Exposé d'**Amandine Bellec**

Comment la nature d'une surface influence l'ordre magnétique de molécules à transition de spin ?

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Les molécules à transition de spin, qui sont constituées d'un ion métallique central entouré par des ligands organiques, possèdent deux états de spin et peuvent basculer de l'un à l'autre par des stimuli extérieurs comme la température ou la lumière. Nous avons étudié les propriétés de transition de molécules de FeII pyrazolyl borate molecules (FePz) déposées sur des substrats métalliques (Au(111) et Cu(111)). L'adsorption des molécules conduit à la formation de réseaux bidimensionnels denses du fait de leur relation d'épitaxie au substrat métallique [Fou19]. Ceci a une influence directe sur la transition en température avec à basse température un mélange de molécules dans les états haut spin ou bas spin [Kel21]. De manière surprenante, en fonction de la nature du substrat, il est soit possible d'observer une répartition aléatoire des états de spin moléculaire sur Cu(111) [Ton21], soit une organisation à longue distance des états bas et haut spin sur Au(111) [Bai16]. Par impulsion de tension il est possible de contrôler l'état de spin des molécules sur Cu(111) [Ton21].

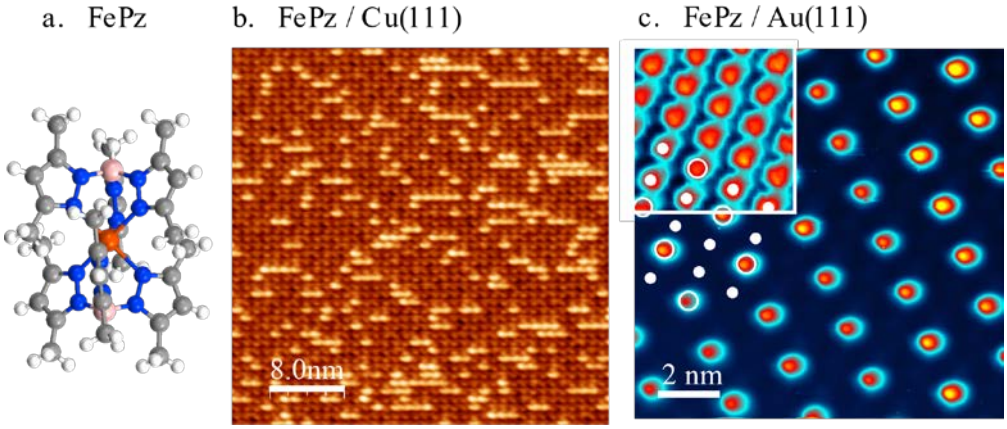

Figure : Schéma de la molécule FePz. Images STM à 0,3V du réseau moléculaire sur Cu(111) avec une répartition aléatoire des états bas spin (molécules brillantes) et sur Au(111) avec une superstructure à longue distance (une brillante . Les molécules brillantes correspondent à l'état bas spin et les sombres à l'état haut spin.

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Eric Bringuier

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Order-to-disorder transformation in an Ohmic resistor: Quantum theory of Joule heating

The Joule-Lenz heating effect in a resistor is a transformation of ordered (electrochemical) into disordered (thermal) energy. The elementary quantitative account of this effect is based on Ohm's conduction law. The latter continues to be a theoretical challenge in the 21st century, just as the Joule heating effect at the microscopic level. This work first reviews the thermodynamical prolegomena to near-equilibrium electrical conduction. The heating effect (under an applied force field) is argued to be a consequence of the thermalization mechanism (acting under no force). We next turn to the microscopic theory in a crystalline solid. Static disorder cannot account for thermalization of the electron gas. The necessary dynamical disorder is handled within a Wigner-function quantum-mechanical framework. Connection is made with the semiclassical Boltzmann-Lorentz description of electron transport. The heating effect is rooted in a quantum disorder embodied in the second quantization of lattice vibrations.

