

Faculty of Science and Engineering

Profile Report: Galaxy Formation, Structure & Evolution / De vorming, evolutie en structuur van Melkwegstelsels

- Discipline: Galaxy Structure, Formation & Evolution
- Level: Tenure-track assistant professor
- Focus domain: research
- FTE: Full time (1,0)

1. Scientific discipline

The discipline is in the broad field of “Galaxy Structure, Formation & Evolution”. One of the main aims of this discipline is to understand how the progenitors of present-day galaxies formed during the first billion years of the universe – from initial conditions set by inflation – and how they structurally evolved via complex physical processes into the wide range of galaxies observed to date, including the Milky Way. The discipline encompasses a broad range of research topics, currently being driven by state-of-the-art (upcoming) ground and space-based observational facilities and numerical simulations, plus data-science tools to interpret their data.

2. Vacancy

The Board of the Faculty opens this position in the context of the “Sectorplannen Astronomy”. The position will be embedded in the Kapteyn Astronomical Institute. The position falls within the framework of ‘Career Paths in Science and Engineering (‘Bèta’s in Banen’ version 5; June 1, 2023). Please see the link for the [criteria and conditions](#).

3. Selection Committee (BAC)

The selection committee consists of:

- Prof. dr. L.V.E. Koopmans (Chair, Scientific Director), RUG
- Prof. dr. M.A.M van de Weijgaert (Education Director, repr. USS), RUG
- Prof. dr. S.C. Trager, RUG
- Prof. dr. K. Caputi [W], RUG
- Prof. dr. E. Starkenburg [W], RUG
- dr. J. Hodge [W], UL
- W. de Roo (MSc student, board member of Sirius A), RUG

Advisors:

- o dr. L. van der Voort (Scientific Coordinator Kapteyn)
- o Femke Postma (HR advisor) **[TBC]**

4. Research area

The candidate's profile should strengthen the research connected to NOVA Network 1 (NW1) “Galaxy

Structure, Formation and Evolution” at the Kapteyn Astronomical Institute. The previous NOVA/Kapteyn evaluations stated that the Institute should create more critical mass in fewer research directions. The Kapteyn Institute has a long and strong history in this research area. Through the Sectorplannen “Astronomy”, Kapteyn plans to strengthen its leading role in galaxy studies, mainly focusing on their formation and evolution over Cosmic time and on the structure and dynamics of galaxies in the nearby Universe, including the Milky Way.

By creating this new position, Kapteyn plans to exploit data/results coming from current (e.g. JWST, Gaia, VLT, LOFAR, ALMA, WEAVE) and upcoming facilities (e.g. Euclid, 4MOST, ELT, SKA). Kapteyn has heavily invested in these facilities over the past decades through the development of instrumentation and science programs, together with the nearby NOVA (optical/IR and sub-mm) labs and with the Dutch Research Council Institutes ASTRON and SRON, with which Kapteyn shares nearly a dozen affiliated staff members.

The position can be observationally and/or modelling/theoretically driven. We aim for a profile that complements research at the other NOVA institutes, ASTRON and SRON. The focus of the new staff member will be on rapidly emerging research areas with a long-term perspective, such as the formation and evolution of galaxies at high and very-high redshifts, detailed structural and dynamical studies of galaxies in the nearby Universe, including the Milky Way, etc., which are strong research directions within Kapteyn.

The new staff member should preferably use or interpret data from the facilities with a significant investment by the Institute and be able to build collaborations within the Institute, NOVA, ASTRON and SRON, and elsewhere.

5. Embedding: institute (and base unit)

The Kapteyn Astronomical Institute consists of a single base unit, and therefore the candidate reports directly to the Scientific Director of the Institute. The institute has a vibrant and currently growing number of 18 (16.8 FTE) scientific staff, including a joint staff member with ASTRON, plus 11 affiliated staff (incl. three Honorary Professors) with ASTRON and SRON. The number of PhD students is approximately 60, and the number of postdocs is approximately 25.

The institute focuses on a number of research domains:

- Galaxy Structure, Formation and Evolution (NW1);
- ISM, Star and Planet formation (NW2);
- Cosmology and Large-Scale Structure (NW1);
- High-Energy Astrophysics and Active Galaxies (more minor research themes; NW1, NW3).

Beyond these domains/themes, substantial staff effort is being put into Advanced instrumentation and software, data science and virtual observatories.

