

Future Trends in Hypercomputation
Sheffield, 11-13 September 2006



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Background to the Workshop

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- What are the Key Questions?

Aims of the Workshop

Participants

Clive Blackwell	Royal Holloway University London, UK
José Felix Costa	Lisboa, Portugal
Simon Foster	Sheffield, UK
Marian Gheorghe	Sheffield, UK
Mark Hogarth	Cambridge, UK
Andrew Hughes	Sheffield, UK
Tien Kieu	Swinburne, Australia
Mariam Kiran	Sheffield, UK
Peter Kugel	Boston, USA
David Love	Sheffield Hallam, UK
Bruce MacLennan	Tennessee, USA
Mike Stannett	Sheffield, UK
Susan Stepney	York, UK
Georg Struth	Sheffield, UK
Apostolos Syropoulos	Xanthi, Greece
(Pete Wells	San Francisco)
Frank Wilson	Sheffield, UK

Programme

Monday 11 September 2006 (Room G30)

09.00 – 09.30	<i>Coffee and Registration</i>
09.30 – 10.20	Mike Stannett Welcome/Overview
10.20 – 11.10	José Felix Costa Five Views over Hypercomputation
11.10 – 11.40	<i>Tea / Coffee</i>
11.40 - 12.30	Peter Kugel Uncomputers
12.30 – 14.00	<i>Buffet Lunch / Discussions</i>
14.00 – 16.30	Break-Out Discussions (<i>including tea/coffee at 15.30</i>)
16.30 – 17.00	Report Back

Tuesday 12 September 2006 (Room G22)

09.00 – 09.30	<i>Coffee and Registration</i>	
09.30 – 10.20	Apostolos Syropoulos	Can we debug the Universe?
10.20 – 11.10	David Love	Hypocomputation?
11.10 – 11.40	<i>Tea / Coffee</i>	
11.40 – 12.30	Susan Stepney	Hypercomputation and the Grand Challenge in Non-Classical Computation
12.30 – 14.00	<i>Buffet Lunch / Discussions</i>	
14.00 – 16.30	Break-Out Discussions (<i>including tea/coffee at 15.30</i>)	
16.30 – 17.00	Report Back	
Evening	Meal?	

Wednesday 13 September 2006 (Room G22)

09.00 – 09.30	<i>Coffee and Registration</i>	
09.30 – 10.20	Tien Kieu	On quantum hypercomputation
10.20 – 11.10	Bruce MacLennan	Super-Turing or Non-Turing?
11.10 – 11.40	<i>Tea / Coffee</i>	
11.40 - 12.30	Mark Hogarth	Title to be confirmed
12.30 – 14.00	<i>Buffet Lunch / Discussions</i>	
14.00 – 17.00	Formation of a Follow-On Network(?) <i>(including tea/coffee at 15.30)</i>	

Local Organisation

Technical Coordination	Mike Stannett
Administration & Finance	Gillian Callaghan
Day-to-day Coordination	{ Andrew Hughes Simon Foster

Network Access

A number of accounts have been created for participants on the DCS network. If you need one to access the internet, webmail, etc, please see the local organisers. **You will need to sign, to confirm that you'll abide by our (standard) regulations concerning network usage.**

Satisfaction Survey

Under the terms of the EPSRC funding, we need to ask participants how well (or badly) they think this workshop has been organised, whether it served its purpose, etc. Please complete and return the anonymous questionnaire before you leave (or as quickly as possible thereafter) — there's one in your pack.

Funding

We'd like to thank the **EPSRC** and the **White Rose University Consortium** for supporting this workshop.



Follow-On Network Funding

Under the terms of the EPSRC funding, we need to decide whether we want to apply for **Follow-On Network Funding**. This is primarily a matter for UK participants, but any such bid would be strengthened if we can demonstrate international interest and support. A copy of the original EPSRC *Call for Proposals* is included in your packs.

Other sources of funding are also available for international collaborations. We need to decide if we want to exploit these.

Background to the Workshop

- ▶ Rapid expansion of the subject
- ▶ Corresponding expansion of related subjects
- ▶ Unclear what the core questions are

Wide Scope of the Subject

Hypercomputation involves a number of disparate fields

- ▶ Philosophy
- ▶ Physics
- ▶ Mathematics & Computer Science
- ▶ Biology & Natural Computation
- ▶ ...

Philosophy

- ▶ What is computation?
- ▶ Formal or informal?
- ▶ Is the Universe computational?
- ▶ Is the brain computational?
- ▶ Is the mind computational?

Physics

- ▶ Xia's Newtonian n -body singularity
- ▶ Malament-Hogarth Spacetime (SAD_n , AD)
- ▶ Quantum (hyper)computation (Hilbert's 10th)
- ▶ One-off results (Pour-El & Richards, Myhill, Xia, ...)
- ▶ BUT: do any models work within the standard model?

Mathematics & Computer Science

- ▶ Types of computation (discrete, analog, cellular, ...)
- ▶ Nature of space and time (e.g. cellular automata in hyperbolic space)
- ▶ Arithmetic Hierarchies (standard, analog, ...)
- ▶ Distributed models (agents, interactions, networks, ...)
- ▶ Bespoke models (trial-and-error, ITTM, Inductive TM, ...)
- ▶ Formal theory: Equational theories

Biology & Natural Computation

- ▶ Computation inspired by/occurring in nature)
- ▶ Distributed computing (neural networks, field computation)
- ▶ Different focus (asymptotics largely irrelevant)

Expansion of Related Subjects

- ▶ Quantum computing
- ▶ Bio-computing
- ▶ DNA-computing
- ▶ P-systems
- ▶ ...

What are the Key Questions?

- ▶ Is hypercomputation a subject? Is it part of something else?
- ▶ Comparison of power?
- ▶ Complexity theory (time, space, energy, ...)
- ▶ How do we validate ideas (arguments against)?
- ▶ Thinking ahead (engineering, programming, measuring)
- ▶ Do we understand *normal* computation yet?!

Aims of the Workshop

- ▶ Researchers in different areas can find out about each other's work.
- ▶ Researchers can get to discuss ideas face-to-face.
- ▶ Set up group to work on Follow-On Network proposal.
- ▶ Promote joint research projects.
- ▶ *Build a hypercomputation community.*