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Liquid-like magnetic domain morphologies in ferromagnetic thin films

Magnetic domain morphology transitions have been the subject of intense study, given that tracking the domain evolution offers insight into the physics of underlying phase transitions. One such case is the spin reorientation transition (SRT) that occurs in the limit of low effective perpendicular magnetic anisotropy in ferromagnetic thin films. Near the SRT, the energetic favorability for magnetic domains to be oriented perpendicular to the film plane and in the film plane becomes vanishingly small – leading to the stabilization of randomly oriented, labyrinthian domain patterns that exhibit rich thermal fluctuations. In this presentation, I will discuss recent work in which we have shown that a similar morphological phase transition can be obtained by delicately tuning the strength of the Heisenberg exchange interaction in ferromagnetic thin film systems. While exhibiting many similarities to the SRT, these systems exhibit a strong preference for perpendicular magnetization throughout the morphological transition. We find that slight increases in the sample temperature result in a dramatic reduction in the periodicity of the labyrinthian domain patterns formed and an increased prevalence of domain wall fluctuations. Furthermore, dynamic susceptibility measurements suggest that the characteristic timescale of the domain wall fluctuations decreases significantly with sample temperature. In contrast to the SRT, our results suggest that the morphological transition that occurs in these systems proceeds via the development of a vanishingly small, rapidly fluctuating domain state. Such a liquid-like stripe phase may be an important ingredient for next generation computing architectures, such as probabilistic or reservoir computing.

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Jean-Louis Brousse

Saint Marcet – La place forte oubliée

Le château de St Marcet était aux XIII^{e} et XIV^{e} siècles la plus grande place forte du comté du Comminges, de l'Espagne à Muret. Ses puissants voisins, Toulouse, la Bigorre anglaise, l'Armagnac et l'Astarac, Foix et l'Aragon, avaient pour objectif de s'attribuer cette terre. Une délicate partition du château entre les comtes et les évêques de Comminges fragilisait l'édifice. Cette succincte évocation fait prendre conscience de la complexité du contexte historique et du désordre qui en découle: la diversité, l'opportunité des alliances matrimoniales et politiques, les guerres entre voisins. La richesse de son histoire, illustrée par les 20 ans de captivité de la célèbre et puissante comtesse Marguerite de Comminges, a donné à ce lieu tout son intérêt et même l'a sauvé. Le propriétaire, Jean-Marc Fontan, travaille depuis près de 20 ans pour réhabiliter ce vaste domaine sur un site peu accessible et compliqué.

Georges Chapouthier

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La complexité en mosaïque, du monde vivant à l'éthique

Le monde vivant est constitué d'êtres dont la complexité émerge en étages successifs, depuis les organites cellulaires jusqu'aux populations animales, en passant par les cellules, les organes ou les organismes, par l'application répétée de deux grands principes : *juxtaposition* d'entités issues d'un étage, puis *intégration* de ces entités pour constituer un étage plus élevé. Comme dans une mosaïque au sens artistique, l'étage ainsi constitué laisse une certaine autonomie aux entités de l'étage inférieur qui le composent. La même construction en mosaïque peut être décrite pour des aspects mentaux du monde vivant : mémoires, traits culturels, conscience, langage, création littéraire et, finalement, éthique.

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G. Chapouthier, The Mosaic Theory of Natural Complexity: A scientific and philosophical approach. [online]. La Plaine-Saint-Denis: Éditions des maisons des sciences de l'homme associées, 2018. <https://books.openedition.org/emsha/200>.

Ph. Depondt,
INSP, Sorbonne Université

Ludwig Boltzmann : un monde peuplé d'atomes.

L'équation de Boltzmann (1872), au-delà de son caractère formel, transporte un monde conceptuel peuplé de particules qui se meuvent « *comme des grains de poussière dans un rayon de soleil* » selon la belle image de Démocrite, qui entrent en collision et s'agitent en tous sens. Ce monde est absolument étranger aux conceptions dominantes en thermodynamique au XIX^{e} siècle : les idées acceptées alors étaient basées sur des quantités directement mesurables, comme la pression ou la température, et non sur des atomes que personne n'a jamais vus ! La démarche de Boltzmann implique un changement de point de vue radical à la fois pour la physique et pour la science. Comment un tel obstacle conceptuel a-t-il été franchi ? Il s'agit là d'un cheminement intellectuel complexe, fort éloigné d'une tranquille promenade dominicale sur le Boulevard du Progrès !

