



Unconventional Computation: Quo Vadis?

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A workshop organized and sponsored by the Center for Nonlinear Studies (CNLS) at the Los Alamos National Laboratory (LANL), with additional support from the Modeling, Algorithms & Informatics Group (CCS-3) and the Santa Fe Institute (SFI)

<http://cnls.lanl.gov/uc07>

Description: Unconventional computation is an interdisciplinary research area with the main goal to enrich or go beyond the standard models, such as the von Neumann computer architecture and the Turing machine, which have dominated computer science for more than half a century. This quest, in both theoretical and practical dimensions, is motivated by the huge gap between information processing in nature and in artifacts and by the hope that certain challenges that computational sciences face today might be tackled efficiently by alternative paradigms. For example, developments in synthetic biology, biochemistry, neuroscience, or optics, show that complex computations are omnipresent in physical systems, but that they cannot always be easily described or reproduced in the context of standard computing models. Given a physical, biological, or chemical system, the question is whether such a system computes, and if yes, then what and how? What are the limits and characteristics of such a computation and how could we "exploit" and "program" the system to perform a specific task in an efficient manner?

The purpose of this workshop is to bring together a multidisciplinary core of scientists who work in the broad field of unconventional computation, to highlight state-of-the-art research in each subfield, to focus on the above-mentioned questions, and to delineate promising future research directions. Both theoretical and experimental contributions will be covered to further the dialog and to foster collaborations. Particular light will be shed on the capability of unconventional computers to solve large-scale real world problems and to eventually outperform classical paradigms. The workshop shall help to further what is generally considered unconventional today into something conventional tomorrow.

The single-track program will be anchored by about 20 invited talks by leading researchers and by a limited number of shorter talks and posters, selected from contributed submissions and describing novel and significant advances in the field. Selected contributions will be published in a journal special issue after the workshop, following standard refereeing procedures. In addition, The Santa Fe Institute is sponsoring a half-day workshop on Neural Computation as part of the general theme of the conference: "Unconventional Computation: Quo Vadis?" The Neural Computation workshop will bring together experimental neuroscientists, computational neuroscientists, and computer scientists to ask "Does the brain 'compute'?. If so, "In what sense?". If not, "What forms of non-computational information processing does the brain perform?". Are there "computational primitives" for the brain that represent first-level abstractions for the brain in the same sense that binary arithmetic and Boolean algebra are "computational primitives" for Von Neumann architectures?

Invited speakers: (tentative) Andy Adamatsky (U. West of England), Howard Barnum (Los Alamos), Jake Beal (MIT), Angela Belcher (MIT), Leon Chua (UC, Berkeley), Peter Dittrich (Friedrich-Schiller U.), Seth Copen Goldstein (Carnegie Mellon), Fredric Gruau (U. Paris Sud), Seth Lloyd (MIT), Jonathan W. Mills (Indiana), Steen Rasmussen (Los Alamos), Hava T. Siegelmann (U. Mass, Amherst), Michael L. Simpson (Oak Ridge), Ehud Shapiro (Weizmann Institute), Darko Stefanovic (U. New Mexico), Tommaso Toffoli (Boston U.), Jim Tour (Rice), Christopher A. Voigt (UC, San Francisco), Ron Weiss (Princeton)

Call for contributions: See conference website for details. Deadline for submissions: Jan 19, 2007

Organizers: Christof Teuscher (LANL), Ilya Nemenman (LANL), Francis J. Alexander (LANL), Greg W. Johnson (LANL), Chris Wood (SFI)

