

December 7, 2004

Biocomplexity Faculty Search  
c/o C. Howard  
Department of Physics  
Indiana University  
Swain West 117  
727 East 3rd Street  
Bloomington, IN 47405-7105

Subject: Letter of Recommendation for Dr. Hongxue Cai

Dear Dr. Howard:

I am very pleased to give Hongxue Cai my highest recommendation for a mathematics-intensive faculty-level position. Hongxue has been my coworker for two-and-a-half years, during which time I have developed a great deal of respect for his mathematical ability and his keen approach to problem-solving. He has, for example, a very solid grasp of tensor analysis, and is quite adept at solving complex problems in fluid and solid mechanics. Moreover, Hongxue excels at interpreting physical phenomena in mathematical terms, and is never daunted by challenges. He is adept at learning and developing new techniques, and he is quite good at explaining his methods. Hongxue's achievements and abilities would be impressive if he were a native English speaker; as a Chinese national working in a third language, they are quite remarkable

Hongxue's work is both original and significant; his finite element model of the mammalian cochlea has made, and continues to make, an important contribution to our understanding of sound transduction in hearing. While earlier lumped-parameter models provided a basic overview of cochlear mechanics, one could argue that they generated more questions than they answered. Dr. Cai's model is making important inroads to answering these questions. For instance, on the basis of Hongxue's work, we have presented important evidence of a radial motion of the tectorial membrane. The precise role of this membrane, which is known to be involved in shearing hair cell bundles to transduce sound into neural impulses, has been debated for many years. Dr. Cai's contribution may soon lay these debates to rest.

Creating this advanced model entailed solving many difficult challenges. I am extremely impressed with the fortitude and novel thinking Hongxue exhibited in meeting these challenges. When existing optical flow algorithms failed to resolve the level of motion seen in successive video frames of cochlear motion, Hongxue solved the problem and advanced the field by incorporating 2-dimensional incompressibility constraints to the algorithm. His novel technique now provides a

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heretofore unseen resolution of motion fields, and represents an important advancement in the field of image processing.

Hongxue was already established in the laboratory when I arrived, and was welcoming and open from the start. He is exceptionally easygoing and a pleasure to work with, and is conscientious and considerate. It is difficult not to like Hongxue.

In short, I am convinced that Hongxue has a very bright future, and will continue to make important advancements in any field of scientific or mathematical endeavor to which he applies himself. He enjoys teaching, and is exceptionally approachable; I would have been quite pleased to have had Hongxue as an instructor in my graduate studies. Hongxue is very bright, and is sure to be an asset to Indiana University's Department of Physics.

Sincerely,



Brett Shoelson, Ph.D.

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