



**Maynooth
University**
National University
of Ireland Maynooth

Ollscoil Mhá Nuad

Maynooth University

QUALITY IMPROVEMENT AND ASSURANCE

PEER REVIEW GROUP REPORT

DEPARTMENT OF EXPERIMENTAL PHYSICS

ACADEMIC YEAR 2018/2019

Date: 25th April 2019

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1. Introduction

The Peer Review Group carried out a review of Experimental Physics which is a department within the Faculty of Science and Engineering. The review was based upon a comprehensive self-assessment report provided in advance by the Department and two days of meetings with staff and students from the Department, senior University managers and external stakeholders from academia and industry.

The Department teaches a direct entry B.Sc. degree programme in Physics with Astrophysics, single honours and double honours degrees in Experimental Physics, a double honours degree with Computer Science including an industry placement, Experimental Physics as part of a Science Education programme, and a higher diploma in Applied Physics.

Department staff are active researchers in space terahertz optics, observational astronomy, atmospheric physics, molecular physics and fluid dynamics, with some very significant research outputs.

2. Peer Review Group Members

Name	Affiliation	Role
Prof. Jane Gray	Maynooth University	
Prof. Gregory Connor	Maynooth University	
Dr Mark Lang	NUI Galway	Co-Chair
Prof. Lorraine Hanlon	UCD	Co-Chair

3. Timetable of the site visit

The site visit was carried out on 13th and 14th of March 2019. The timetable is attached as an appendix.

The panel was very satisfied with the timetable and also appreciated having the freedom to request additional meetings.

4. Peer Review Methodology

4.1 Site Visit

The panel very much appreciated the hospitality and courtesy shown by the University and the Department, which facilitated its work. The meeting facilities provided were excellent as was the organisation by the Office of Strategy and Quality. The Physics staff and students were all very open and helpful and engaged fully with the review. The tour of the Department was well organised and informative. Overall the panel found the review process to be an enjoyable experience.

4.2 Preparation of the Peer Review Group Report

The panel members commenced preparation of the report text in the afternoon of the second day of the review. A summary of the main findings was agreed and verbally presented to the Departmental staff. The draft report then went through a number of iterations off-line with all panel members contributing and agreeing the final text.

5. Overall Assessment

5.1 Summary Assessment of the Department

5.1.1. Departmental governance and organisation

The Department is led by a Head of Department who is also the Subject Leader and has been for some time. There is a Departmental committee structure and postgraduate students are represented within the Department Committee, which includes all members of the Department. There is also a staff-student committee which provides a forum through which student views are fed back into the Teaching Sub-Committee. In general, the Department is characterized by a commendable spirit of collegiality and mutual cooperation. This enables staff members to work together flexibly to meet day-to-day challenges.

The allocation of academic workloads is carried out fairly and calibrated according to number of graduate students being supervised and research grants administered.

5.1.2. Teaching, learning, assessment and student feedback

Five BSc undergraduate degrees are offered through the Department, three of which are accredited by Institute of Physics (IOP). One degree (BSc Physics with Astrophysics) is a designated entry programme and one is part of a programme administered by the MU Department of Education. The other three are pursued through the 'omnibus' system of common entry to science. The Department delivers three postgraduate programmes: MSc by research, PhD, and a Higher Diploma in Applied Physics that acts as a qualifier to the MSc.

The Department places a strong value on accreditation of their degree programmes by the Institute of Physics. The strong emphasis on laboratory skills and well-equipped laboratories are vital components of this accreditation.

There is a good mix of appropriate assessment of learning. Formal student evaluations including both centralised Student Evaluation of Learning Experience (SELE) and a paper survey carried out by the Department indicate a high level of student satisfaction with their learning experience. The Department has undertaken to continue administering paper feedback questionnaires to ensure consistency and quality of student feedback.

Members of the academic staff have actively participated in innovation in teaching and learning and have achieved national recognition for excellence in teaching. The Department has been very active and innovative in teaching outreach activities to second level students. The Department organises successful field trips for undergraduate students and has developed a collaboration with Cardiff University that may allow for greater internationalisation in the future.

The Department has been successful in maintaining – and modestly increasing - numbers of undergraduate students in third and fourth year since the last quality review exercise ten years ago.

