

REF quality standards - UoA9 Physics

An educated guess as to the meaning of the different quality standards in the Physics sub-panel of REF2014.

Class	Prompts	Comments
U	Not research as it would be understood in an external assessment exercise.	We had one U last time with the comment “contained only material in common with another output”. This may have been because we submitted the same output twice (a large ATLAS paper), for different people who had made very distinct contributions. Alternatively it may be that we submitted two papers for one investigator with very similar titles. Conclusion: we need to be cautious.
1*	'Nationally recognised'. Consider – Is there any evidence on which types of output/research were treated as 1* in REF2014?	We had no 1* outputs last time around. It's not something that should bother us - we don't do 1* research.
2*	'Internationally recognised'. Consider – What characteristics does 2* research have in this discipline? (These could be either basic, e.g. the nature of the publication outlet, or substantive, e.g. the way evidence is used at this level.) What defines the boundaries between 1* and 2*, and between 2* and 3*?	The majority of outputs produced in the department are either 2* or 3*. A 2* paper will be published in a refereed journal and will advance the subject but will not be of particular interest, except perhaps to a very specialised audience. It may well lead to a poster or a short, contributed talk at a specialised workshop, but not to an invited talk at a larger conference. In general for our previous submission (except for AMO) whenever we were unsure about the 2*/3* boundary, the true grade was most likely 2*.
3*	'Internationally excellent'. Consider – What characteristics or attributes does 3* research have in this discipline? (These could be fundamental or presentational, clearly-defined or cumulative.) What defines the boundary between 3* and 4*?	The vast majority of our submitted outputs in REF2014 were 3*. To be 3* you need: (i) to have done something genuinely new, not derivative, (ii) to have attracted a substantial number of citations (varies between sub-fields: anything from 5-10 for some theory up to 50-100 for some areas of astronomy), (iii) to have published in a well-regarded journal (see list in Appendix). This work is likely significant enough to be accepted as a contributed talk at an international conference.
4*	'World-leading'. Consider – What does 'world leading' mean in this discipline? Are examples available? What characteristics or attributes does 4* research have in this discipline? (These could be fundamental or presentational). What makes the reader certain that the output merits the highest standard? What defines the boundary between 3* and 4*? Is it realistically possible to have 4* research in all types of output? If not, in which types is it possible?	In the previous REF all papers that we graded 3*/4* seem to have been deemed 3*. A critical analysis suggests that a 4* paper needs to demonstrate something completely new. I think that it cannot be enough to be simply the best at doing something that is already mainstream. In particular, it excludes those publications that: are incremental; demonstrate something new but niche; develop a new technique but do not yet have data to apply it to; have not attracted large numbers of citations. The work is likely to attract offers of plenary talks at international conferences.

Appendices:

- List of Physics journals deemed of sufficient quality for REF.
- *Confidential - available to review on request:* critical analysis of Physics output grades in REF2014.

12-point grading system

In UoA9 (Physics) the panel worked on a 12-point grading system for REF2014. That was then translated onto the *-gradings as follows: 0 - 0*; 1 to 3 - 1*; 4 to 6 - 2*; 7 to 9 - 3*; 10 to 12 - 4*.

Although not official strategy, one panel member commented that it was useful to break that 12 points down into 3 groups of 4 points each, one for each of the three quality indicators of Significance, Originality & Rigour. Within each category the grades roughly translate to: 0 - no worthwhile contribution; 1 - significantly below average; 2 - average; 3 - significantly above average; 4 - outstanding. That leads to the following observations:

- In the absence of anything to mark it out as excellent, an output will be considered average and will score 2/4 in any given category.
- A paper that is average in all 3 respects will therefore end up with an overall score of 6 and be graded 2*.
- To get 4* a paper has to be outstanding one of the three categories and well above average in the other two, or outstanding in two categories and average in the third.

My strong recommendation is that we should follow this 3×4 -point system in our own internal evaluations for many reasons:

- It mimics the internal workings of the panel last time around;
- It focuses our reasoning on each of the three different assessment criteria - should the balance of these be modified then we won't have to start again from scratch;
- Breaking the evaluation up in this way I believe will lead to much more accurate and consistent evaluations;
- We need to rank our outputs on a much finer scale than the 1-4* (in practice 2-4*) that is the final outcome. That is because we need to submit the **best** publications to maximise the chance that the panel assessments will agree with our own. The difference between an output graded 7/12 and 9/12 is huge: the former is in danger of being graded 2* whereas the latter may tip over in 4*. To give them both the same internal grade is to throw away valuable information and risk making an inferior submission.
- Finally, the knowledge that a paper is close to a grade boundary is very valuable for feedback. People will be able to see just what they might need to do to push their papers over that 3*/4* boundary. Moreover, they will learn to consider all three of the assessment criteria rather than focusing on just one or two.

REF-quality (3*/4*) journals: listed by research group. This list is not exhaustive but is an indicator of quality.

- Common to all
 - Nature (in all its various forms)
 - New Journal of Physics
 - Physics Letters B (PLB)
 - Phys.Rev.A. (PRA)
 - Phys.Rev.D. (PRD)
 - Physics Review Letters (PRL)
 - Science
- Astronomy (Astro)
 - Astronomy & Astrophysics (A&A)
 - Astrophysical Journal (ApJ)
 - Monthly Notices of the Royal Astronomical Society (MNRAS)
- Atomic, Molecular & Optical (AMO) / Quantum Technology (QT)
 - International Journal of Quantum Information
 - Quantum Information and Computation (Rinton)
 - NPJ Quantum Information (Nature group)
 - Nanophotonics (de Gruyter)
 - Atoms (MDPI)
 - Photonics (IEEE)
 - Review of scientific instruments (AIP)
- Experimental Particle Physics (EPP)
 - Journal of High Energy Physics (JHEP)
 - European Physical Journal C (EPJC)
 - Journal of Instrumentation (JINST)
 - European Physical Journal D (EPJD)
 - Nuclear Instruments and Methods in Physics Research Section A (NIM A)
- Materials Physics (MatP)
- Review of Scientific Instruments (RSI)
- Theoretical Particle Physics (TPP)
 - Journal of High Energy Physics (JHEP)
 - Journal of Cosmology and Astroparticle Physics (JCAP)
 - Nucl. Phys.
 - European Physical Journal C
 - Computer Physics Communications
 - Journal of Physics G
 - Europhys.Lett. (EPL)
 - Phil.Trans.Roy.Soc.Lond.
 - Class.Quant.Grav.
 - Mod.Phys.Lett.
 - Int.J.Mod.Phys.