ARTEMATICA 2015
Wolfgang Pauli Lectures

Frettlöh Hofstetter Widmer Weibel

K Ü N S T L E R H A U S
12 October 2015 | 03 - 07 pm

The Wolfgang Pauli Lectures are initiated and selected by Georg Gottlob, University of Oxford and Vienna University of Technology, as part of ARTEMATICA 2015, an interdisciplinary event at the Vienna Künstlerhaus, which also comprises the *body interference* exhibition .Four lectures, organised by the Wolfgang Pauli Institute in cooperation with the Vienna Künstlerhaus, deal with interdisciplinary approaches linking mathematics and computer science with the arts, in particular, with visual arts and music.

03:00 pm	Dirk Frettlöh	Mathematical Quasicrystals And Inductive Rotation Tilings
04:00 pm	Hofstetter Kurt	On the Event Horizon of Order
05:00 pm	Gerhard Widmer	Con Espressione! Towards a New Level of Music Understanding in Computers
06:00 pm	Peter Weibel	Gotthard Günther and the Digital Revolution

The Wolfgang Pauli Lectures 2015 are additionally supported by the Vienna University of Technology - Faculty of Informatics, Informatics Europe, Zentrum für Informatikforschung as well as Two Congruent Zero.

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ARTEMATICA 2015

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Karlsplatz 5, 1010 Vienna
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ARTEMATICA 2015

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12 Oktober 2015 from 03:00 to 07:00 pm within the frame of the exhibition *body interference* at the Vienna Künstlerhaus

The Wolfgang Pauli Lectures 2015 are part of ARTEMATICA 2015, an interdisciplinary event at the Vienna Künstlerhaus, which also comprises the *body interference* exhibition. The lectures, organised by the Wolfgang Pauli Institute, deal with interdisciplinary approaches linking mathematics and computer science with the arts, in particular, with visual arts and music. Fantastic new developments and insights will be discussed and explained to the public. In the first talk, the mathematician Dirk Frettlöh will present the mathematical fundamentals of the method of Inductive Rotation. This method, which allows the generation of aperiodic tilings, will be put in a broader artistic context in the second lecture to be held by the artist Hofstetter Kurt, its inventor. Hofstetter will also discuss other results and artistic contributions inspired by mathematics. In the third lecture, the computer scientist Gerhard Widmer will explain how musical expressivity can be captured by computer programs. Finally, in the fourth lecture, the artist and media theoretician Peter Weibel will tell us how Gotthard Günther's „Cybernetic Ontology" could help us to understand the digital revolution.

The Wolfgang Pauli Institute (WPI) is an interdisciplinary centre of excellence comprising top research groups in Vienna and all of Austria in the fields of mathematics, computer science, physics, material sciences, biology, and other areas. Wolfgang Pauli, who was born in Vienna in 1900 and who worked in Germany, Switzerland and the United States, was one of the most eminent quantum physicists, he was awarded the Nobel Prize for discoveries such as the Pauli Exclusion Principle. Pauli tried to go beyond hard science, for example, by working with C.G. Jung on the latter's concept of synchronicity.

The members of the WPI are awardees of important grants of excellence such as the Wittgenstein and Start awards by the Austrian Science Fund FWF, high-level FWF projects such as Special Research Programmes (Spezialforschungsbereiche), and Doctoral Programmes (Doktoratskollegs), grants by the European Research Council ERC, other large EU projects, and so on. Full members are not elected, but may join the WPI as soon as they have obtained a qualifying grant of excellence. Three years after a grant funding has ended, full membership with voting rights is replaced by a corresponding membership until a new excellence grant is obtained. Thus, a dynamic turnover of people and fields of research at the WPI is ensured, using independent international evaluations as the only criterion.

Above all, the WPI tries to connect its members' research groups in an approach to interdisciplinary research, whereby excellent individual groups are linked via thematic programmes, where at least two groups jointly invite international visitors to run working groups, workshops, and summer schools to benefit Austrian science and scholarship, and to profit all scientists and doctoral students in Austria. This central WPI activity is co-funded by a grant of the Austrian Ministry of Science and Economy. Moreover, WPI itself very efficiently acts as a host for EU and FWF grants. Such grants can be directly affiliated at the WPI in a synergetic partnership with Austrian universities rather than in competition with them.

A typical WPI thematic programme in physics, say on Schrödinger equations, would include experimental physicists as well as theoretical and computational physicists plus pure mathematicians as well as numerical mathematicians. It would range from basic research to experiments and computer simulations. A long-term priority field is quantum information theory, where also informatics plays a crucial role. Another example out of many is the focus on computational logic which takes advantage of the international stronghold of TU Wien in this area. Within this focus, programmes on logic and complexity and on web data-processing help TU Wien to broaden their excellent basic research in mathematical and computational logic towards applications and interdisciplinary collaborations.