5.1.3. Research activities and outputs

All academic staff in the department are research active and research is considered a core function of the department.

Current areas of research are: space terahertz optics, including experimental cosmology; molecular physics; atmospheric physics; experimental fluid dynamics and observational astronomy. There is an emphasis on the design, modelling and building of instrumentation in-house.

The €2M in research income (2013-2018) has been almost all into the space terahertz optics group. The majority of funding has been from ESA, with some funding from the EU (FP7) and, more recently, SFI. In addition, the four IRC studentships in the department have been in this group.

Over the last six years, departmental staff have authored and contributed to 130 research publications and 53 published conference proceedings.

Five publications co-authored by departmental staff related to the Planck satellite mission in the journal *Astronomy & Astrophysics* between 2014 and 2016 have garnered more than 17,000 citations in total, according to Astrophysics Data System (ADS).

The challenges facing the department in research are well understood and articulated in the Self-Assessment report. The difficult national funding environment, the lack of critical mass in certain areas of research, the absence of post-docs, heavy teaching loads and the currently low number of post-graduates, are all identified as challenges/threats to sustaining and building on recent research successes and historical strengths.

Expanding international and interdisciplinary collaborations is a priority for the Department in order to address sub-critical mass in certain areas.

5.1.4. Staffing and staff development

The department has six technical staff (one half-time), supporting the department's laboratory and experimental equipment at an excellent professional level. The technical staff feel well supported in their interactions with teaching staff. The panel was particularly impressed with the positive atmosphere of teamwork and flexibility linking the technical staff with one another, and with teaching and administrative staff. The contribution of technical staff is an important component of the enthusiastic and collegial atmosphere which pervades the department.

Career development of technical staff has been good over recent years, with two technical staff earning their doctorates while employed by the department.

The department has one administrative staff member. She has a wide range of tasks and responsibilities, supporting the teaching staff, technical staff, and department-linked students.

The academic staff expressed considerable warmth and enthusiasm for the department; there were no strong complaints regarding teaching staff career development opportunities. However, the teaching loads in the department, particularly after taking into account the department's very careful attention to high-quality laboratory presentation and oversight for students, seem high. Teaching

staff are doing too much teaching by the typical benchmarks of research universities and this is likely impacting research productivity.

5.1.5. Resourcing and Facilities

The Department is doing an excellent job of managing its resources to provide a quality undergraduate programme.

It is housed in a purpose-built building, commissioned in 1998. The panel were impressed with careful and effective use of laboratory space. The facilities are probably maximally used and future growth may require additional space.

One concern of the technical staff is the ageing quality of the equipment inventory in the department, and the growing need for ad hoc technical staff intervention to keep ageing equipment working, often beyond the equipment's natural working life.

The panel noted that the Department contains excellent mechanical and electrical workshop areas.

The Department has an extensive network of computers, including a cluster, and these are essential both for teaching and research. The maintenance of these requires significant effort.

Some significant pieces of research equipment have recently been purchased in the Terahertz area.

An excellent learning space is provided for the final year students, with dedicated desks and computers and a social area.

5.1.6. Internal and external engagement

The engagement of the Department with University supports (e.g. Access office, Library, Campus services) are all viewed positively by Department members. Particular mention was made of the Maths Support Centre, which provides individual tutoring to physics students having difficulty with mathematics.

Physics staff play an active role on University committees, appointments and promotions boards.

There is strong external engagement with other Universities and Institutes. Staff have been members and officers of various professional bodies including the Institute of Physics in Ireland.

5.2 Self-Assessment Report

The self-assessment report provided in advance to the panel was comprehensive in nature, well organised and informative. The panel very much appreciate the level of detail presented in the report and the open and frank style. All staff of the Department and the postgraduate representative played a role in the preparation of the report. The Department commenced the self-assessment process by reviewing the previous 2009 review and improvement plan. Sub-groups were established to draft various sections of the report and discussions took place at fortnightly Departmental Committee meetings. The first draft was circulated at an "away-day" followed by extensive discussions. The panel were impressed with the collective ownership of the report by the Department and satisfied that it is an accurate assessment.

