Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Quality Review of the School of Physics

05-08 November 2024

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Introduction:

This report is the outcome of a review of the School of Physics that took place from 5-8 November, 2024. We would like to extend our sincere gratitude to everyone for the significant time investment in preparing the extensive information and documentation needed for the review, as well as the time taken to meet with all of us. Over the course of a busy few days we met with the Quality Office contacts, the Officers of the College, academic staff, administrative and technical staff, postdoctoral researchers, postgraduate and undergraduate students. The guided tours provided insight into experimental facilities in a Centre, teaching labs of undergraduates, a lecture hall, as well as office space of undergraduate and graduate students. We very much appreciated the open and constructive conversations we were able to have with everyone, which made our job as review panel much easier. All groups displayed a high level of engagement with the review process. We also benefited from excellent organisation by the Quality Office, the School of Physics, the valuable assistance of an Internal Facilitator and the very useful notes summarising our interactions.

Context:

Although the review concentrates on the School of Physics, the wider context of the Irish scientific landscape and the policies of Trinity College Dublin within which the School operates, are integral to its success. Trinity has a distinguished history and a beautiful campus. The University continues to have an internationally prestigious reputation. The central location in Dublin and the historical site has many advantages but also the disadvantages of making structural changes difficult and expensive. Moreover, the cost of living in Dublin is making it more difficult to attract both students and faculty on the current national salary scales. It is clear that there are enormous challenges and constraints coming from the lack of sufficient government investments as well as the overheads on grants not fully covering internal costs.

Trinity has an important responsibility for the society of Ireland, today and in the future. Ireland has transformed from an agriculture-based economy into a highly developed knowledge-based economy with a high-tech industry e.g. in the field of information and communication technology, medical technology and software development. Ireland is the headquarters of major high-tech companies (Apple, EMC and Johnson Controls, Google, Facebook, Twitter, LinkedIn, Amazon, eBay, PayPal and Microsoft.) The overall profile of the Physics School is based upon its core strength in materials science and condensed matter physics, with new taught MSc programs focused on Quantum Science and Energy Science, and a burgeoning Astronomy & Space Science group. This profile along with the choice of focus for the School's competitive Research Centres is consistent with the external requirement to contribute ideas and human

capital to enhance Irish prosperity.

To attract and develop human capital for Ireland, to work most efficiently with local companies, and to pursue world-leading research and excellent teaching, experimental equipment and infrastructure must be maintained at a high level. The quality and reliability of these necessary facilities are currently endangered. The capability of the SoP to compete nationally and internationally (both for funding and for recruiting) will inevitably decline with time without investment in state-of-the-art instrumentation, and the space and buildings appropriate to a modern research environment. Moreover the ambition of the College is to increase student numbers. If the School of Physics is to contribute to this ambition the availability of high-quality lab space must increase.

As the speed of development in the international Physics domain increases, driven in part by the increases in the number of high-level universities in China, India and other parts of the world, the School of Physics will also find it increasingly difficult to be competitive without support from modern digitalization and software and well-trained administrative staff.

Strategy:

A key recommendation of our report is that the School of Physics needs to develop a rolling 5-year strategy for education, hiring and facilities. Better forward planning is needed for retirements, academic jobs, space and equipment. This is to aid coherentthinking and to place the School in a position to respond quickly to funding opportunities. We recommend asking junior academic staff to play a key role in defining this strategy, as they are more likely to think outside the box, and many have more recent international experience so can suggest fresh ideas from elsewhere. Not to mention, it is their future so they will be highly motivated. Furthermore we recommend an overhaul of the records that are kept, as an aid to spotting current and developing areas of concern. Suggestions of useful data are given throughout the report.

The School might also wish to consider a Scientific International Advisory body similar to that considered helpful by the Centres.

ACADEMIC PROGRAMMES

Undergraduate Admissions:

Physics in Ireland is fighting several headwinds in terms of attracting students. Only 11% of secondary students take physics at leaving certificate level. This is the same pool of applicants for the plethora of new engineering and computing degree options throughout Ireland. Moreover, Dublin is expensive, so students will attend universities

nearer home.

The school should keep careful records of applicant numbers to assess whether there is a problem with declining admissions numbers. This will facilitate planning of whether to devote more resources to recruitment. Possible directions to improve recruitment if necessary would be expansion of the Trinity Walton Club or consideration of new degree programmes.

Undergraduates:

Students overall seem to do well coming out of the program, many stay on as PhDs, and there is a general appreciation for the School. The curriculum seems to be sufficient to also segue into PhD positions internationally, despite not being an integrated BSc/MSc. Senior years were in general satisfied with the programme. The laboratory rooms for undergraduate teaching are very well developed and well maintained and supported.

We did, however, hear some complaints from students in the earlier years which should be investigated to see whether there are widespread issues. Firstly it seemed hard to obtain clear data on dropout rates and changes of course. This is important information which should be available for year-on-year comparisons. Secondly a better systemshould be developed for lecture feedback, aiming to design the most useful questions and obtain comments from as many students as possible. The feedback should then be seen by a high-level Physics committee to identify and act on any points of concern. A clear way to collect and process this data, and a policy to post evaluations and the official response, would go a long way to signal to the students that their concerns are being addressed.

