CALIFORNIA INSTITUTE OF TECHNOLOGY

THE THOMAS J. WATSON, SR.,
LABORATORIES OF APPLIED PHYSICS 128-95

November 28, 2003

Dear Sir or Madam:

It is a pleasure to write a letter of recommendation for Jordan Gerton. Jordan entered my lab nearly two years ago as a postdoc on a project to investigate near field contrast mechanisms and use that knowledge to build an optical microscope with 10 nanometer resolution. My group has been working in the area of near field microscopy for a number of years; the project had become moribund until Jordan came in and revitalized it. Jordan completely redesigned and rebuilt the apparatus from the ground up, and has succeeding in obtaining world record optical resolution. He has been using the apparatus to make fundamental investigations into the nature of molecule-light-solid state interactions. The results of his work have resolved an outstanding mystery in the field and led to the practical application of creating the first fluorescence microscope whose resolution approaches the molecular length scale.

Our instrument combines an atomic force microscope with a photon-counting optical microscope. By creating an optical interaction between a laser beam, the AFM tip, and the sample, one is able to acquire optical images whose resolution is limited only by the sharpness of the AFM tip – and not by diffraction, as is the case for far-field optics. This field of apertureless near field microscopy has been around for nearly a decade, and has been beset by a number of controversies. First, what is the nature of the contrast mechanism, and how can it be best exploited? Second, (as in all near field microscopy work) what is the true resolution of images obtained in this manner? We designed our instrument to perform systematic studies of potential contrast mechanisms, and discovered that we were able to measure large fluorescence enhancements in the vicinity of the tip via the "lightning rod" effect. Jordan mapped out the enhancement as a function of distance, and was able to definitively show that the data matched a theoretical prediction from the literature. Furthermore, he showed that the effect was sensitive to both the material of the tip and the polarization of the laser. Jordan went on to use this contrast mechanism for optical imaging of semiconductor quantum dots and rods with ~ 10 nanometer resolution – a world record for fluorescence. We have written up these results and a submission to Physical Review Letters is imminent.

Jordan has found his interests moving from pure physics to biophysics, and he expressed a desire to move his focus from studying the basic physics of near field microscopy towards using high resolution microscopy to investigate basic biological problems – in this case, to study the structure and dynamics of proteins involved in cell membranes. Last year he won the Beckman Fellowship to support this research program; this prestigious postdoctoral fellowship was awarded to two scholars after a nation-wide

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application process. It is sponsored by the Beckman Institute at Caltech, whose mission is to promote interdisciplinary research on the interface between biology and other sciences. Jordan used part of his fellowship money to attend a molecular biology "boot camp" last summer, and is full of ideas for how his research can proceed into biophysics, both here at Caltech and as he begins his independent academic career.

Jordan is a very good scientist – he has an excellent grasp of basic physics, great technical skills, a healthy dose of skepticism that leaves no stone unturned, and is an independent thinker. His interpersonal and mentoring skills are also excellent. By combining knowledge from his doctoral research in atomic and optical physics with his new skills in near field microscopy and biophysics, he is poised to make many contributions to biophysics. He would make a great addition to your faculty!

Sincerely,

Stephen Quake
Professor of Applied Physics and Physics
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