The report is set in the context of the University's strategic plan (2012-2017). There is a detailed profile of the Department followed by a discussion of undergraduate teaching, learning and assessment. Research, scholarship and postgraduate education activities are then analysed. A detailed SWOT analysis is presented for both undergraduate education and research and scholarship. The final section of the report consists of a draft quality improvement plan. There is a sensible strategy to address many of the issues the Department has identified under the headings of teaching learning & assessment, research & scholarship, and management & HR. The plan closes with a vision for the future. The panel generally endorses the improvement plan. However, we suggest that it would have been useful to give some consideration to the possibility of forming a mutually beneficial structured alliance with the Department of Theoretical Physics.

6. Findings of the Peer Review Group: Commendations and Recommendations

6.1 Overview

6.1.1. Department governance and organisation

The current leadership model in the Department has worked well. Much of the management of the teaching programme is devolved to academic and support staff.

The Department should plan for the introduction of a system of fixed-term appointed or elected heads, as is becoming the norm in the sector.

6.1.2. Teaching, learning, assessment and student feedback

The panel was impressed by how positively both undergraduate and postgraduate students spoke about their learning experiences and about the support that they received from members of staff, including academic, technical and administrative staff. Academic staff members demonstrate a high level of commitment to teaching and learning. Postgraduate students who had experience of departments in other universities spoke about the high standards expected at Maynooth and of how much they valued this. The valuable contribution of technical support staff to the quality of teaching and learning was very evident. The effort and engagement of postgraduate students in contributing to teaching was also commented on and valued by the students themselves.

The extent to which fourth year students felt themselves to be an integral part of the Department community and connected to the research activities of staff was also commented on very favourably. Students recognized and valued the 'open-door' policy adopted by all members of academic and administrative staff. Some concern was expressed that the Staff Student Committee could be more effective if meetings were not 'omnibus' – i.e. if there were separate meetings for students in different year groups. Students reported that it was not always clear how student feedback to the Department was acted upon. These concerns could be addressed through small adjustments to the Staff Student Committee.

Some students commented on problems in the level of preparation in Mathematics depending on the pathways followed through the degree programme. The Department recognizes that this might

be an issue and has proposed solutions including liaising with the Departments of Theoretical Physics and Chemistry to discuss the possibility of streamlining teaching of common topics. Regular meetings take place between EP and TP to try to streamline course offerings, but obstacles remain. Some of these are associated with the structure of the omnibus science entry system, but the panel recommends that the Department continue to try to progress this goal. [Note: this was also recommended by the last Quality Peer Review Panel and in the Department response they emphasize a big difference in emphasis between courses taught in the two departments.]

Timetabling constraints leading to very long days for students were noted as a problem both within the Department Self-Assessment Report and by students in their meetings with the panel. Students also noted that occasionally lab work did not align with lectures and this is likely also an issue of facilities, lack of space, lack of multiple sets of apparatus and timetabling. Some undergraduate students expressed a desire for a more integrated and developmental experience across their degree. These problems are likely associated with the reality that the Department is operating 'at capacity,' especially in relation to laboratory teaching.

The comparatively small numbers of academic staff and of post-graduate students available to act as lab demonstrators represents a potential challenge that will require planning for recruitment and to sustain and increase postgraduate numbers in the near to medium term. Staff noted that little University support was available for Masters by Research students, even though the MSc is a useful pathway for students of Experimental Physics. The panel noted with concern the relatively low levels of financial support available to postgraduate students within the university.

The panel noted that there is a high burden of teaching responsibility (3.5-4 lectures per week plus labs) on academic staff.

In the context of very large increases in student numbers in Maynooth University as a whole, there will need to be continued effort to sustain and grow numbers, including through inter-departmental initiatives.

6.1.3. Research activities and outputs

Diversification of funding and exploration of commercialisation opportunities may be routes to growth in certain areas e.g. environmental physics could avail of SEAI or EPA funding streams.

Ireland's membership of ESA and ESO, inter-governmental organisations whose missions directly address areas of research within the Department, provides avenues for enhanced international collaboration, research training opportunities and funded postgraduate studentships (e.g. 1 year at an ESO telescope as part of a PhD).

