

## Preface

These proceedings comprise the invited lectures of the second international symposium on Emergent Quantum Mechanics (EmQM13), which was held at the premises of the Austrian Academy of Sciences in Vienna, Austria, 3-6 October 2013.

The symposium was held at the "Theatersaal" of the Academy of Sciences, and was devoted to the open exploration of emergent quantum mechanics, a possible "deeper level theory" that interconnects three fields of knowledge: emergence, the quantum, and information. Could there appear a revised image of physical reality from recognizing new links between emergence, the quantum, and information? Could a novel synthesis pave the way towards a 21st century, "superclassical" physics? The symposium provided a forum for discussing (i) important obstacles which need to be overcome as well as (ii) promising developments and research opportunities on the way towards emergent quantum mechanics. Contributions were invited that presented current advances in both standard as well as unconventional approaches to quantum mechanics.

The EmQM13 symposium was co-organized by Gerhard Grössing (Austrian Institute for Nonlinear Studies (AINS), Vienna), and by Jan Walleczek (Fetzer Franklin Fund, USA, and Phenoscience Laboratories, Berlin). After a very successful first conference on the same topic in 2011, the new partnership between AINS and the Fetzer Franklin Fund in producing the EmQM13 symposium was able to further expand interest in the promise of emergent quantum mechanics.

The symposium consisted of two parts, an opening evening addressing the general public, and the scientific program of the conference proper. The opening evening took place at the Great Ceremonial Hall (Grosser Festsaal) of the Austrian Academy of Sciences, and it presented talks and a panel discussion on "The Future of Quantum Mechanics" with three distinguished speakers: Stephen Adler (Princeton), Gerard 't Hooft (Utrecht) and Masanao Ozawa (Nagoya).

The articles contained in these proceedings represent the talks of the invited speakers as written immediately after the symposium. The volume starts with a contribution by organizers Jan Walleczek and Gerhard Grössing, essentially explaining why emergent quantum mechanics, and other deterministic approaches to quantum theory, must be considered viable approaches in quantum foundations today. This is followed by the exposition of Stephen Adler's talk who introduced to a general audience key questions at the current frontiers of quantum mechanics during the opening evening (with the contents of his conference talk appearing elsewhere). The conference proceedings then continues with the presentations as given in their chronological order i.e. starting with the opening talk of the scientific program by Gerard 't Hooft. While the page number was restricted for all invited speakers, the paper by Jeff Tollaksen was given more space, as his invited collaborator Yakir Aharonov was unable to deliver a separate talk, in order to represent both contributions in one paper. Note that the talks of all speakers, including the talks of those who could not be represented in this volume (M. Arndt, B. Braverman, C. Brukner, S. Colin, Y. Couder, B. Poirier, A. Steinberg, G. Weihs and H. Wiseman) are freely available on the conference website as video presentations (<http://www.emqm13.org>).

The organizers wish to express their gratitude to Siegfried Fussy and Herbert Schwabl from AINS for



the organizational support. The organizers also wish to thank Bruce Fetzer, President and CEO, John E. Fetzer Memorial Trust, and the Members of the Board of Trustees, for their strong support and for funding this symposium.

We also wish to thank the Austrian Academy of Sciences for allowing the symposium to be held on their premises, and Anton Zeilinger, President of the Austrian Academy of Sciences, for his welcome address. The expertise of the Members of the Scientific Advisory Board of the EmQM13 symposium, Ana Maria Cetto (Mexico), Lajos Diósi (Budapest), Maurice de Gosson (Vienna), Edward Nelson (Princeton), Theo Nieuwenhuizen (Amsterdam) and Helmut Rauch (Vienna), is also gratefully acknowledged.

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The front cover image shows two bouncing oil droplets on an oscillating oil surface, as they are employed by Couder, Fort, Bush, and others to show macroscopic analogues of wave-particle complementarity (courtesy of Dan Harris and John Bush, MIT).