Physics should consider:

- Whether the earlier years of the course give sufficient opportunities and time for understanding and problem solving, rather than just teaching to an exam. Assessment based on exams is not required in the Bologna model and other assessments (corrected homework with feedback, projects/reports) could enhance the depth of learning.
- Whether the balance of lectures and problem-solving sessions where the students can receive feedback on difficulties is optimal. There are obvious staffing constraints, but we note below that post-docs are keen on having more teaching opportunities.
- If the syllabus has the right mixture of fundamental physics and more research-led material.
- How the variation in knowledge and ability between different groups of incoming

students can be addressed.
- Whether the material is presented in the right order e.g. so that the mathematics needed to properly appreciate the physics comes early enough.
- If the “Mastering Physics” is helpful for the undergraduates.
- Whether there is good balance between the use of power-point and blackboard/i-pad teaching.
- A maximum in the number of years a lecturer teaches the same course to avoid stagnation of material.
- Checking whether lecturers are encouraged to take training courses, and work within Trinity more generally to ensure that succinct and useful courses are available.

In addition, one significant issue raised from multiple sides during our visit was concern about exam scheduling determined at the College level. To provide students with the necessary time and mental space to review and consolidate complex material, we believe that there should be a minimum of one full week revision period between the end of teaching and the beginning of the exams.

Postgraduate taught programmes:

- The two taught programs in Quantum Science and Energy Science are very successful, attracting significant international registration. Students were very positive about the environment, the social connection within their cohorts, and the feeling of being supported in general.
- Postgraduate taught programmes are becoming increasingly important, both in terms of bringing money into the university and in terms of encouraging graduate student applications. We recommend that serious thought should be given to planning new taught MScs (and modules for PhD students) both within Physics and across the faculty. For example, the panel thought that Data Science/Machine Learning is an important growth area, and a major attractor of national and international students, that could be addressed by a collaboration between Maths, Physics and Computer Science. However we caution that a prerequisite for a new taught degree is enthusiasm from within Physics as there would be an inevitable increase in workload. Many other universities are offering new MSc programmes in this area so care should be made to find a unique spin that also highlights local research expertise that cannot be found elsewhere
- Records should be kept of the number of students and their undergraduate university to assist planning. There may be room to advertise the programmes more widely across Ireland and internationally.

Further points which arose in discussions with the students:

- Students entering the course from non-Trinity backgrounds may appreciate extra support (e.g. preliminary reading assignments per course, additional problem/tutorial sessions particularly at the beginning of the course to fill gaps in preparation). Several students in the taught MScs are coming in from eg. engineering, and do not have a ‘pure physics’ background.
- Female students in both programs mentioned they had no female teachers, whether TAs, in tutorials or in lectures, and they found this discouraging. One commented that alumni/career events arranged locally had 30-40% women in attendance so they also found it non-representative of the field.
- The students appreciate career/networking opportunities. More information about industry internships would be appreciated, and there appeared to be an imbalance of such initiatives, or at least the level of organisation, between the two taught programmes.

Postgraduate research programmes:

- Research students were also very positive about their experience at Trinity. There was an obvious sense of commitment to, and enjoyment of, their research. There was ample evidence that they were treated as “trainee researchers” rather than “useful worker bees”. The large majority of students complete on time, but figures for dropouts and over-runs should be available.
- PhD student numbers were down last year which, if it continues, will have a serious impact on research and TA assistance. This may be due to the high cost of living in Dublin and there are signs of improvement following the recent increase in PhD stipends. Numbers should be monitored closely as good PhDs are vital to the success of Physics.
- Although they feel connected to their own groups, the postgraduate students reported a lack of communication and community building, inside the School and across Schools. This is an inevitable consequence of the diffuse nature of the SoP across several sites, and the School recognises this and is taking steps to address it. Multiple students across groups cited a desire for a “unifying” common space.

Other points which arose in our discussions:

- The School has digitised its PhD administration to reduce administrative burden (which had increased since formalisation of the PhD structure). The whole process of the student journey is now encapsulated in the system, the process is driven by the students, giving them a level of responsibility over their progress. This has proved very successful and is vital in allowing the physics graduate administrator to deal with a large number of students.
- Timing can be a problem in transferring well-educated and talented undergraduates to the postgraduate program. It often takes so long to apply for funding that students have already moved on. For example, the undergraduate final research project takes place in the first semester of the fourth year, and by that time the Irish Research Council application deadline has already passed.
- There is a good range of external seminars, from both academics and industrialists.
- For the research PhD 10 ECTS module/training credits are required. This can be a hollow exercise if no appropriate courses are available. Directing students to a relevant summer school could be a good alternative.
- There are several student seminars each year. All speakers are post-graduate students, and this is required preparation for the viva. Some students said they see this as a waste of time as they do not understand the presentations outside

their own area. The panel completely disagrees, but wonders if an effort can be made to get the students to communicate their research more effectively to a wider audience, and whether the seminars can be linked in some way to the attempts to get graduate students to socialise together?

- Student registration can be a slow process. It can be done online, but approval can take weeks. First year students from abroad have difficulties in waiting for a social security number before payments can be made – this can take months. The students felt that more orientation information would be helpful.
- Finding housing in Dublin is difficult and as much early advice as possible would be helpful. Possibly help with pre-arrival “matching” to facilitate students finding house-mates. Information on an internal School wiki (made available upon acceptance) would be helpful.