Efforts to establish interdisciplinary research (and teaching) programmes with other departments in the University should be enabled by institutional supports and more flexible academic/programmatic structures.

Strategic recruitment in terahertz optics technology to maintain critical mass after a senior upcoming retirement is an identified priority for the Department. This is a key research strength not only of the Department, but of the University as a whole and should be planned for accordingly to ensure there is no hiatus or lack of leadership.

Ensuring a new appointee in the area of atmospheric physics would enable the interdisciplinary expansion in the area of climate/environmental science and is a second strategic priority for the

Department, building on existing heritage and opening up new avenues for funding and growth in student numbers.

6.1.4. Staffing and staff development

The technical staff expressed a desire for Maynooth career development courses that had relevance for them. They felt that this had been the case in an earlier period at Maynooth. The Human Resources office in the university should be made aware that career development courses need to cater to technical staff.

The single administrative staff member plays a vital role at the centre of the Department. Given the large number of tasks, there is a clear need for more administrative resources, and perhaps a careful strategic overview regarding the allocation and scope of administrative tasks.

There is a need for a larger research time allocation for teaching staff, though this is contingent upon continued success in attracting postgraduate students (to cover some teaching needs) and upon successful research grant funding.

Taking sabbatical leave did not appear to be a common practice among the academic staff. Such leave is generally considered as very beneficial and the University should explore why this is the case and consider providing greater financial support.

In terms of academic staff numbers, the Department is relatively small by University standards and this poses challenges such as over-dependence on individuals and heavy teaching loads. The panel recommends a more aggressive approach to rationalising similar modules taught by different departments and exploring a closer structured alliance with the Department of Theoretical Physics in order to reach a more sustainable size that could deliver benefits in the longer term e.g. in streamlining programme structures, enhancing research collaborations and growing national competitiveness in strategic areas.

6.1.5. Resourcing and Facilities

We noted that much of the laboratory equipment is now ageing and there are increasing issues with the availability of spare parts. It is kept serviceable by the trojan efforts of the technical staff. Now would be an appropriate time to invest significantly in equipment renewal.

Whereas there are excellent facilities provided for the final year students we recommend that additional seating should be provided for students in other years to facilitate and encourage peer learning.

6.1.6. Internal and external engagement

Wider awareness of physics-focussed job opportunities for students would be beneficial for them in visualising their future careers. Graduates of the Department are in high demand, especially from a nearby multi-national. Graduate skills, such as the ability to think through, diagnose and solve a problem, are valued as essential attributes. Inclusion of techniques from industry such as model-based problem solving, into an element of the undergraduate degree, could enhance future employability and engagement with a broader range of possible employers.

While the lecture timetable is currently carried out centrally, timetabling of labs and tutorials is done locally. This causes some confusion to students and adds workload to Departmental staff. It may be more efficient if all timetabling could be done centrally.

6.1.7. Implementation of recommendations for improvement made in Peer Review Group Report arising from last quality review

The 2009 Peer Review Group Report summarizes its recommendations for improvement in a series of fifteen items classified into the four categories: Teaching, Research, Management and University Procedures. These points are addressed in turn in the 2009 Quality Implementation Plan along with planned actions. Appendix 1 of the current Self-Assessment Report provides a detailed point-by-point discussion of the Quality Implementation Plan and its realized implementation over the last ten years. The department has done an excellent job of responding to the 2009 Peer Review Group Report, and Appendix 1 of the current Self-Assessment Report gives a clear overview of this response.

Some of the critical issues facing the department in 2019 are similar to those in 2009. This does not reflect lack of a response on the part of the department, but rather the endemic nature of some issues and lack of structural supports to address them. The 2009 Peer Review Group Report highlights the problem of deficient mathematics preparedness of some undergraduate physics students, and the need for improvement in the mathematics support services for the department. The issue of uneven mathematical preparedness at the undergraduate level also features in this report (see Section 6.3 below). This endemic issue will always need careful monitoring by the department.

The 2009 Peer Review Group Report puts considerable stress on the need for the department to channel its research efforts into a limited number of common research themes, in order to allow economies of scale in such a small department. Our own Peer Review Group Report makes that same point which is also emphasised in the Department's own strategy for future recruitment.

