From: Nicholas Proudfoot <njp@uoregon.edu>
Subject: **CAREER09 reviewer comments**
Date: November 29, 2009 11:16:08 AM PST
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11 Attachments, 0.5 KB

Review #1

Proposal Number:	0950383
Performing Organization:	U of Oregon Eugene
NSF Program:	Algebra,Number Theory,and Combinatorics
Principal Investigator:	Proudfoot, Nicholas J
Proposal Title:	CAREER: Geometric category O and symplectic duality
Rating:	Very Good

REVIEW:

What is the intellectual merit of the proposed activity?

Rating: Very good (high end)

Beilinson and Bernstein showed that a certain category of representations may be interpreted in terms of D-modules on the flag variety. The PI has a beautiful grand picture of how something analogous may be true for more general symplectic varieties. The proposal lays out a large vision of what might be true, and the generosity of that vision means that there is great scope for interesting work. The PI lays out a long series of specific conjectures, most of which are out of reach, but many of which have smaller predictions that the PI (and collaborators) will undoubtedly make significant progress on.

What are the broader impacts of the proposed activity?

Rating: Good to very good.
The main broader impact will be through workshops related to the research program.
This was interesting, but weaker than many of the other proposals reviewed in this regard.

The PI has an active interest in education at many levels, including teaching at the Canada-USA Mathcamp and teaching high school students at Columbia. The PI already has a Ph.D. student, and has written a paper with another Ph.D. student at Oregon.

Summary Statement

The proposal was impressive by both metrics, but was superceded by other proposals. It was roughly in the middle of the proposals I reviewed, but close to those above it, and well above those below it.

Review #2

Proposal Number:	0950383
Performing Organization:	U of Oregon Eugene
NSF Program:	Algebra,Number Theory,and Combinatorics
Principal Investigator:	Proudfoot, Nicholas J
Proposal Title:	CAREER: Geometric category O and symplectic duality
Rating:	Excellent

REVIEW:

What is the intellectual merit of the proposed activity?

Building on the model of the BGG category O and its equivalence with the category of D-modules on the flag variety (via the Beilinson-Bernstein isomorphism), Proudfoot has given a number of important conjectures on an analogous category of sheaves on some symplectic varieties, including Hilbert schemes of ALE spaces, Nakajima quiver varieties and hypertoric varieties. If true, these conjectures will have very interesting representation theoretic consequences; in particular, for the spherical rational Cherednik algebras, finite W-algebras and level-rank duality.

What are the broader impacts of the proposed activity?

Proudfoot proposes to hold annual workshops. The aim of these workshops will be to get the participants to study a collection of papers lying outside their areas of expertise. This will enable them to broaden their horizons.

Summary Statement

Excellent proposal.

Review #3

Proposal Number:	0950383
Performing Organization:	U of Oregon Eugene
NSF Program:	Algebra,Number Theory,and Combinatorics
Principal Investigator:	Proudfoot, Nicholas J
Proposal Title:	CAREER: Geometric category O and symplectic duality
Rating:	Very Good

REVIEW:

What is the intellectual merit of the proposed activity?

This proposal is about the symplectic geometry and representation theory associated to D-modules and the category of representations of a Lie algebra, denoted category \mathcal{O}. Using the cotangent bundle of a variety, the PI intends to study a geometry analog of category \mathcal{O}. He includes 9 concrete conjectures relating this geometric analog with known properties of category O, including generalizing Kirwan' surjectivity theorem, Bialynicki-Birula stratification, homological properties, standard objects, and the standard Koszul property.

The PI also conjectures an analog Schur-Weyl duality for pairs of symplectic varieties. The duality is also conjectured to generalize Langlands duality on Lie groups, Gale duality on toric varieties, and to relate to mirror symmetry in physics (along with 4 more topics).

In addition, he also has projects on geometrization of matroid invariants, intersection cohomology of symplectic quotients, and Nash blow-ups of toric varieties.

The research in this proposal is very impressive, even though it is a bit distant from my field. In total, this proposal includes 19 specific conjectures and appears to unify many areas of the highest caliber research. PI's prior work suggests he is very well suited to attack these problems.

What are the broader impacts of the proposed activity?

Broader impact: proposed activity is a week long workshop for advanced graduate students and postdocs from around the country on current research papers in the intersection of representation theory, algebraic geometry and combinatorics. The intension would be to facilitate the share of ideas between these fields.

PI has prior experience teaching high school students at Mathcamp and the Ross program. Currently, has one graduate student (no name given). Furthermore, PI has organized seminar series on many levels including the "Many Cheerful Facts" seminar at Berkeley.

Summary Statement

The research in this proposal is excellent. However, the education component does not reach down far enough to the younger students in my opinion. The proposed activity is very closely related to the PI's research and will only be accessible by the highest level students. This proposal is better suited for a regular NSF grant.

I recommend funding if possible.

Panel Summary #1

Proposal Number: 0950383

Panel Summary:
Panel Summary

The PI plans to generalize the Beilinson-Bernstein isomorphism to the symplectic setting. The panel felt that this work was very interesting, contained unique ideas, and was potentially transformative. The PI presented a big picture view of the area, presenting 20 something conjectures which could also serve as a road map for future progress. The PI has established a good track record in a very exciting area.

Although the PI presented an interesting proposal for an annual workshop reporting on recent interesting work in the mathematics community, it was felt by some panelists that the PI did not directly address interactions with those at the level of younger graduate students or below. On the other hand, it was noted that the broader impact section as written did not fully reflect what the PI has actually done. In particular, the PI has actively engaged in the organization of many seminars, has a graduate student and has written a paper with another PhD student, and has also interacted with high school students (in mathcamp).

Overall, the panel placed this proposal in the "highest priority for funding" category.

The summary was read by/to the panel and the panel concurred that the summary accurately reflects the panel discussion.