

## Division of Information and Communication Sciences

### Discipline Profile – Physics: Teaching and Research Staff<sup>1</sup>

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#### Overview of the Physics Discipline

Physics is fundamental to all the natural sciences and plays a central role in the development of new technologies. Together, theoretical and experimental research, investigate basic questions about the intrinsic laws of the universe. The results of this research are applied to interdisciplinary fields and to practical use. Physics is a core discipline for all science and technology students, and challenges students to explore the underlying principles of all physical phenomena as well as to develop analytic and problem solving skills, good laboratory techniques, numerical analysis, and technical writing and oral communication skills. A solid grounding in science is also important for all graduates not just those in the sciences. In particular, as technology plays a greater role in society and the economy, technological and scientific literacy is of increasing importance.

Macquarie University's Department of Physics has great strengths including:

- a highly motivated and well-qualified staff who are enthusiastic about and committed to the subject of physics and its related areas;
- high quality and innovative approaches to teaching;
- an international reputation for excellent research;
- a number of research-only staff, working either on their own fellowship research or on projects led by other staff;
- strong links and collaborations with other universities nationally and internationally, government research organizations and industry; and
- outstanding dedication and contributions to Macquarie University.

#### Expectations for Teaching, Scholarship, Research and Service

Members of staff are not expected to be equally involved in each of the activities described below, but it is expected that each staff member balances less activity in some areas by greater activity in others. Individual members of staff may also develop activities not explicitly mentioned, which contribute significantly to the Department.

#### Qualifications

Staff at Associate Lecturer (Level A) would be appointed with at least a good Honours or Masters (Research) degree, and with prospects for award of a PhD. All staff who hold a PhD degree or equivalent shall be appointed at Level A.6 or higher. Additionally, two or more years of postdoctoral research or teaching experience is normally expected for Lecturer (Level B) and above. At least some teaching experience or research student supervision at tertiary level is also expected for appointment at Level B and above. For appointment at Senior Lecturer (Level C) and above, lecturing and course development experience is expected.

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<sup>1</sup> This document deals with expectations for Teaching and Research staff. A separate document: 'Discipline profile – Physics: Research-Only Staff' deals with expectations for Research-Only staff.

## Research and Scholarship

Physics research at Macquarie University is well respected nationally and internationally, and the Department is recognized within the University for its research areas of excellence. The Physics department is the site of two nodes of ARC funded Centres of Excellence: Centre for Quantum Computing Technology and Centre for Ultrahighbandwidth Devices for Optical Systems. The Department is also home to the Centre for Lasers and Applications and other highly successful research groups and individual researchers.

Research and scholarship in physics are demonstrated by at least one of the following:

- carrying out and publishing individual and team research;
- reflection and preparation for research;
- writing articles and other publications;
- scholarship and research for teaching;
- research in teaching (in line with the University's mission of research-based teaching);
- undertaking higher research degrees or appropriate qualifications;
- submitting research and teaching development proposals;
- research management; research supervision, including supervision of research students;
- consulting and forging industry links; presenting scholarly papers, addresses to conferences;
- editing journals and books;
- refereeing/reviewing grant proposals, journal articles and theses;
- professional development for research and scholarly activity; and
- travel associated with this work.

The outcomes of many of these activities are difficult to quantify, but are none-the-less important. Even less easily measurable is the maintenance of the research, reading and thinking necessary for the development of the scholarly understanding necessary to support the teaching of physics in the Department including the development of undergraduate laboratory work, as well as the growth and development of the individual.

Research productivity in physics is generally measured by the dissemination of new results in internationally peer-reviewed journals and conferences, as well as the production of patents in some cases. Physics publications can include letters and longer articles, however in the physics discipline, letters in publications such as *Physical Review Letters*, *Europhysics Letters*, *Applied Physics Letters*, *Physics Letters*, *Optics Letters*, *Electronics Letters*, *Astrophysical Journal Letters*, *Monthly Notices of the Royal Astronomical Society*, *Astronomy & Astrophysics Letters*, and *Nature* are often regarded as having higher impact than articles and may be seen as evidence of timeliness and importance of the research reported. Joint-authored papers are common, reflecting the collaborative nature of much experimental research in particular. Conventions on the order of authors vary. The publication of monographs is less common in the discipline.