Postdocs:

The post-docs echoed many of the points made by the graduate students. The post-docs we talked to were enjoying their research and were well-embedded within their local groups. They do, however, share the same concerns spread across the School at all levels regarding IT, space, administration and research equipment. We note that:

- The post-docs are very supportive of the formation of the Postdoc Academy across the College, and nurturing this, and setting up pathways for interaction with the College Executive is encouraged. Providing a small budget for social activities would be helpful as would providing an informal meeting space (common room) or a lunch space during the vacation for post-docs (and grad students).
- The post-docs would like more opportunities to teach for their career advancement. A more open system of allocating teaching opportunities would be helpful.

RESEARCH AND INFRASTRUCTURE

Research:

The School’s research is impressive. The School’s physics citation impact per university income (Fig 7.5 in SAR) is high. Another metric indicating the success of the research program, is the high average ratio of PGR students and post-docs to 30 academic staff, with significant external funding (in some cases due to smart recruitment) via prestigious ERC, IRC, SFI and URF grants.

There has been success in obtaining external funding for Research Centres CRANN and AMBER. These provide a critical mass promoting high-level research, they facilitate interactions with industry, and aid in the recruitment of PGR students and postdocs and increase the possibility of hiring top-class faculty. Physics and the Research Centres appear to communicate well, particularly given the difficulty of diverse locations.

The reorganisation of Science Foundation Ireland and the Irish Research Council into Research Ireland needs to be watched with care. An advantage could be more opportunity for fields that until now have been ineligible for Science Foundation Ireland grants, like astronomy, but facilitating this may require a national strategy and lobbying. If new opportunities arise, Physics should be ready to exploit them.

Hiring of academic staff has been relatively opportunistic lately; several junior academic staff have been recruited who moved with their ERC Starting Grants and University Research Fellowships. This has proven very successful. However, it is a strategy that can lock in budget without first thinking creatively what else could be done, or paying sufficient attention to how the School will evolve. We think that it is important that the School creates a 5-year rolling strategy to take account of existing and new appointments, and of retirements. Serendipitous hiring should certainly be pursued but should be tensioned against long-term strategy.

Hiring a Research Programme Officer was a strategic decision that has been a great success, facilitating among others 3 ERC Starting Grants. The impact on new grant income should continue to be monitored to facilitate planning.

Space:

Space is a major problem, which is understandable for a university with a campus in the city centre, thus it is all the more important to use and allocate this space efficiently. Physics has been doing their best with what they have but the way the space is located and dispersed is a particular problem. It matters greatly that scientists are co-located as ideas often follow from discussions. Both graduate students and post-docs wish to feel more connected to Physics as a whole, as well as their individual groups, and would appreciate a common area where everyone can come together.

We also note that the desired recruitment of more undergraduates is in tension with space capacity issues, particularly lab space for practicals. Moreover, taught MSc courses are also numbers limited by lab space for projects.

In the short term it would be helpful to:

- Include space issues in a strategic plan to better communicate long-term needs to College, particularly since it is in the College's interest to raise student numbers.
- Think ahead for shorter term space requirements to allow time for requests to be processed.
- For College to overhaul the system of allocating space to allow faster response to requests, and to make transparent processes for space allocation.
- Set up an efficient, Trinity-wide, on-line scheme for room allocation and booking to make it easier to find space for one-off events such as vivas or workshops.
- Better response by building maintenance to critical incidents (e.g. flooding of an important piece of immovable equipment which seriously affects the progression of the graduate students involved in the associated experiments).
- Note that storage space (e.g. of old exam scripts and deliveries) is a problem for admin staff.
- Work towards an atmosphere of trust that promotes space sharing between Schools (as works well in Centres).

Equipment

Ageing equipment is also a major risk. The laboratories are increasingly not state-of-the-art, and this is affecting research, as well as the ability to recruit people and the training of graduate students for future industry roles. We encourage College to continue to develop lines of communication with leading international companies with a foothold in Ireland, who can help lobby the government to support the universities, that in turn train the local pool for companies to recruit. We also encourage the SoP to include a large equipment survey and prioritised "wish-list" in their strategic plan to allow fast response to any funding calls**.**

School Infrastructure:

Workshop: This is very much appreciated by academic staff who think it is vital in terms of specialised knowledge and the ability to get fast solutions when customised parts are needed, at a much better price than a central workshop would provide. An in-house workshop allows working through a project with PIs and students, and hence also provides training to students in how equipment is made. The workshop staff take great pride in their work and enjoy being able to help both teaching labs and researchers. The workshop equipment is, however, very outdated to the extent that even spare parts are not available. Staff do very well with what is available, but a strategic, long-term plan

is needed to work out how to feasibly replace equipment and train staff in use of up-to-date technology. Once new equipment is in place might there be opportunities to sell workshop services outside Physics to help cover costs.

Computing and IT support: Local to central communication for high performance computing is going well. Within the School IT is fully occupied with teaching and admin issues which leave little time for post-doctoral support. On a positive note, the internal structures the School IT have enabled for admin are very much appreciated, and we recommend building on this 'backstage' system to include wiki/living documents aimed at onboarding new staff and students.

Possible improvements include:

- The panel was very surprised by the outdated College VPN policy which appears cumbersome and can make it difficult for people to work from home or while travelling.
- Some experiments are not well connected to an IT infrastructure.
- There are delays in setting up new accounts – we were told that this is a hugely bureaucratic process requiring multiple signatures.
- The external facing website (a pilot from a College reboot) is not up to spec and should be improved as soon as possible.

GOVERNANCE AND ADMINISTRATION

The school is run by an Executive Committee which is large but seems to run very effectively, with consensus-based governance that works.