In connection with WPI thematic programmes, renowned senior long term visitors can be appointed as Pauli Fellows, with a special funding for female fellows, the "Olga Taussky" WP-Fellowships. All major funding decisions are approved by an International Advisory Board composed of outstanding scientists, among which a Field Medalist, a Turing Award winner, and a Gödel Prize winner. The WPI operates very quickly and dynamically. Thematic programmes start right after their approval, and the budget allocation is flexible, to be able to quickly respond to new developments. Young promising international researchers can be appointed within 24 hours and funded as "Pauli Postdocs" for a few months, before obtaining a long-term position within their host group, e.g. by a Marie Curie grant of the EU or a Lise Meitner grant of the FWF.

The WPI has particularly close links to France. It hosts the Institut CNRS Pauli, an Unité Mixte Internationale (UMI) of the French National Research Council CNRS, which brings up to five researchers to Austria with their salary paid by the CNRS. Only very few institutions in Europe are considered sufficiently excellent and interesting by the CNRS to earn such an UMI.

Being mainly focused on the so called "MINT" sciences, i.e., Mathematics, Informatics, Natural Sciences, and Technology (Engineering), the WPI is active in fundamental research but also puts emphasis on applications, from mathematical finance for pricing of energy options (in cooperation with, for example, EdF and Verbund), from micro-magnetism for magnetic recording devices, to applied computational logic and automated web data extraction.

Finally, the WPI aims at maintaining and fostering the Viennese spirit of interdisciplinarity reaching out into art and philosophy. As a first initiative towards this goal, the WPI is organising the Wolfgang Pauli Lectures, herewith announced. We welcome you to this event and hope you will enjoy these lectures and find them interesting.

Georg Gottlob, President WPI — Norbert J. Mauser, Director WPI

Dirk Frettlöh / D

03:00 pm

Mathematical Quasicrystals And Inductive Rotation Tilings

Abstract:
The discovery of aperiodic tilings (Berger 1966, Penrose 1974) and of physical quasicrystals (Shechtman et al 1984) initiated the development of a mathematical theory of aperiodic tilings („mathematical quasicrystals"). Today this is an active field where many mathematical disciplines meet.

In 2010 the artist Hofstetter Kurt suggested a new method for generating aperiodic tilings, the Inductive Rotation Tilings. This method is of artistic interest: after a few iteration steps, fascinating novel patterns arise, and hidden patterns are generated. We applied the theory of aperiodic tilings to this new examples and obtained several results, e.g. on diffraction properties or model set properties of these tilings (F-Hofstetter 2015). This talk gives an overview on the theory of mathematical quasicrystals and how Inductive Rotation Tilings fit in.

Dirk Frettlöh, Mathematician, Technische Fakultät - Universität Bielefeld, photo © TechFak Bielefeld, 2012

Hofstetter Kurt / A

04:00 pm

On the Event Horizon of Order

Abstract:
Hofstetter Kurt is an artist who addresses geometry in his work. Based on mathematical insights he has discovered new construction principles, as well as new recursive methods in geometry. This lecture gives an overview of his artistic research work and his way of thinking and seeing, addressing the following topics.

(1) Parallelism and circulation: the infinite pendulum;
(2) The Sunpendulum project;
(3) New algorithms for constructing the Golden Ratio;
(4) The principle of Inductive Rotation (IR): new methods for generating aperiodic and asymmetric tilings;
(5) Artistic materialisations of IR tilings;
(6) Moebius Sounds – audiovisual installation dream'sdreams.

Hofstetter Kurt: conceptual & media artist photo © Barbara Doser, 2015

Gerhard Widmer / A

05:00 pm

Con Espressione! Towards a New Level of Music Understanding in Computers

Abstract:
Research in Sound and Music Computing (SMC) and Music Information Retrieval has led to some spectacular successes in recent years. However, we have barely scratched the surface of what music really is, and what it is in music that moves and speaks to us -- let us call this the expressivity of music. Computers cannot tell whether a performance expresses playfulness or ennui, solemnity or gaiety, determination or uncertainty; they cannot predict how a piece will be perceived by listeners, nor can they produce or play music with a specific expressive quality. I will look at some of the things that computers can already do with music, and why this is still far from real musical ‚understanding'. I will introduce (performance-related) expressivity as an important dimension of musical communication, will discuss and demonstrate what it means to quantify, characterise, and predict this via computer; will review recent work on computational models of performance expression; and will identify some of the big challenges that need to be solved on the way to machines that can recognise and interpret musical expressivity in useful ways.

Gerhard Widmer, Computer Scientist, Johannes Kepler University, Linz, and OFAI Vienna, photo © Gerhard Widmer 2015

Peter Weibel / A

06:00 pm

Gotthard Günther and the Digital Revolution

Abstract:
Recently in media theory an operative ontology takes ground. Therefore it can help to remember the more or less forgotten work by Gotthard Günther and his „Cybernetic Ontology" (1962). Already 1957 he published a book „The Consciousness of Machines" and later contributions to a Non-Aristotelian Logic.

My lecture tries to prove, how his operational dialectic could help us to understand better the contemporary digital revolution.

In addition to his talk, Peter Weibel will exhibit his installation 'Vulkanologie der Emotionen'.

Peter Weibel, Artist, Curator and Theoretician, Director of ZKM | Center for Art and Media Karlsruhe, photo © ZKM, 2010

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