International collaboration is well established in the discipline. Expertise and leadership are recognized by invitations to write major topic reviews, or to give key presentations at conferences and workshops, or editorship of journals or conference proceedings. The rate of publication varies between areas of physics, but an active researcher would be expected to publish one or more articles in peer-reviewed journals annually. A leader of a research team would expect to produce proportionately more publications per year, depending on the number, standard, and experience of the team members. Prolonged lead times are common in experimental work and projects such as astronomical surveys for research purposes, so that

publication rates may be sporadic. Expert assessment is appropriate to assess the quality of the published work, and, for example, journal impact factors vary between different sections of the discipline, depending on the size of the field and conventions for citations.

Other research activities may have outcomes that are not easily measured in terms of publications alone. Such activities include the development and commissioning of instrumentation for collaborative facilities, establishment of new research directions and production of astronomical survey results, which are used by a wider astronomical community. Commercial and collaborative activities such as liaison or consulting with companies or research organisations, and the generation of patents are also valued. External competitive and internal research grants are normally sought for most areas of research in physics. External grants include, for example, ARC Discovery and Linkage grants, and competitively awarded time on experimental facilities such as telescopes. Some staff are able to maintain their research productivity without external funding. Research and Honours student supervision is common in the Department (with a typical enrolment of ~25 postgraduate students and ~5 Honours students at any one time) and the Department values its postgraduate research students highly.

Academic staff at all levels are expected to spend approximately 40% of their time engaged in Research and Scholarship.

For staff at Level A, research activity would be supervised by more senior staff, and might be demonstrated by participation in conferences and workshops, as well as publication of journal articles. Staff would be expected to apply for internal research funding if the opportunity arose. At Level B and above, the staff member would be developing an independent research area. This may be demonstrated for example by senior authorship of journal articles or application for both external and internal research funding. Staff at Level B and above may also supervise Honours and postgraduate research students. Most staff at Level C and above would be expected to have a record of success in attracting funding from external and internal bodies, although it is recognized that not all staff require such funding to be research-active. Staff at Level C and above would be expected to develop a national reputation for their research, which may be demonstrated by any of the following: acting as a peer reviewer for journals or funding bodies, applications for access time on facilities, examination of higher degree theses for other universities, organization of conferences or workshops, giving invited talks at conferences, supervision of completed higher degree or Honours students, or authorship of review articles. Associate Lecturers (Level D) and above would develop an international profile for their research, with an expectation of a high level of research productivity as measured against international standards for the relevant sub-area of the discipline. Such staff are also expected to mentor the research of junior staff in the Department. At Level E, international research leadership and performance in the discipline is expected. Excellence in research leadership may be demonstrated, for example, by organization of international conferences, recognition by professional societies, editorship of leading journals, publication of high impact journal articles and reviews, or leadership of a strong research team.

Scholarship in the discipline is expected of all staff. This may take the form of development of understanding of new areas of physics, synthesis and re-evaluation of existing knowledge, and development of teaching approaches which incorporate new insights into students' learning of physics, including laboratory experiments and classroom teaching. External recognition of such scholarship, by for example, the authorship and publication of research monographs or textbooks, or invitations to review or assist in the development of another University's teaching program, or invitations to speak at workshops or conferences on

teaching developments would be unusual in the discipline, and would be strong evidence of excellence in scholarship at Level C and above.

## **Teaching**

The undergraduate teaching program includes core units and electives leading to a Bachelor of Science degree in Physics, Astronomy and Astrophysics, Mathematical Physics, or a Bachelor of Technology degree in Optoelectronics. Meritorious students can proceed to an Honours degree in these areas. These degrees are all accredited as Physics degrees by the Australian Institute of Physics during regular reviews.

