Professor Ryu Sasaki
Associate Editor of **Nuclear Physics B [FS]**
Editorial Board Member of **J. Physics A**
YUKAWA INSTITUTE FOR THEORETICAL PHYSICS
Kyoto University
Kyoto 606-8502, Japan
PHONE : +81-75-753-7025
TELEFAX : +81-75-753-7071
E-mail : ryu@yukawa.kyoto-u.ac.jp

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Biocomplexity Faculty Search Committee, c/o Prof. Rob de Ruyter van Steveninck
Department of Physics, Indiana University,
Swain Hall West 117, Bloomington, IN 47405-7105
U.S.A.

To whom it may concern,

It is a great pleasure for me to write a letter of recommendation on behalf of **Andrew Bordner**, who has applied for a Junior Faculty Position in Biocomplexity at your Department. He has a very flexibly thinking mind and has wide interests/expertise in theoretical/mathematical physics and computational mathematics/biology. I am only vaguely aware of his recent activity in theoretical/computational biology. I understand his current research is the development of new algorithms based on the fast multipole method, wavelet analysis and boundary element methods for fast calculation of the electrostatic forces on macro molecules in an ionic solution, which are implemented in C++. Including the current position he has more than eight years of post-doctoral research experience, enough publications of high quality and citations, together with many research travels. I (together with my colleagues, Ed. Corrigan (York, F.R.S.), David Fairlie (Durham).) have been impressed by the clarity of his writing, seminars and explanations of detailed calculations. I strongly believe that he will become a very good researcher/teacher in your group.

At YITP (Yukawa Institute for Theoretical Physics, Kyoto University), Andy became a member of my research group as an N.S.F.-JSPS (Japan Society for Promotion of Science) foreign fellow. He got interested in integrable quantum field theories, in particular, affine Toda field theories and Calogero-Moser models. Low dimensional quantum integrable systems have been a very fruitful area of theoretical physics and contributed a lot for understanding the structure of quantum field theory 'beyond perturbation'. One important characteristics of integrable dynamical systems is the existence of mutually involutive (commuting) conserved quantities as many as the degrees of freedom (Liouville's theorem).

In two years at YITP he produced six papers. In a paper by himself "Commuting charges of quantum KdV and quantum Boussinesq theories from the reduction of W_∞ and $W_{1+\infty}$ algebras", *Mod. Phys. Lett.* **A13** (1998) 541-552. Andy constructed explicitly the infinite number of quantum commuting conserved quantities of the well-known integrable field theories. This will be a major step towards the understanding of the nature of 'Quantum

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(Liouville) Integrability'. The other five papers are on Calogero-Moser models in a series of collaborations with me and others. "I: a new formulation", *Prog. Theor. Phys.* **100** (1998) 1107-1129, (with me and E. Corrigan, F.R.S. (Durham)); "II: Symmetries and Foldings", *Prog. Theor. Phys.* **101**, (1999) 487-518, (with me and K. Takasaki (Kyoto)); "III: Elliptic Potential and Twisting" *Prog. Theor. Phys.* **101**, (1999) 799-829, (with me); " V: Supersymmetry, and Quantum Lax Pair", *Prog. Theor. Phys.* **103** (2000) 463-487 (with me and N. Manton (Cambridge)); "Generalised Calogero-Moser models and universal Lax pair operators" *Prog. Theor. Phys.* **102** (1999) 499-529, (with me and E. Corrigan, F.R.S. (Durham)). The Calogero-Moser models are one-dimensional dynamical systems with long-range interactions. They are completely integrable if the interparticle potential is an elliptic function or its degenerations. The types of the interactions are governed by Lie algebras. We have solved problems of more than twenty years old: proof of the integrability of all models including the one based on E_8 and the unified understanding of all the Lax pairs. We believe this will have an enormous impact on the theory of integrable systems, function theory, etc. He is very good in translating abstract ideas into algorithmic languages so that various hypotheses could be tested by formula manipulating programs. We had to evaluate commutators of big matrices, sometimes 126×126 or 240×240 with function entries, which were made possible only by Andy's programming skills.

I really enjoyed working with him, which is a relatively rare phenomenon with post-docs. I must admit, I do not have a good skill in computation, though I have been in theoretical physics for more than a quarter century after Ph.D. As for simple problems which I can manage, Andy usually makes a computer program in about one fifth of my time and it runs about ten times faster than mine. I do not know how to quantify his algorithmic skills in solving very complicated problems. The joint work owed much to his computational skills.

Andrew Bordner is a hardworking, friendly young physicist/mathematician who interacts well in physics, mathematics and other aspects of life. He speaks Japanese very well (perhaps best among my dozen of foreign post-docs and Ph.D. students) and plays aikido.

Maybe I emphasised too much his ability and talents in theoretical physics. I am sure that the training in basic thinking would be helpful for Andy when he enters a new job, thanks to his quite flexible personality. I recommend Andrew Bordner for the Junior Faculty Position in Biocomplexity at your Department very strongly.

Sincerely yours,

Ryu Sasaki