applications (including recommendation letters) received by 30 September 2026 will receive full consideration.

For informal inquiries or any questions regarding the positions and the application process, please contact Dr. Rosita Kokotaneckova at rkokotaneckova@nao-rozhen.org