The Department of Physics serves other science students by providing 100 level and 200 level units, and also offers general interest units in the Physical Sciences at 200 level. Above all, the Department strives to make the subject of Physics accessible to students with a wide range of backgrounds and abilities. Some Physics staff have been recognized by the University as Outstanding Teachers.

Teaching staff take great care to prepare and develop teaching material for lectures and tutorials, and to assess and update the material on a continuing basis. Laboratory teaching is particularly important, and the laboratories are well-equipped and supported. Lectures in specialist units at 300 and Honours level are normally taught by staff with research expertise in the particular area. Typical teaching allocations are currently approximately 2 full units of lecturing per year with additional tutorial and laboratory supervision duties. Some units are offered externally, and supporting material for units is often available online.

From time to time the Department engages in major course redevelopment including the introduction of units with entirely new subject content, and introduces new service units to meet the needs of other departments. Innovative approaches to teaching and research on teaching methods within units are also encouraged.

All teaching-and-research staff at all levels are expected to spend approximately 40% of their time devoted to teaching.

Level A staff are expected to supervise laboratories at 100-300 level and to prepare and teach tutorials at 100 level. Such staff would do limited lecturing at 100 or 200 level, or in 300 and 400 level units in the staff member's specialty, and would assist in marking assignments and examinations.

Staff at Level B and above would be expected to prepare and deliver lectures, tutorials and demonstrations in core units to 300 level, and in specialist units at 300 and 400 level, set and mark assignments, essays and laboratory reports, and coordinate units as the opportunity arose. Staff at Level B and above would be responsible for setting and marking examinations, grading and preparing relevant examination documentation. Staff at Level B and above are expected to supervise Honours and postgraduate student research projects.

All staff are expected to supervise laboratory classes at 100 or 200 level, while staff with an experimental research focus are assigned to 300 level laboratories on the basis of their specialist skills. Staff at Level B and above are expected to offer academic advising, preclusions, and to prepare calendar entries, handbooks, quality documentation, and course promotional material as necessary. All staff are expected to seek regular feedback on their teaching performance, to reflect on their teaching and to develop their skills in teaching. All staff provide consultation for students in the units taught.

Staff at Level C and above may convene programs of study, or act as Director of a degree program. Staff at Level C and above might demonstrate outstanding teaching by recognition by external bodies, such as invitations to review other teaching programs and curricula, awards for teaching, or invitations to participate in teaching workshops organized by external bodies. Staff at Level D and above are expected to make a distinguished personal contribution to teaching at all levels.

### **Service to the University and Community**

Service to the Discipline of Physics is encouraged through participation in national or international professional societies (Australian Institute of Physics and other societies such as the Australian Optical Society and the Astronomical Society of Australia, as well as overseas counterparts) and through interactions with schools and teachers. Other service activities may include supervision of work experience students.

Service to Macquarie University takes a number of forms, including participation and leadership of committees, promotion and community outreach, and personnel advising and appointment. Some members of the Department have contributed to the University in unique and personal ways such as the development of the Foundation for Astronomy. The Department of Physics regards itself as an essential component of the University, and strongly encourages staff members to serve the University. Academic staff at all levels are expected to spend approximately 20% of their time engaged in professional activities and administration.

Staff at Level A and above are encouraged to be members of a professional society and to foster students' interest in the discipline. All staff are expected to participate in department and divisional meetings, and to provide administration of all units taught.

Staff at Level B and above are expected to promote the University and its courses to prospective students and to participate in outreach programs for schools as the opportunity arises. Staff at Level B and above manage their research budgets and accounts, and prepare documentation related to their research funding as appropriate. Staff at Level B and above may serve on departmental committees and administer departmental budgets and accounts.

Staff at Level C and above might act as consultants for outside organizations, and might also serve on committees of professional societies. Staff at Level C and above may serve on divisional committees as the opportunity arises, and may also act on selection and promotion committees for academic and general staff. Such staff may act as personnel advisers for junior staff.

Staff at Level D and above might demonstrate leadership in professional societies. Staff at Level D and above may represent the Department or Division at policy-making levels inside or outside the University, and chair committee meetings. Staff at Level E are expected to demonstrate leadership at Division or University level.