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This is a letter of recommendation in order to support the application of my graduate student Timothy Hosgood to participate at the conference on applied category theory that will be held in Oxford next summer.

Tim made his undergraduate studies at Oxford and his, in my opinion, a talented and original young mathematician. I gave him a rather difficult PhD project whose main goal is to link very specific constructions of complex geometry related to twisted cochains developed in the 70's / 80's, and more modern topics related to homotopical algebra and derived algebraic geometry. The major part of the geometric part of this project is nearly settled, and Tim works now way more intensively on the categorical side : he has to face a number of concrete of problems (like computing homotopy colimits of complexes of sheaves, or dealing with explicit simplicial categories) in category theory, that are not at all easy. This why I think he would greatly benefit from the material presented at this conference.

Sincerely yours,

Tim Hosgood

January 13, 2019

Background

I wrote one of my masters theses on derived algebraic geometry in the sense of Ton and Vaqui, i.e. using symmetric monoidal categories as ring objects, and so have a reasonable amount of experience with the relevant theory. My other thesis was on formalising a categorical approach to persistent homology and computational algebraic topology. I followed the masters course on category theory in my time at Oxford, and so learnt 'the basics', and have spent a lot of my time over the last few years getting to grips with higher category theory as used by algebraic topologists and geometers. Generally, (higher) category theory very much interests me, and homotopy type theory is one of my biggest side interests (thanks to a long-lived infatuation with Haskell). I've also followed a course on quantum computing (again during my masters at Oxford) and really enjoyed it, but am only mildly aware of the categorical formalism of this.

I should be defending my thesis this calendar year, and its aim is to define Chern classes in Deligne ('holomorphic') cohomology of coherent sheaves on complex-analytic manifolds by using twisting cochains, simplicial differential forms, and other such 'derived algebraic-geometry tools'.

Project Preference

1. Simplifying quantum circuits using the ZX-calculus
2. Traversal optics and profunctors
3. Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces
4. Partial evaluations, the bar construction, and second-order stochastic dominance

5. Toward a mathematical foundation for autopoiesis

6. Complexity classes, computation, and Turing categories

Availability and funding

I would be available to come to Oxford for the 15-26th of July modulo funding problems. It is not impossible that I would be able to obtain funding from my team, but also far from being a given.

Statement

The department of algebraic geometry and topology at Aix-Marseille University is very classical in its focus, and so I would really profit from the chance to interact with other categorically-minded people. In my thesis research I have come across many ideas which would really be better explained if done so in a more nPOV-ish way, and so I would love to able to improve my understanding of actually applied category theory. I am also leaning more and more towards the applications of homotopy theory to programming languages and suchlike, and would relish in the chance to hear more about this. In an ideal world, I would end up in a department with a strong categorical focus, and I really think that this conference would be a good first step towards achieving that.