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Letter of recommendation for Dr. Stefano Boccaletti

Dr. Boccaletti is an extraordinarily productive and very successful young researcher. He has made substantial and original scientific contributions to several important problems on spatio-temporal dynamics of complex systems. His list of publications is outstanding. He has accomplished significantly more than most colleagues in Nonlinear Science who are already of the rank at full Professors. He has published a large number of high quality papers in highest regarded journals, such as Phys. Rev. Lett., Europhys. Lett., Phys. Lett. A, Physica D, Phys. Rev. A and E, Chaos, Opt. Comm., J. Opt. B, Geophys. Rev. Lett. I would like especially to emphasize that he is first author of three large reviews on the following three different topics of *Nonlinear Sciences:* pattern formation, controlling resp. synchronization of nonlinear systems which have been published in the prestigious review journal Physics Reports. His papers have already reached an important impact and they have excited new research in various areas.

Dr. Boccaletti's research is truly interdisciplinary ranging from *Nonlinear Optics* and *Hydrodynamics* to *Ecology* and *Earth Sciences*. The problems on which he has worked are at the forefront of Nonlinear Science. He is very original and has already stimulated several young researchers. After he went to the University of Navarra (Pamplona) he built there in a very short time a highly visible centre for Nonlinear Science. Now, back in Florence, he has combined theoretical with experimental expertise and has again built up a new group in the INOA which has already had an important scientific output. For the purpose of commenting on the scientific merits of his work, in the following I will select 5 areas to describe the impact of his work:

1) Experimental and theoretical discovery of the transition from bulk- to boundary-controlled patterns (Phys. Rev. Lett. 70, 2277 (1993))
Pattern formation and competition in extended media is a widespread phenomenon. In general, patterns that form can be induced by boundary imposed symmetries, or selected by internal physical properties of the morphogenetic material. He fully described the transition route between two such pattern forming mechanisms, and gave the first evidence that both mechanisms can take place within the same system at different parameter settings.

2) Experimental evidence of domain coexistence in two-dimensional pattern formation (Phys. Rev. Lett. 76, 1063 (1996))
This work gave an exhaustive description of a pattern forming systems where different sysmmetries and spatial scales coexist in segregated spatial domains, in a way very similar to what happens with different species in ecological systems.

3) Introduction of an adaptive technique for chaos recognition and control (Europhys. Lett. 31, 127 (1995))
He introduced a novel technique for chaos control that improves substantially the efficiency of the well known Pyragas' control method by means of a time variable adaptive gain parameter. This method has been successfully applied for chaos targeting, filtering noise from chaotic data sets, chaos synchronization, control of phase defects in infinite dimensional systems (differential-delay equations), and control and synchronization of turbulent states in space extended systems (e.g. complex Ginzburg Landau equation).

4) Experimental evidence of phase synchronization in fluid convection (Phys. Rev. Lett. 85, 5567 (2000))
He was the first to demonstrate phase synchronization in a Benard-Marangoni convective cell in the regime of time-dependent chaotic convection. Besides being the first evidence of such a phenomenon in fluid dynamics, it also constituted evidence of control over a spatially extended system by a localized external perturbation. This has stimulated synchronization studies in many spatio-temporal systems, e.g. in electrochemistry, lasers and ecology.

5) Asymmetric coupling effects for the synchronization of spatially extended systems (Phys. Rev. Lett 91, 064103 (2003))
He has analysed effects of asymmetries in the coupling configuration in the setting of different synchronized states of a one-dimensional field obeying a complex Ginzburg Landau equation. This way he has found new effects such as asymmetry controlled thresholds for synchronization and asymmetry driven anomalous phase synchronization.

Dr. Boccaletti is a highly distinguished researcher in Nonlinear Science with a substantial international reputation. He was invited to present keynote talks at many important conferences and workshops in Nonlinear Science, Optics and Physics all around the world. His talks are well-organized and exciting. He is also very active in the organization of workshops, conferences and schools. He is in the organizing board of the Experimental Chaos Conference and together we organized two workshops and a seminar in the Max-Planck-Institute for Physics of Complex Systems (Dresden) in 2001. He is a member of the advisory board of the journal CHAOS.

To summarize: I stongly recommend Dr. Stefano Boccaletti for a senior faculty position in your faculty; he is outstanding in all aspects.

Sincerely,

(Prof. Dr. Jürgen Kurths)
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Fellow if the American Physical Society

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