

Faculty of Science and Engineering

Profile report: Tenure track assistant professor in experimental tests of symmetries in particle physics

- Discipline: *Experimental particle physics*
- Level: *tenure-track assistant professor*
- Fte: *Full time (1,0)*

1. Scientific discipline

The research field is centered on experimental precision measurements that test symmetries in particle physics.

2. Vacancy

This position is opened by the Board of the Faculty (ref. PT/gl/23/00068) and will be embedded in the Van Swinderen Institute, basic unit the High Energy Frontier. The position falls within the framework of 'Career Paths in Science 4' ('Bèta's in Banen 4'). Please see link for [criteria and conditions](#).

3. Selection committee (BAC)

The selection committee consists of the following members:

- Prof. Daniël Boer (chair, full professor, director of the VSI)
- Prof. Elisabetta Pallante (full professor theoretical physics, RUG)
- Prof. Marcel Merck (full professor experimental particle physics, VU, Maastricht U. and Nikhef)
- Prof. Antonio Pellegrino (honorary professor at VSI, experimental particle physics, Nikhef)
- ... (master student quantum universe, RUG)
- Prof. Diederik Roest (full professor, education director VSI, RUG)
- Prof. Julia Even (associate professor experimental nuclear physics, RUG)

In addition, we add the following advisors to the committee:

- Dr. Kristof de Bruyn (UD, experimental particle physics, RUG)
- Femke Postma (HR advisor for the VSI)

4. Research area

The research area of this position is associated with the Large Hadron Collider beauty (LHCb) experiment located at CERN, the European organisation for nuclear research. The LHCb experiment performs precision measurements of decays of subatomic particles containing a beauty/bottom quark to test the Standard Model (SM) of elementary particle physics and search for signs of physics beyond the Standard Model. Recent experimental results from the LHCb experiment have found puzzling discrepancies with the SM predictions when comparing select decay paths containing electrons, muons or tau leptons with one another. These comparisons test so-called

lepton flavour universality, which forms a cornerstone of the Standard Model. Understanding these discrepancies is a high priority for the high energy particle physics community, and will require additional measurements of related decay paths. The success of these measurements is intricately related to the performance of the LHCb detector and its future upgrade, and in particular its silicon pixel Vertex Locator. To further reduce the statistical uncertainties on LHCb's experimental measurements in the future, more proton-proton collisions need to be analysed simultaneously. This will require the development of new technology relying on picosecond timing information to separate the collisions from one other in both space and time. With this position we aim to strengthen the contribution of the Van Swinderen Institute to the LHCb experiment.

5. Embedding: institute (and base unit)

The aim of the Van Swinderen Institute for Particle Physics and Gravity is to study the fundamental forces of Nature in the Universe, by connecting the physics at the Planck-scale (quantum gravity) via sub-atomic scales (particle physics) to cosmic dimensions. Research in experimental as well as theoretical framework is conducted at three frontiers: the cosmic, high energy and precision frontier. The advertised research position will be embedded in the high energy frontier. Experimental research is conducted locally in precision atomic/molecular physics experiments at low energies, at CERN to study lepton-flavour violation and lepton universality (LHCb Collaboration), and there is participation in the analysis of data from astrophysical observatories, like the Planck satellite and Simons Observatory.

6. Local and (inter)national position

The Van Swinderen Institute, together with the Bernoulli Institute (mathematics) and the Kapteyn Institute (astronomy), coordinates the research theme 'Fundamentals of the Universe' of the Faculty of Science and Engineering. At the national level, the VSI is a university partner of the Dutch National Institute for Subatomic Physics (Nikhef), participating in the Nikhef research portfolio in theoretical particle physics, LHCb, and table-top experiments for particle physics. VSI members participate in the Dutch research school for theoretical physics (DRSTP) and the research school for subatomic physics (OSAF). At the international level, the research conducted at the VSI is part of the experimental efforts at CERN (primarily LHCb, but there is also collaboration with the Alpha experiment and experiments at Isolde). Increasingly the research of the Cosmic Frontier is becoming data driven, opening opportunities to join large international efforts, like the future Laser Interferometer Space Antenna (LISA), the CMB-S4 array, and/or the Einstein Telescope.

7. Expected contributions to research

The candidate will develop a research line that has strong connections to the ongoing activities of the VSI LHCb group. The team contributes both to data analyses and detector development for the LHCb experiment at CERN. The data analysis activities focus on testing lepton flavour universality in the leptonic decays of subatomic

particles that contain a beauty quark. The hardware activities focus on LHCb's Vertex Locator silicon pixel detector and R&D for the next generation of fast silicon pixel detectors, aiming to include picosecond timing information in LHCb's tracking algorithms. The candidate will supervise bachelor, master and graduate students on related research projects. The candidate is expected to obtain a substantial amount of external funding for PhD projects.

8. Expected contributions to teaching

The candidate will contribute to teaching within their expertise in the bachelor and/or master programme of physics, and strengthen the existing programmes with for example courses on fundamental physics and experimental techniques. Upon appointment, depending on experience and formal qualifications to date, the candidate may be required to enter a nationally standardized tertiary teaching skills certification trajectory (BKO or Basis Kwalificatie Onderwijs), successful completion of which is a condition for extensions and tenure.

9. Expected contributions to the organization

The candidate is expected to have an active interest in, and to provide a positive contribution to the management and organizational tasks of the institute. At the level of the FSE, the candidate will contribute to the organization 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 organizations and contribute to the visibility of the institute and the university.