Přednášky se konají v 17:00 v posluchárně M1 na Janáčkově nám. 2a v Brně, pokud není explicitně uvedeno jinak.

18. října

Geoff Prince (La Trobe University, Victoria, Austrálie)
The Inverse Problem in the Calculus of Variations

Abstrakt:

The inverse problem in the calculus of variations for ordinary differential equations consists of classifying second order ordinary differential equations according to whether their solutions are those of Euler-Lagrange equations and exhibiting the non-uniqueness of the resulting Lagrangians when they occur. A less ambitious problem is that of finding all (if any) such Lagrangians for a given system of differential equations. This talk provides an introduction to the local version of this inverse problem (in both its aspects), its implications and some of the knowledge about systems of second order ordinary differential equations that have resulted from its study. The presentation is intended for a general audience.

13. prosince

Bob Coecke (Computing Laboratory, University of Oxford, England)
Kindergarten Quantum Mechanics

Abstrakt:

Achieving both a foundational and high-level understanding of the quantum mechanical structure is a long-standing problem, ever since John von Neumann denounced his own quantum mechanical formalism back in 1935. This quest is today more relevant than ever in the light of the recent quantum informatic endeavour. It is fair to say that the current manipulations of matrices (i.e. arrays of complex numbers) are kin to the manipulations of 0's and 1's in the early days of computing. We report on a recent research strand, initiated by Abramsky and myself in [1], and further developed for example in [2,3,4]. While traditionally only infinite dimensional Hilbert spaces have been considered to be of interest to topologists, we show that finite dimensional quantum mechanics itself supports a purely topological high-level quantum formalism. In fact, this topological formalism both formalizes and extends Dirac's braket notation for quantum mechanics in a 2-dimensional fashion. Importantly, while most of the quantum structural research has been thus far "purely academic", the topological calculus proves to be extremely useful for the design and analysis of quantum information protocols, both qualitatively and quantitatively [1]. For example, it turns several sophisticated quantum informatic protocols into trivial undergraduate exercises [3]. Also theorems such as Naimark's theorem admit extremely elegant purely topological proofs. As compared to Birkhoff-von Neumann quantum logic, which has led to an order-theoretic paradigm for the study of the quantum mechanical structure, this new setting does come with traditional logical mechanisms such as deduction. In fact, it turns out to be some kind of hyper-logic as compared to the Birkhoff-von Neumann non-logic. The actual mechanism of deduction topologically incarnates as "yanking a rope". There are also strong connections of this work with other fields of mathematical physics such as topological quantum field theory. The main recent development in this research program is the ability to capture quantum measurements and classical data manipulations within the language which was initially designed to capture quantum entanglement. We are for example able to distinguish between classical non-determinism, stochastic processes, reversible classical processes etc. At the core of all this lies an analysis of the abilities to clone and delete data in the classical world "from the perspective in the quantum world". In this view, the classical world looks surprisingly complicated as compared to the very simple quantum world.