The 2009 Peer Review Group Report and Quality Implementation Plan were written during a government budget crisis of unprecedented severity. Reflecting this, there is a strong emphasis on cost control in those two documents. We believe that this overriding emphasis on cost control is no longer appropriate for the department in 2019. The new quality implementation plan should be more ambitious and expansive in its plans.

6.2 Commendations

The Peer Review Group commends the achievements and quality of the Department in the following areas:

6.2.1. Leadership, governance and organisation

The current Head of Department has encouraged and supported staff to take on leadership roles. There is a strong sense of collegiality and cooperation among all staff - academic, technical and administrative - which is led from the top.

The Department has subscribed to the Institute of Physics' Juno programme as a 'Supporter' and will apply for 'Practitioner' status by 2021. There is a commitment to gender equality that was evident in interviews with undergraduate students, who declared no negative experiences related to their gender.

The flexibility and cohesion of the technical team is noteworthy, with no demarcation in operation. Staff move between different areas as needs arise and take responsibility for procurement, teaching support and outreach, as well as core technical activities.

6.2.2. Teaching and learning

The main degree programmes for which the Department has sole responsibility are all accredited by the Institute of Physics. The academic staff strive to implement innovative teaching approaches and a coherent learning experience for students that encompasses laboratories, field-work, homework assignments, class tests, tutorials and lectures. The Department's teaching excellence has been recognised with a national 'Teaching Hero' award to a member of staff. The Department plays a notable leadership role in coordinating the University's Certificate in Science programme for mature student entry to Science.

The Department places a high value on laboratory training and invests considerable time and enthusiasm in this work. Undergraduate laboratories are extremely well organised spaces, reflecting the high level of care and attention that they receive. The postgraduate demonstrators receive suitable training and are committed to doing a high-quality job.

Both undergraduate and postgraduate students receive a high level of individual and collective support from the Department. The students benefit from (and appreciate) the open-door policy operated by the staff. The availability of dedicated computers and desk space for each 4th year gives the students a feeling of inclusion within the Department and an identity as 'Physicists.' This contributes to positive learning outcomes and career development.

6.2.3. Research

The space terahertz optics research group is strongly international, connecting the Department to globally leading space missions, such as Planck, and ground-based experiments e.g. QUBIC. The terahertz optics research activity has significant commercialisation potential. All academic staff are research active.

6.2.4. External engagement

The Department has pursued a successful strategy of internationalisation, notably through its collaboration with Cardiff University. The Structured International Option in the BSc (Physics with Astrophysics) allows eligible students to spend a semester at Cardiff University studying Astrophysics exclusively.

The Department has also been active in promoting public understanding of and engagement with science, including through the schools' programme and university outreach events. SFI 'Discover' programme funding for 'Dr. Mindflip's Ultimate Learning Experience' supported the development of an interactive video game about physics that went on tour to reach low-intervention counties and areas.

6.3 Recommendations for Improvement

Institutional/Strategic Recommendations

Number	Recommendation	Additional PRG Comments
1	Support the Department's strategy of targeted advance replacement of academic staff.	
2	Provide additional support for academic staff who wish to take sabbatical leave.	
3	Provide funding for the renewal of lab equipment.	
4	Improve the funding levels for postgraduate teaching scholars to at least bring them in line with the norms across the University sector.	In addition, ensure that scholars have sufficient time to devote to their research.

Recommendations to the Department

Number	Recommendation	Additional PRG Comments
1	Maintain Institute of Physics accreditation and recognition of undergraduate degree courses.	
2	Maintain the strong laboratory component of the undergraduate programmes.	
3	Put formal structures in place to ensure that students in 3 rd and 4 th year have sufficient mathematical skills.	
4	Provide some tutorial support after the 1 st year.	
5	Provide a dedicated physics problem solving class.	
6	Review the current staff-student committee meeting format and provide clarity on when issues have been resolved.	
7	Provide students with some physics-oriented careers guidance.	
8	Associated with the Juno practitioner application process, provide a safe forum for staff and students to raise gender and inclusion related issues.	
9	In advance of the upcoming retirement of a senior academic staff member, recruit a new staff member in the terahertz optics/communications area.	It is preferable that there should be overlap between the new and retiring staff members.
10	Recruit a new academic staff member in the atmospheric physics/climate change area	Again, an advanced replacement ahead of scheduled retirement dates would be advisable.
11	Explore a closer structured alliance with the Department of Theoretical Physics.	One possibility would be retaining the individual discipline identities as two units within a combined School of Physics.