Academic staff were concerned about the difficulties with space and equipment. They felt that the SoP was sympathetic to the challenges of balancing world-leading research, teaching and administration and lauded recent efforts (e.g. the appointment of a Research Programme Officer). They appeared strongly committed to the success and well-being of their research and undergraduate students. Promotion of academic staff was halted for some period, which led to much dissatisfaction and a feeling of unhealthy levels of internal competition. This seems to have improved with some recent waves of promotions but establishing a clear and transparent scheme for promotions will help reduce any internal tensions.

In general, we were very impressed by the highly motivated and engaged School administrators and technical staff, who are loyal to the school and sympathetic to the academic staff and students. Their input to the School is highly valued by the Executive

Committee and the academic staff in general. The administrative and technical staff appreciate the flexibility they are given for scheduling their work hours around family/care commitments. A major problem is the rapid turn-over of staff, who would prefer to stay but feel that the salary and promotion structure is uncompetitive. This leads to a loss of expertise and the necessity of repeated recruitment and onboarding, which in turn adds to the stress and workload of the remaining staff. The staff recognise that the promotion rules are fixed by the College but suggested that some 'creative' incentives could help sweeten the deal such as extra vacation days or extra training to improve future 'promotability'. In general the staff would like more targeted and progression training opportunities e.g. potentially working towards a PhD for highly skilled technical workers. In several cases training is offered but schedules are prohibitive or certain training is not encouraged by the School.

Although there is obvious collegiality throughout the school, there was some concern about issues with the flow of information between different groups within the School. This has recently improved because of an initiative whereby the School Manager meets administrative staff weekly to keep them updated. Technical staff have similar arrangements. Work is in progress to formalise the appointment of graduate student and post-doc representatives to the Executive Committee (which is seen as very welcoming by these groups).

School administration:

The administrative load on staff and students at all levels is very high and there are problems due to outmoded and cumbersome College processes. A particular point of concern, which we heard from admin staff and research students, was expense claims which are slow and inefficient and appear to be driven by an emphasis on bureaucratic following of rules rather than common sense.

Suggestions:

- Improve systems and documentation on how to claim expenses.
- Secondment/shadowing of staff between related School and College admin departments to gain a better understanding of the frustrations on both sides related to various processes
- Establishing formal positions of responsibility to ensure that decisions/upcoming changes are communicated in a timely way to anyone potentially affected.
- Create a Wiki as part of the 'backstage' environment as the School would benefit from a living document sharing knowledge about areas such as:
    - useful startup advice for new members of the School (one doc per level)

- submitting expense claims
- housing tips
- teaching tips, “crib sheet” on educational structure and requirements
- names of student and postdoc representatives

This Wiki can be populated as a start during staff retreats if they are a day longer to dedicate time to brainstorm

College administration:

College admin on all levels (SITS, finance/reimbursements, room reservations, grades/certifications, risk register) appears to be causing undue stress not only for the School but also for their own admin staff (apparently there is a very high burnout/turnover rate). One gets the impression that things have been running in emergency mode for a long time, leaving no room for a complete restructuring, but the current system is not sustainable, and College should prioritise a concerted drive for better IT systems and more efficient admin processes.
Examples where progress is needed are a new, digital, functional software backend for finance/reimbursements, for room booking and space allocation, and for courses/grading/exams. It will take an upfront financial investment but over the long term will pay for itself in terms of more efficient administration, improve staff/admin morale, and free up more successful research and teaching time for College academic staff. The College Executive Board mentioned this is underway so it would be good to have more direct contact between admins (as suggested above, via secondments).

We recommend:

- Formulating a clear policy on admin request deadlines and a priorisation system. Often admin tasks are sent to School or staff with very short deadlines, and everything is presented as urgent. There is a need to commit to a realistic timeline for admin tasks and institute a prioritisation system (maybe 1 week for urgent, 2 weeks average, 3-4 weeks necessary but not urgent, and ‘nice to have’s’). This should be mirrored for admin tasks sent to College from the School and for in-School admin. We were told that “more senior staff know what they can ignore, whereas new staff do not”.
- That an effort is made to reduce unnecessary documentation and reporting.

Further points that arose from our conversations with staff:

- The Student Administration System (SITS) does not handle custom programmes, particularly for postgrads, so all postgrad marks and results have to be entered manually into records.
- Physics have some exemptions to College regulations on compensation (linked to IoP professional accreditation), so admin staff have to manually alter undergraduate results for publication.
- At year end, when progressing students, any errors have to be formally corrected at Academic Registry; at busy exam times this can be frustrating.
- SITS does not produce digitally verifiable transcript of results upon request, which students increasingly need to apply internationally, and the stress of this need in an already deadline-heavy period is enormous. This process should be automated.

