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פרופי איתמר פרוקציה
חמחלקה לפיסיקה כימית

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Prof. de Ruyter, Head
Biocomplexity Faculty Search
c/o Ms. Yana Teterina
Department of Physics
Indiana University
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Dear Professor de Ruyter,

This is a letter of reference for **Dr. Stefano Boccaletti**.

I have met Dr. Boccaletti for the first time eight years ago, and since then I met him in several international meetings, and I followed his work. During three visits in Firenze five years ago and last year, and in Pamplona three years ago, I had the opportunity to study his work more closely.

In my opinion Dr. Boccaletti is one of the most promising young nonlinear physicists in Europe. He has a very good combination of analytic tools, excellent physical understanding and genuine interest in experiments and in phenomena. These days when much work in nonlinear physics has turned to mathematics it is refreshing to see a burning desire to understand complex physical systems which is combined with the skills necessary to succeed. I believe that Dr. Boccaletti will be an excellent choice for any physics department which seeks an active researcher that is on his way up in achievements and in international reputation.

Dr. Boccaletti's track record is excellent. He started his research career with the study of pattern formation in active nonlinear optics. In a series of papers he presented analysis of experiments that use a ring cavity with a photorefractive crystal on which two incident beams produce a grating which scatters light from the pump to the cavity beam. The control parameter in these experiments is the Fresnel number which governs the effective number of degrees of freedom. One can go from low Fresnel numbers, where only few pure cavity modes are present, to high Fresnel numbers where the pattern is a

superposition of a large number of modes which compete in time to give rise to complex spatio-temporal patterns. Dr. Boccaletti presented interesting analysis of the transition between the two regimes in terms of defect statistics. He could show convincingly that at low Fresnel numbers the patterns are boundary dominated, whereas for large Fresnel numbers they are bulk dominated.

Dr. Boccaletti went on to study pattern formation in nonlinear passive optics. In this case the ring cavity contains a liquid crystal light valve, adding a nonlocal interaction to the effects of diffraction. Using a fiber bundle to rotate the beam one observes coexistence of different patterns with different wavelengths in different spatial domain. To my best knowledge this is the first situation in which such a phenomenon is seen. From my discussions with Boccaletti I got the impression that he is very close to an elegant theory that will give the reasons for this interesting result.

In addition to his work in optics, Dr. Boccaletti was involved also in the study of excitable media. He considered both biological systems and nonlinear active optic devices and showed they exhibit a new type of excitability. The theoretical ideas led to a new experiment in CO₂ laser with intracavity saturable absorber and the results were in good accord with the general theory.

Another subject to which Boccaletti offered important ideas is the control of chaos. His main contribution is a new strategy, which is adaptive, to achieve such a control. He developed an algorithm that is based on a continuous readjustment of the time interval between observations. This approach allows also to discriminate between the deterministic and the random components of chaotic signals. The algorithm was successfully tested on nontrivial chaotic signals, including those with more than one positive Lyapunov exponents. I was impressed by his contributions in this field and invited him to write a review for Physics Reports on the subject. He has done a great job, and the review was very well received.

All in all, we have here a young, active, and successful researcher that made already significant contributions to the field of nonlinear physics. Boccaletti is an excellent speaker, transmitting his ideas with clarity, care and precision. I am sure he will excel as a teacher. If I compare him to his peers in Italy or in Spain, I can say that very few reach his level of excellence. In addition, he is personally charming and dependable, and I would have been very happy to offer him a position in my own Institute. I recommend him to you with very high terms.

Sincerely Yours,


Itamar Procaccia