APPENDIX A: EXPERIMENTAL PHYSICS: PEER REVIEW GROUP SITE VISIT TIMETABLE

Date: Tuesday 12 th March		
Time	Description	Venue
19:00	<p>Convening of the Peer Review Group</p> <p>Briefing by: Aidan Mulkeen, Vice President Academic and Registrar PRG agrees a Chair, and discuss the visit Identification of any aspects requiring clarification or additional information</p> <p>Dinner for members of the Peer Review Group, University Executive Member and Faculty Dean</p>	<p>Booked Carton House Hotel at 7pm for 6 people under the name Mulkeen</p> <p>Aidan Mulkeen Ronan Farrell Lorraine Hanlon Mark Lang Greg Connor Jane Gray</p>
Date: Wednesday 13 th March		
Time	Description	Venue
8:30- 9.00	Convening of Peer Review Group	Council Room
9.00-9.45	Professor Anthony Murphy, Head of Department	Council Room
9.45 -10.30	Group meeting with all Department staff (Head of Department recused)	Council Room
10.30-11.00	Refreshments	Council Room
11.00-12.30	Tour of facilities of Department, escorted by HOD	Department
12:30 -13.00	Staff Group 1 (Administrative) Ms Grainne Roche, Departmental Administrator	Council Room
13.00 -14:00	Working Lunch	Reserve Pugin Hall/ Table with service for Quality/4 people
	Meet with Students:	Council Room
14:00 -14:45	Undergraduate Students (8)	
14.45-15.15	Research Postgraduate Students (7)	

15.15-15.30	External Stakeholder/Phonecall Dr Stephen Scully Carlow IT (Collaborator)	Council Room
15.30-16.00	Staff Group 2 (Academic) Dr Frank Mulligan, Senior Lecturer Dr Michael Cawley, Senior Lecturer	Council Room
16.00-16.15	External Stakeholder/Phonecall Ms Elaine Gaughran, Senior Process Engineer, Intel	Council Room
16.15-16.30	Break	Council Room
16.30-17.00	Professor Ray O'Neill, Vice President for Research	Council Room
17:30-18.00	PRG meeting – identification of any areas for clarification and finalisation of tasks for following day	Council Room

Date: Thursday 14 th March		
Time	Description	Venue
9:00-9:30	Convening of Peer Review Group	Council Room
9:30-10:00	Professor Ronan Farrell, Faculty Dean	Council Room
10.00-10.30	Dr Charles Markham, Computer Science Dept	Council Room
10.30-11.00	Staff Group 3 (Academic) Dr Creidhe O'Sullivan, Senior Lecturer Dr Neil Trappe, Senior Lecturer Dr Dan Nickström, Assistant Lecturer	Council Room
11.00-11.30	Refreshments	Council Room
11.30-12.30	Staff Group 4 (Technical) Mr Derek Gleeson, Chief Technical Officer Mr John Kelly, Chief Technical Officer Mr Pat Seery, Senior Technical Officer Dr Ian McAuley, Senior Technical Officer Mr David Watson, Senior Technical Officer Ms Marie Galligan, Senior Technical Officer	Council Room
12.30-13.00	Staff Group 5 (Academic) Dr Marcin Gradziel, Lecturer Dr Peter Van der Burgt, Senior Lecturer	Council Room
13:00-14:00	Working Lunch	Pugin Hall/Reserved Table with service for Quality, 4 people
14.00-14.30	Professor Anthony Murphy, Head of Department	Council Room
14:30-16:30	Preparation of Exit Presentation	Council Room
16:30-17:00	Exit presentation to all departmental staff, made by the Chair of the PRG, summarising the principal commendations and recommendations of the Peer Review Group	Council Room
17:00	Refreshments and Exit of the PRG	Council Room