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Agent-based Model from Statistical Physics for Political Polarization

We show in this talk the dynamics of the political polarization by the use of a model borrowed from statistical physics. We consider three political groups: the strongest group governs, the weaker group is in opposition and the third independent group has no political affiliation but is contrarian to the governing group. We use in this study a spin model to describe individual members of each group. Group i (i=1,2,3) contains a number of members who interact with each other via an interaction J_i. This parameter defines the intrinsic strength of the group. The inter-group interactions are K_{ij} ($i,j=1,2,3$ with $i\neq j$) which are not necessarily symmetric, namely K_{ij} may be different from K_{ji}. In addition, the members of group i at the time t interact with the averaged stance of group j at an earlier time $t-1$. We use Monte Carlo simulation to study the dynamics of these interacting groups and show that the third group may be polarized to reinforce the weaker group to win an election for instance. The model can be applied to the political system of the USA. Note that MC results shown here are in agreement with the mean-field theory using the same model [1].
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Emmanuel Farge

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Environmental hydrodynamic marine mechano-biochemical stimulation of first multicellular organisms evolutionary emergence

The evolutionary emergence of the primitive gut in Metazoa, one of the decisive events that have conditioned the major evolutionary transition leading to the origin of animals, is thought to have been intimately associated to the formation of multicellular invagination (*i.e* gastrulation) and endomesodermal differentiation. However, the biochemical cues at the origin of gastrulation and endomesoderm formation remain uncertain.

Interestingly, the activation of both Myo-II and the □-cat pathway by Y654-□cat phosphorylation, have been found to be mechanotransductively triggered in leading to EM morphogenesis in *Drosophila* embryos and endomesoderm specification in the gastrulating and epibolying species *Drosophila* and Zebrafish respectively, two species having diverged from first bilaterian ancestor around 570 million years ago[1,2].

We now find that hydrodynamic mechanical strains, reminiscent of soft marine flow, trigger tissue gastrulation and inversion via a Myosin-dependent mechanotransductive process, in the metazoan *Nematostella vectensis (Cnidaria)* and the multi-cellular choanoflagellate *Choanoeca flexa* considered as the closest living relative to metazoans. We further show that, similar to bilaterian animals, gastrulation in the cnidarian *Nematostella vectensis*, induces biochemical endomesoderm specification through the mechanical activation of the □□catenin pathway via the phosphorylation of Y654.

These observations suggest that primitive gut emergence in Metazoa may have been initiated by marine mechanical strains in multicellular pre-Metazoa more than 700 million years ago, thanks to Myosin mechanosensitive properties crucial for this evolutionary transition. A process achieved by endomesoderm specification via mechanosensitive Y654-containing □□catenin evolutionary emergence in first Metazoa, and specifically conserved in all Metazoa[3,4].

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Vincent Fleury

MSC

A model for active biological morphogenesis coupling von Karman thin plate equation and Landau-de Gennes Q-tensor for cell organization

Biophysics of development is progressing steadily. It is recognized that formation of organs is a biomechanical process including stresses and deformations. From a theoretical point of view, it is necessary to include forces in tissue development to understand how forms unfold. However, living tissue is not a uniform material, it is composed of cells, and cells tend to form organized layers.I will present a theoretical framework which is able to produce biological forms from a plate theory coupled to an active nematoid field. The theory consists of a von Karman plate equation coupled to a Q-tensor dynamics, however, in this description the Q-tensor is not a static description of a nematoid field but the actuator of a field of force. The Q-stress tensor serves as active stress in the von Karman equation to generate thin plate deformations. Numerical solutions of this coupled problem will be presented with application to biometrics.

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Balancing structural and functional asymmetries during gaze orientation: expanding further the bilateral hypothesis

It is proposed that the static orientation of the eyes is the outcome of multiple and simultaneous equilibria (poly-equilibrium) of commands that cancel each other out (Goffart 2019). From the visual activities evoked by the retinal stimulation to the recruitment of premotor neurons responsible for the horizontal and vertical components of saccadic (fast) and slow movements, no movement is initiated as long as the recruited channels convey commands that counterbalance each other. Moreover, the orienting saccades would merely be the physical expression of intracerebral processes that restore balances between sensorimotor channels whose activities are mutually opposed. This new viewpoint extends to the kinetics of saccades insofar as their curvature is the signature of bilateral and balanced commands. Assuming unequal number of synapses, neurons and emitted action potentials between opposing channels, these asymmetries can still lead to relatively straight saccades if a process (presumably cerebellar and bilateral) adjusts their balance.