The mission of the Kapteyn Astronomical Institute is to perform front-line research in astronomy, astrophysics and related fields, aided by the presence of NWO-institutes ASTRON and SRON, and to provide an excellent educational environment for both graduate and undergraduate studies. The Institute’s mission and its policy and strategy are closely linked to and partly define the mission of the

Netherlands Research School for Astronomy, NOVA. Research is mainly concentrated on two of three themes of NOVA, namely “formation and evolution of galaxies: from high redshift to the present” and “formation and evolution of stars and planetary systems”. In the process of doing this research, scientific staff members are building several instruments for large-scale facilities, both on the ground and in space. They aim to maximally exploit the existing and upcoming instruments scientifically, reaping the rewards of years of dedicated preparation, and to position themselves in scientific and instrument leadership roles in current (e.g. JWST, Gaia, VLT, LOFAR, ALMA, WEAVE) and future instrumentation (e.g. Euclid, 4MOST, ELT, SKA) and to prepare the next generation of young scientists for a future in science and society through high-quality education at the bachelor, master and PhD levels, closely connected to the research done at the institute.

The excellent reputation of the Kapteyn Astronomical Institute has made it possible to attract promising, high-quality astronomers to the University of Groningen. The facilities that the Institute offers, such as world-class observing facilities (e.g., ESO, La Palma, LOFAR), involvement in space missions (e.g. Gaia, Euclid, JWST), data reduction and computing facilities, instrumentation infrastructure, and scientific environment, make the Kapteyn Astronomical Institute a very attractive institute for astronomical research in the world.

The position connects to and strengthens our research focus on “Galaxy Structure, Formation, and Evolution” and our position within Network 1 of the Netherlands Research School for Astronomy, NOVA. It also strengthens our ties to the NOVA Instrumentation Labs, SRON, ASTRON and JIVE, and opens new national/international funding opportunities.

6. Local and (inter)national position

The NOVA NW1 “Formation and evolution of galaxies: from high redshift to the present” group at the Kapteyn Astronomical Institute at the University of Groningen currently covers expertise on a wide range of sciences related to galaxy structure, formation and evolution, e.g. related to their cosmological context (cosmic web), reionisation, high to low- z galaxy formation and evolution, galaxy kinematics and galactic archaeology. In this, the Institute collaborates with groups in, e.g. Leiden, Amsterdam, Nijmegen, SRON and ASTRON, and internationally with many groups. NOVA, specifically NW1, has strongly invested in the Euclid, ELT, JWST, ALMA, WEAVE/4MOST, and LOFAR/SKA missions and instruments. With this new position, the institute envisions strengthening its exploitation of these upcoming instruments and deepening existing collaborations with Leiden and the nearby SRON and ASTRON institutes. Kapteyn/NOVA will have prime access to the first data from, e.g. Euclid, ELT, WEAVE/4MOST and SKA, enabling a more detailed characterisation of high- z galaxy formation (e.g. with the ELT, JWST, SKA) all the way down to the structure of nearby galaxies including the Milky Way (e.g. with the WEAVE/4MOST instruments).

7. Expected contributions to research

The candidate will be an expert in the field of galaxy structure, formation and evolution. They are expected to be a key player in observationally exploiting data from, e.g. the Euclid, WEAVE/4MOST, JWST, ALMA, LOFAR/SKA, ELT (upcoming) instruments/facilities and/or in numerical simulations and

modelling to interpret such data. The expertise will complement other staff working on galaxy structure, formation and evolution, who focus on topics ranging from, e.g. high-z galaxy formation to nearby galactic archaeology. They are expected to develop an independent research group, obtain substantial external funding to contribute to the Institute's and NOVA NW1 research and sustain an active and competitive research group of PhDs and postdocs.

8. Expected contributions to teaching

The BSc/MSc program Astronomy comprises roughly 300 students. The candidate will be expected to teach (primarily) courses such as the Astronomy Bachelors and Masters programs, especially courses such as *Introduction Astronomy*, *Observational Astronomy*, *Statistics for Astronomy*, *Numerical Methods*, *Physics of Galaxies*, *Cosmology*, *Astrophysical Hydrodynamics*, *Galaxy Formation & Evolution* and *Active Galactic Nuclei*, and develop them further. Other appropriate courses will be taught as needed by the programs. The candidate will also be actively involved in developing new and ongoing courses.

9. Expected contributions to the organisation

The candidate is expected to have an active interest in the running and well-being of the institute and to provide a positive contribution to its management and organisational tasks. At the level of FSE, the candidate will contribute to the organisation of the faculty, for example, by participating in working groups and committees in the fields of teaching, research and management. The candidate will participate in relevant national and international organisations.