Communications:

A communication strategy should be developed to facilitate the best split of resources between attracting students and fund-raising. Links with industry should be facilitated at both School and College level, as should possible philanthropic avenues. We noted:

- Trinity Walton Club is an exceptional program which has reached almost 7000 pupils in 10 years, forms a cohort of students over several years, serves as a powerful recruitment tool for the School for diverse students, and has found a sustainable model that pays for itself. It also provides important training for local post-graduate students who teach and mentor the TWC cohorts.
- The TYPE program is also very promising. The goal post-covid is to expand from a few days to eventually two weeks, and the capacity could also be expanded as a way to attract more physics undergraduates.
- It is important to continue to grow the relationship with Trinity Access Program to reach more students from disadvantaged backgrounds.
- So far 4 PG scholarships for women (2) and students from the Global South (2) have been funded by industry. We recommend keeping working on industrial links as potential for more recruitment and partnerships, for instance to create structured work experience internships during the project phase since many taught MSc students will want to move directly to industry.
- The telescope is a good opportunity for outreach events (e.g. on issues of dark sky awareness, astrophotography, statistics, can also set up smaller telescopes on stands).
- Pools of ‘outreach TAs’ could be created to help increase capacity for regular local public engagement, which in turn provides the TAs with valuable science communication training
- There may be potential to grow more partnerships via Erasmus
- Pursue international recruitment goals, in tandem with the College.
- There may be opportunities for “circular” investments (scholarships from industry

→ more UG/PG students in STEM → job placements in said companies → strengthening ties with those companies → more scholarships) and chance of larger investments like new equipment.

Diversity:

The School has been working very hard to improve diversity in general, at all levels. The tracking of diversity has mostly focused on gender, and these efforts are already starting to pay off, such as around 30% at the PG student level, which is comparable to the international average in Physics. The academic staff level is still around 10% but expected to keep improving, and most recently there have been several female junior staff recruited who brought grants, and one of the Chair Professorships is now a woman. We commend the School for these improvements, and their achieving an upgrade to Athena Swan Silver status and encourage them to continue, particularly looking at recruiting more women at the senior level. Experience has shown this can make a major difference for the female students and junior staff, as well as aiding in recruiting more diverse candidates. Strategic recruiting via the Sally Chairs or possibly with some industry partnership should be possible (as with Prof. Hess) with a bit of creativity. One suggestion in particular is to join forces with other institutes in the STEM faculty and pool vacancies to create a prestigious prize tenure track fellowship for women, that comes with some startup, and is very broad in scope. Having a centrally supported prize fellowship that is widely advertised will draw attention that you will not get for a single, narrow position. The experience in several countries (see in the NL the Rosalind Franklin (Groningen), the McGillavry (Amsterdam), and in DE the Emmy Noether Fellowship) is that one gets a very impressive pool of applicants.

At the student level we remarked earlier about the 4 PG scholarships from industry, two for women and two for students from the Global South. Such scholarships are a great start and it seems obvious to try to work on industry partnerships to grow the number of scholarships like this to help increase diversity, but then the School has to be ready to support them.

Various EDI training is carried out for the staff, in unconscious bias and at the College level, bystander training, however it is not clear if all support teachers (TAs for labs, tutorials) receive this training, and the students should also receive bias and bystander training. We note this is particularly important given the comments by several female students that they never see female TAs or staff teaching.

The committee also encourages the School to consider axes of diversity beyond gender, such as students from disadvantaged backgrounds, immigration backgrounds, and consider how to recruit and support such students in a more strategic way. Having dedicated conversations about these topics will help raise the comfort level around such discussions and the improved awareness will also improve the feeling of belonging within the School. One could consider a lecture series by experts a few times per year, perhaps Faculty wide to reduce costs.

Summary

1. The School of Physics is performing extremely well across the board despite difficult external circumstances.

2. Better forward planning is needed for retirements, academic jobs, space, equipment, and an internal and external communications strategy. The School of Physics should develop a 5-year rolling strategy with input from across the seniority profile of the academic staff.

3. Space and equipment limitations pose a serious threat to the School. The School and College should work together to try to find innovative solutions.

4. The School should work to strengthen links with Irish industries, to the mutual benefit of both.

5. We recommend that serious thought is given to planning new taught MSc programmes within Physics or as joint initiatives across the faculty.

The reviewers report highlighted a number of recommendations including:

1. The Panel recommends that the School of Physics, with the input of the junior staff within the School develop a rolling 5-year strategy to plan for future staffing needs and resources.
2. The Panel recommends the School review the student records system(s) in place (e.g., applicant numbers, dropout rates, change of course etc.).
3. The Panel recommends that the external facing website is improved and internal staff communications are considered (e.g. new staff orientation etc).
4. The Panel recommends examining the foundational aspects of the undergraduate physics degrees (i.e. balance of foundational physics teaching and research, problem solving opportunities etc).
5. The Panel recommends that the School keep working on industrial links as potential for

more recruitment and partnerships, for instance to create structured work experience internships during the project phase since many taught MSc students will want to move directly to industry.

6. The Panel recommends that thought be given to planning new taught MScs (and modules for PhD students) both within Physics and across the faculty.

Closed comments:

Both the School and the College are obviously working very hard to improve and promote Trinity in difficult external circumstances. Therefore it is unfortunate that there seems to be an 'us vs them' mentality between the School and the College.

Historical actions seemed to rankle for longer than is reasonable (chair application, removing direct entry nanoscience programme, emeriti staff offices, some cross-school space 'borrowing' that didn't go well). The committee noticed a few occasions where the perception of the same event differed significantly between the two groups, and a discussion in good faith might benefit the School going forward and help to develop a mutual understanding of the difficulties faced by both sides.

The paperwork we were sent was overwhelming and must have resulted from considerable effort on the parts of the Quality Office and the SoP. Would it be possible to cut down on this to save unnecessary work? e.g. CVs for individual academics could be replaced by links to their Google Scholar and personal web pages?

