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Dear Martin,

**Thesis by Matyas Stanek**

I write in response to your request for an opinion of the Diploma Thesis submitted by Matyas Stanek entitled "Classical and quantum logic operations on OAM superpositions".  I should start by apologising for the delay in sending this to you and I trust that this will not cause any undue difficulties.

The principle idea in the thesis is to suggest ways in which some elementary, but important, mathematical or logic operations can be given physical realisation using the orbital angular momentum of light.  The idea that the, in principle, unbounded spectrum of orbital angular momentum can be used to carry information and perform computations has been known for a long time, but there has been surprisingly little work on the implementation of such computations.  The work presented in this thesis represents an interesting and, perhaps, important step in this direction.  As far as I am aware, is an original contribution and one that, at least in part, should be publishable in the archival literature.

The thesis introduces the orbital angular momentum of light and describes bow it can be generated, manipulated and measured.  This demonstrates a clear knowledge of the essential background and of the key elements of the literature and of the current state of the art.  Chapter 2 introduces the logic operations to be implemented and how they might be realised using some of the components introduced in the first chapter, notably the parity sorter.  The description of these is clear and I have no doubt that these operations should be realisable in the laboratory, although perhaps rather challenging to attempt.  The following chapter discusses the move into the quantum domain and, although also challenging, the analysis here is convincing, both in the mathematical analysis and in the description of technical details.  The thesis is completed by a treatment of real-world practicalities, which I also found to be convincing.

I note that there will be a review stage for Mr Stanek's work and thought to suggest a few questions I would ask him were I present and that you might like to explore with him: (i) It is clear that suitable holograms or spiral phase plates serve to impart on a beam the desired azimuthal phase dependence, but do they actually produce well-behaved beams such as the Laguerre-Gaussian modes? (ii) It's a simple point, but do the elements (in particular the OAM sorter) distinguish between positive and negative values of $l$? If not, how might this be done? (iii) Finally, what additional challenges might an experimenter expect to face in moving from the classical to the quantum regime? These are all quite open-ended questions, but might serve to determine the extent to which Mr Stanek has delved into the subject and understood the subtleties.

Overall the thesis represents a fine piece of work. It is, in my opinion, a thesis of high quality given the stage of the candidate's studies. I note your request for a suggested grade. In response I can state only that a student, at this stage, presenting this thesis for examination in my own Department would certainly qualify for a first-class grade and, for this reason, I am minded to recommend the grade A(excellent).

Yours sincerely

**Professor Stephen M. Barnett FRS FRSE**
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