

University of Groningen
Faculty of Mathematics and Natural Sciences
Zernike Institute for Advanced Materials

Profile report: Optical Spectroscopy of Condensed Matter
(optische spectroscopie van gecondenseerde materie)

Discipline: Physics

Appointing level: Full/ Associate professor

Appointment: full time (1.0 fte)

1. Scientific discipline

Optical spectroscopy studies the interaction of matter with light. This scientific discipline provides information about the static and dynamic physical properties of materials at different length and time scales. With the help of electromagnetic radiation, it is not only possible to study the electromagnetic response, but also the transport of energy, charge, and spin carriers in materials. Applications are very broad ranging from photonics, quantum communication to optoelectronics. In this broad field the candidate is an experimental scientist.

2. Vacancy

This position is opened by the board of the Faculty of Mathematics and Natural Sciences (FMNS, 13/00778) and will be embedded within the Zernike Institute for Advanced Materials.

3. Selection committee (BAC)

Prof. C.H. van der Wal, scientific director of the Zernike Institute for Advanced Materials and professor Physics of Quantum Devices,

Prof. J. Knoester, professor Theoretical Physics

Ms. Prof. M. A. Loi, professor Photophysics and OptoElectronics

Prof. R.A. Hoekstra, professor Experimental Atomic Physics

Ms. Prof. P. Rudolf, professor Experimental Solid State Physics and director Graduate School of Science

Prof. H. Bakker, External member, professor Ultrafast Spectroscopy, AMOLF

Student member

Dr. J.P. Birkner (advisor, scientific coordinator Zernike Institute)

Ms. A. van der Woude (advisor, Human Resources)

3. Short description

Optical spectroscopy is an active research field that studies the electronic properties, the excitation dynamics and the structure of materials. The past decade has witnessed exciting developments in optical spectroscopy, both in extending existing techniques into other wavelength regions, notably the X-ray part of the spectrum, as well as in the development of multidimensional short-pulse techniques that probe excited state correlations both in time and space and the discovery of novel (nonlinear) optical

microscopies, thereby giving unprecedented insight into the origin of physical, chemical, and biological properties of complex materials. A combination of these techniques could allow research in a wide range of energies and time scales. Optical spectroscopy is used for the characterisation of almost any material, but the most relevant study objects for the present position are low-dimensional magnetic materials, transition metal oxides in relation to electromagnetic functionality, organic materials in relation with electron and energy transport, biomaterials or nanomaterials. The candidate is an experimental scientist focussing on optics and whose research interest is to study the fundamental interaction of light with matter, the electronic properties of complex materials particular in relation with energy, charge, and spin transport.

The physics groups at the University of Groningen (RUG), embedded in the Zernike Institute for Advanced Materials, pursue research activities ranging from theory, modelling, surface science, microscopy, spectroscopy, transport phenomena to device fabrication and are leading global players in their fields.

4. Discipline and external situation

The University of Groningen has a long tradition of excellent research in the field of optical spectroscopy. It has focused on a wide range of materials ranging from strongly correlated electron systems, water, aggregates of molecules, organic semiconductors, or organic-inorganic hybrids and supramolecular systems. In order to address fundamental questions of these materials, close collaborations exist with the theory groups of the Zernike Institute (e.g. prof.dr. J. Knoester, prof.dr. R. Broer and prof.dr. S.J. Marrink). Collaborative relations and scientific exchange with other experimental groups with interest in the discipline (e.g. prof.dr. M. A. Loi, prof.dr. C. H. van der Wal, prof.dr W. R. Roos, dr. T.M. Cordes, dr. M. Pchenitnikov and Dr. R. Tobey) inside the Zernike Institute are expected.

Optical spectroscopy has an enormous impact because it reveals dynamics of energy, charge and spin degrees of freedom on microscopic length and time scales and has strong relations with various technologies including light-harvesting, imaging, communication (photonics), data processing/storage and (medical) diagnostics. Possibilities for industrial collaborations are highly desirable and appreciated.

At the national level there are several very active research groups in the field, specifically at the AMOLF Institute in Amsterdam, TUEindhoven, TUDelft, VU Amsterdam, University of Amsterdam, RU Nijmegen.

The main national sources for funding research on optical spectroscopy are administrated by Netherlands Organization for Scientific Research (NWO) through its foundations for Physics (FOM), chemistry division (CW) and Technical Sciences (STW). International research programs administrated by the European Union are another source for funding.

5. Research group and institute

The Optical spectroscopy group is expected to have a synergic relation not only with the other Zernike Institute groups working on light-matter interaction but also with groups focusing on the synthesis of new materials, device fabrication and theory.

Intra-Institute collaborations are encouraged and (when possible) financed.

6. Expected contributions to research

The candidate is expected to initiate and develop a research program in the field of Optical Spectroscopy of Condensed Matter.

The research should have a visibility on the national and worldwide level and lead to publications in top journals. The research is expected to cross-fertilize the existing research within the institute and should lead to a strengthening of the international reputation of the group and the institute.

Obtaining substantial external funding is crucial. Supervision of PhD students is an important part of the research activities. The research is expected to strengthen the existing efforts within the Zernike Institute in the field of optical spectroscopy of condensed matter and to take an international leadership role.

7. Expected contributions to teaching

The candidate is expected to contribute to the teaching in the bachelor and master degree programs within the Undergraduate and Graduate Schools of Science as well as to the Topmaster program Nanoscience, organized by the Zernike Institute.

She/he is expected to participate in the teaching program of specialized courses in relation to optical spectroscopy and other related topics.

Furthermore, the candidate will be involved in supervising bachelor, master and PhD students.

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 promotion to a higher rank.

8. Expected contributions to the organisation

The candidate is expected to play a role in the general organization of research within the faculty and the institute. Furthermore, contributions to existing and new teaching programs are expected, as well as to the management of education.

9. Career perspective

The position will be offered as a full or associate professorship according to the document "Career Paths in the Sciences" of the faculty (www.rug.nl/fwn/careerpathsinscience).