School of Physics Response to the External Reviewer's Report

Introduction

On behalf of the School of Physics, I would firstly like to acknowledge the time given and comprehensive work of the external reviewers as part of this review process. The effort and care that they have shown whilst engaging with School's staff and students has been considerable. I also wish to thank them for the quality of their report and the consideration that they have put into the report's development. The report reflects the extensive experience and range of perspectives within the review panel. This has resulted in a thorough review of all aspects of the School's activities and structures.

This report provides an overview of the reviewer's recommendations and the corresponding initial responses from the School of Physics. The range of recommendations chosen for inclusion, deliberately covers various aspects of the school's operations, including general school issues, communication and recruitment strategies, degree programmes, postdoctoral initiatives, staffing, and processes.

Over the coming months, the School will work with relevant college stakeholders to develop an implementation plan that will respond to the reviewer's recommendations in more detail.

School of Physics Strategy and Planning

The School's finances are intrinsically linked to both teaching and learning, and the research activities conducted by the School. Additional activities (degree programmes, research projects, events/outreach) require considerable thought and adequate resourcing (space, infrastructure, workload) to support them. As such, the reviewers recommended the development of a 5-year strategy for the School. This project is already underway and will include a School of Physics staffing plan which is cognisant of expected staff retirements. It is imperative that the backfilling of these positions is completed as soon as possible in order for the School to maintain its current level of activity and performance. It will also include identification of the School's space and infrastructure needs to support School operations.

In addition, the reviewers have recommended the appointment of a scientific advisory panel to the School of Physics. The School Executive Committee notes that the School has many staff who through AMBER and CONNECT memberships have access to their Scientific Advisory panel. The School Executive Committee have discussed a School specific advisory panel, who do not believe that this is currently required but members of the centre advisory panels may be invited to engage with the School through the School's Director of Research.

Staff and Internal Communications

The School acknowledges the reviewers' recommendations to provide enhanced supports for new and existing physics staff. In response, the School plans to roll out a new internal website, signposting relevant processes and providing centrally available information for the School community. This website will also provide guidance on financial processes and the relevant documentation required to complete each step, which was recommended by the review team.

Further work to support a wider School communication strategy will also be considered. This work is likely to include a revamp of the School's website with improved signposting and an investigation of the School's social media presence.

The reviewers report includes a recommendation to provide support staff with increased training opportunities. The School can confirm that support staff are already actively encouraged to seek any relevant training to enhance their knowledge and skills. However, the implementation of staff shadowing is being considered, including shared projects and rotation of event management.

Research Activities and Research Infrastructure

The School's establishment of the Research Funding Manager (previously Research Programme Officer) has been overwhelmingly positive. In their report, the reviewers recommended that the School examine the impact of this appointment. Initial impact analysis on new grant income has shown significant increases in both grant application volume and corresponding funding successes. Traditionally, the School has had significant funding success through national postgraduate funding sources. In recent years, this funding has declined. As recommended by the reviewers, the Research Funding Manager will focus on increasing the existing conversion rate from Research Ireland postgraduate applications to new postgraduate registrations. Finally, the Research Funding Manager regularly engages with national (e.g. Research Ireland) and international funding body representatives. Through these channels, concerns are communicated regarding the timeline of calls and award announcements. It is hoped that this will also lead to greater administrative alignment between the School and the funding bodies.

The School is currently assessing the feasibility of other research administrative supports that can be put in place to increase post research award processes.

The reviewers also acknowledged the School's dependence on aging infrastructure. Both items require significant investment and are directly affected by the national and European funding agenda. Through the Research Funding Manager, it is hoped that the School can identify potential mechanisms to support greater external investment in these areas.

The reviewers highlighted the School's concern over the shortage of space within the School's footprint. It is hoped through the development of the School's 5 year plan, the need for space requests to college can be forecasted and submitted in time to meet the space demands of the School.

Undergraduate and Postgraduate Programmes

During the review process, the reviewers met with both undergraduate and postgraduate representatives, as well as the relevant members of School staff associated with teaching and learning. In addition to the reviewers' recommendations below, the School also notes that its Institute of Physics undergraduate accreditation has been renewed in full up to 30th Dec 2027 (c.f. QC/22-23/045, QC/23-24/024, and QC/23-24/044).

The reviewers highlighted the high standards of the School's undergraduate teaching laboratories, as well as the introduction of the School's Undergraduate Laboratory Coordinator.

The panel asked the School to consider the overall balance of fundamental physics and research-led teaching as well as the time allocated to problem-solving in the School's undergraduate programmes. In response, the School has assembled a committee to examine these recommendations. This committee is expected to propose a number of undergraduate reforms. The committee's recommendations are likely to include structural changes to the freshman years of the degree programmes and the introduction of activities to support fundamental physics learning. These reforms are also in response to the introduction of a new Leaving Certificate Physics curriculum. It is expected that Mastering Physics will remain as the preferred resource for Freshman teaching in 25/26.

The reviewers commented that not all undergraduate students were receiving the required allocation of tutorials associated with their courses. To address this, the Head of School has communicated clear guidelines to all teaching staff. These guidelines include a mandatory tutorial allocation per module.

The reviewers recommended that the School consider their student feedback method. In response, the School is currently rolling out a new digital undergraduate student feedback for all modules in semester 2 24/25. It is expected that this process will be semi-automated. The purpose of this initiative is to support a more comprehensive and transparent student feedback process across the School. This process will be extended to postgraduate taught programmes in the next academic year (25/26).

The reviewers recommended that the School investigate challenges around undergraduate exam scheduling processes. Exam scheduling is administered centrally by Academic Registry which the School is supporting through the provision of exam venues in the SNIAM building. Although the School is invited to advise on exam timetables, ultimate control of the undergraduate exam schedule control lies with Academic Registry.

The reviewers recommended in their report to consider the addition of a new MSc programme. The School has reviewed the feasibility of this but notes that additional activities are resource dependent. However, the School has had recent success with external funding calls (e.g. the Human Capital Initiative and the generation of the School's MSc in Quantum Science & Technology). If a similar funding call becomes available, the School is prepared to consider an application to the call.

As part of the School's structured PhD programme, postgraduate students are required to complete 30 ECTS worth of modules alongside their research. The reviewers expressed concern over the selection of modules available to PhD students and urged the School to consider alternative potential credit bearing research activities (e.g. summer schools, workshops etc). Following this recommendation, the Director of Postgraduate Teaching and Learning will work to implement these suggestions into a revised process.

The reviewers highlighted concerns expressed by the School's postgraduate body about the relevancy of the School's PG seminar programme. In response, the Director of Teaching and Learning (Postgraduate) has produced clearer guidelines and recommendations (content, pitch etc) which have been circulated to the postgraduate community. The School has also revamped its Physics for Teaching Assistants module which is a mandatory component of the 1st year of the structured PhD programme. The module now includes these PG seminar guidelines as well as training on science communication and pitching for scientific and non-scientific audiences.

To further support the School's EDI mission, the module also includes unconscious bias training and teaching for multicultural classrooms.

The reviewers highlighted the need for increased provision of pastoral support to incoming students. The School is currently recruiting a replacement Global Officer, a role that is currently vacant. The remit of this role is to advise incoming international students and researchers on immigration, accommodation and the availability of other relevant college supports. In addition, the School's dedicated MSc course administrators also provide recommended reading lists to incoming MSc students from alternative subject backgrounds to support their integration into the School's MSc programmes.

The reviewers also highlighted the need for a review of record keeping processes particularly in areas such as student completion rates. The School is currently assessing the potential addition of standard operating procedures to support this but acknowledges the constraints of the current IT system in place. Work is also underway to identify additional secure storage for the School's administrative team. The reviewers report highlighted the Schools support staff and praised the School's provision of a bespoke Backstage system for supporting PGR administration.

Postdoctoral supports

The reviewers advised that the School examine the supports provided to the School's postdoctoral researchers. The School has supported the establishment of a new Postdoctoral Commitee and has appointed a postdoctoral representative on the School's Executive Committee. Funding and administrative support for social networking has also been provided. Evaluation of potential postdoctoral teaching opportunities is currently underway and will be rolled out for the 25/26 academic year.

Equality, Diversity and Inclusion

The School was successfully awarded an Athena Swan Silver Award in September 2024. Following from this significant achievement, and review recommendations, the School has extended the remit of the School's EDI Committee. The School has also appointed a Director of Equality, Diversity and Inclusion (EDI) to the School's Executive Committee. The remit of this role will include identifying further mechanisms to enhance the visibility of female role models, to support greater diversity in the School's student recruitment, as well to identify increased social and career networking opportunities for students and researchers.

Outreach

The reviewers acknowledged the success of the Trinity Walton Club in supporting the School's outreach and engagement programme and recommended expansion. Evaluation of the feasibility of this is underway, but additional activities are resource dependent, particularly the availability of space.

Conclusion

The School of Physics continuously strives to deliver its academic and research mission in the best way possible whilst maintaining a diverse and welcoming community. The School of Physics is actively addressing the reviewers feedback and are committed to supporting their recommendations as efficiently and effectively as possible. The School again wishes to extend their thanks to the review team and look forward to engaging with college stakeholders throughout the implementation of their recommendations.

Professor Jonathan Coleman
Head of School

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Response from the Faculty Dean to the Reviewers' Report

First and foremost, I take this opportunity to extend my sincere thanks on behalf of the Faculty, to the members of the expert review panel (Professors Julia Yeomans (Oxford), Sera Markoff (Amsterdam) and Stefan Blügel (Forschungszentrum Jülich & RWTH-Aachen)), the internal facilitator (Professor Cliona O'Farrelly) and staff in the Quality Office. My face-to-face meetings with the entire review team were an invaluable part of the process and helped me to appreciate the evolving thoughts and considerations of the review panel.

The reviewers undertook a comprehensive assessment of all aspects of the School of Physics, meeting academic staff, students, researchers, technical and administrative support teams over 3 days (5-8 November 2024). The result is a forward-thinking and considered external report. This recognises the challenges pertaining to the delivery of high-quality teaching and research in Physics, which is a rapidly moving discipline with multiple components, and one that is dependent on marketing its relevance, state-of-the-art infrastructure and facilities for continued success.

The report is constructed broadly around the separate discussions and viewpoints of students and researchers and looks at the various functions of the school. It draws on some insightful observations and key findings, providing a helpful direction of travel for the school and indeed the wider college. Unusually the panel have described 'the historic' perceptions of some of the groups of stakeholders. In capturing these, they have been able to distil down and articulate within the report practical actions that would help to improve an understanding of and appreciation for the many contributions to the School's current success, and indeed to its future success. A persistent theme therefore within the report are suggestions for building 'a sense of community' and collective purpose.

One such recommendation is that the school plans now for future training and resource requirements and strives to align these with a carefully considered staff recruitment and staff replacement strategy.

This recommendation comes with (i) a clear mandate to encourage junior faculty, many of whom are highly effective researchers, to be active participants in formulating a vision for the school and (ii) a call for data-driven decision-making at school level, to enable it to recognise trends and identify the drivers in important matters such as student recruitment and retention, and to further plan for and mitigate risk. Such local understanding would inform many of the functions of the school, build cohesion and communication channels between stakeholders and serve to unify the school under a shared purpose and implementation plan.

The reviewers speak to the importance of the CRANN Research Institutes and AMBER centre in enabling significant high-profile research outputs to happen and in energising industry engagement. They note the core strengths of the school in Materials Science and Condensed Matter Physics and the new areas of growth in Quantum Science, Energy Science and Astronomy and Space Science. The latter have been enabled by the 'hiring of academic staff [that] has been relatively opportunistic lately' and while applauding the immediate benefits of this strategy the reviewers advise for longer-term thinking and greater anticipation of future needs e.g. via the

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development of a prioritised equipment list, or the modernising/combining of the Physics workshop with similar ones across the faculty. The reviewers recognise where connected thinking might link the desires of some members of the school with the needs of another e.g. providing teaching opportunities for postdoctoral researchers (PDR) within the modules of the structured PhD programme would provide a rich learning experience for both PDR and PhD students alike.

There are many 'nuggets and ideas' throughout this review which are richly deserving of further consideration. The recommendations which range from the specific to the general are at once informative and constructive. Some observations are very interesting e.g. that the call for IRC graduate applications closes before final year capstone projects conclude, and, the evident success of the school-hosted Research Funding Manager. The suggestion that a lunch room should be found during the summer for academic and research staff/students to share is also a simple community-enabling proposition.

Many of the items called-out by the reviewers are relevant to the faculty and college more broadly. The issues around burdensome administrative processes, some of which require manual workarounds are recognisable, as is the development of local 'back-stage' IT processes to support teaching and student needs. Challenges around the flexible and effective use of space are well-made as is the encouragement for College and faculty to develop better lines of communication with external agencies, and international companies, and to garner their support.

In conclusion, this review has informed my thinking and appreciation of the school and the wider context in which it operates. I welcome the reviewers' comments and value their often innovative and perceptive recommendations.

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Appendix 1: Terms of Reference

Terms of Reference for School Quality Reviews

Context: The School of Physics is one of eight Schools that sit under the Faculty of Science, Technology, Engineering and Mathematics (STEM). The School offers academic programmes on the National Qualifications Framework at Level 8 (Honours Bachelors); Level 9 (Postgraduate Taught and Research Masters) and Level 10 (Doctoral programmes).

The School is the lead School in the Physical Sciences stream for Undergraduate Science with moderatorships in (i) Physics; (ii) Physics and Astrophysics and (ii) Nanoscience. The School collaborates with the School of Mathematics on the Theoretical Physics programme. The Physics and Theoretical Physics programmes are accredited by the Institute of Physics, last accredited in September 2022. The School offers two Postgraduate Taught Masters programmes in Energy Science and Quantum Science as well as a suite of opportunities in these Research areas.

In terms of size, the School provides places for 400 full-time undergraduate students and provides service teaching for a further 500 undergraduate students. The School has 30 postgraduate taught students, and 130 postgraduate research students. The School has 29 faculty, many of whom undertake research that is aligned with the Trinity Research Institute CRANN (Centre for Research on Adaptive Nanostructures and Nanodevices) and the SFI-funded Research Centres AMBER (Advanced Materials and BioEngineering Research) and CONNECT (Future Networks and Communications). In addition, some of our postgraduate students carry out their research at the Dublin Institute for Advanced Studies (DIAS) or the Armagh Observatory.

In May 2023, Trinity with industry partners Microsoft, IBM, Horizon Quantum Computing, Algorithmiq and Moody's Analytics launched the Trinity Quantum Alliance (TQA) which aims to be a catalyst for investment in quantum technology in Ireland. This new partnership poses exciting opportunities for the School of Physics.

Purpose of a School Review is to:
(i) to provide a structured opportunity for a School to critically reflect on its activities and plans for development in the context of the school and college strategic plans and other strategic initiatives;

(ii) to benefit from a constructive commentary by reviewers who are external to College and experts in their field at a senior academic level;

(iii) to ensure that quality and standards in teaching, research and administration are ~~being~~ maintained and enhanced, and that any areas of concern are identified and addressed;

(iv) to promote the enhancement of the School's provision as part of a strategy for continuous quality improvement.

Outcomes of a School Review:
The Review Team is invited to assess and make recommendations to the University under the following categories:

(i) School Strategy in terms of its fitness-for-purpose to respond to the College strategies, the internal and external environment, emergent risks and opportunities in the relevant discipline(s), both nationally and internationally.

(ii) The quality of the School's academic programmes and the teaching and learning resources and learning environment (internal and external to campus) that underpin the delivery of:

a. undergraduate programmes, curricula and graduate attributes
b. postgraduate taught programmes, curricula and graduate attributes
c. postgraduate research programmes and outputs
d. postdoctoral development and advancement

(iii) The quality of the School's research and communications strategy, including its participation in and engagement with Research Institutes, Centres and College Research Themes

(iv) The availability, distribution and use of resources within the School to deliver on its academic mission. These might be Physical, Infrastructural, Financial or Human and might involve access to Facilities and/or be related to capacity building.

(v) The effectiveness of the School's governance, management and administration structures in delivering and supporting the achievement of its strategy and mission.