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Critique of the cerebralization of notions belonging to the physical sciences and mathematics

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During the last decades, confusions were made in the domain of cognitive neuroscience, between the concepts, the measurements (and their numerical transformations) and the physiological processes that generate the measured phenomenon. The limitations of measurements and their associated theoretical notions led some authors to propose nativist and evolutionist options, such a coding of space, time and number in the brain. For example, in the neurosciences of movement, the activity of neurons would encode kinematic parameters: when they emit action potentials, neurons would "speak" a language imbued with notions of classical mechanics. Yet, the movement of a body segment is the mere ultimate measured product, the outcome of multiple processes taking place in parallel in the brain and converging on the groups of neurons responsible for muscle contractions. In my presentation, I will present a different viewpoint and expose my criticisms about the so-called "neural code for number".

Michel Grossetti
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Effacer le désordre
Les changements de logement et les nouveaux liens créés durant le confinement de 2020 et leur perception à posteriori à partir des données de l'enquête « La vie en confinement » (Vico)

L'enquête « la vie en confinement » (Vico) est une enquête longitudinale sur la crise sanitaire de la Covid-19. Le premier questionnaire, rempli durant le premier confinement français (Avril-Mai 2020), comportait des questions sur le fait de se confiner ailleurs que chez soi et sur les relations créées dans le contexte du confinement. Des questions posées lors de la troisième vague (décembre 2021) sur les mêmes sujets font apparaître des contradictions avec les réponses de la vague 1. Interrogées sur les changements de logement durant les différentes phases de la crise, une partie des personnes qui avaient déclaré avoir changé de logement n'en font plus mention. De même, une partie des personnes qui avaient évoqué des relations nouvelles en vague 1 ne citent plus presque deux années plus tard aucune nouvelle relation créée dans le contexte de la crise. Au-delà des effets de formulation des questions, une explication possible de ces contradictions est que les déclarations de la vague 1 correspondaient à une réalité et que celles de la vague 3 font apparaître un effet d'oubli de changements qui ont été éphémères. Tout se passe comme si certaines personnes effaçaient en partie de leur mémoire une partie des désordres engendrés par la situation exceptionnelle du premier confinement, renforçant ainsi les continuités et les stabilités dans leur parcours et leur situation sociale.

Clearing the Disorder

Housing changes and new relationships created during the 2020 lockdown and their perception in hindsight from the Life in Lockdown (Vico) survey data

The "Life in Lockdown" (Vico) survey is a longitudinal survey of the Covid-19 health crisis. The first questionnaire, completed during the first French lockdown (April-May 2020), included questions about being away from home for lockdowns and about the relationships created in the context of lockdown. Questions asked in Wave 3 (December 2021) on the same topics reveal contradictions with Wave 1 responses. When asked about changes in housing during the different phases of the crisis, a proportion of people who had declared having changed housing during the first lockdown no longer mention it. Similarly, a proportion of people who had mentioned new relationships in wave 1 no longer mention any new relationships created in the context of the crisis almost two years later. Beyond the effects of the wording of the questions, one possible explanation for these contradictions is that the answers in wave 1 corresponded to a reality and those in wave 3 reveal an effect of forgetting changes that were ephemeral. It is as if some people were partially erasing from their memory some of the disruptions caused by the exceptional situation
of the first lockdown, thus reinforcing the continuities and stabilities in their lives and social situation.

Didier Joubert
Ministère de l'intérieur

L'épidémie de violences collectives : manifestation de désordre et de complexité

Au-delà des formes de ritualisation qui permettent d'en apprivoiser les effets, l'objet de cette intervention est de mettre en évidence l'opposition entre la banalité des phénomènes de désordres collectifs et des comportements violents qui leur sont fréquemment attachés et la complexité de leur prise en compte par le juriste.

Quels que soient l'attachement des français à l'objet « manifestation » et la spécificité française du désordre de rue, il sera loisible de montrer que les mécanismes sont récurrents et que la contagiosité n'est pas spécifiquement française : elle se moque des frontières comme des murs des prisons.

En s'appuyant notamment sur les travaux de plusieurs historiens et la confirmation par le calcul de la vraisemblance d'hypothèses fondées sur la connaissance pratique des violences émeutières de l'auteur, cet exercice de style s'attache ainsi à souligner la difficulté à faire face aux épidémies de violences collectives. A cet effet, une approche du phénomène par l'Histoire et la cinétique (I) permettra de mieux saisir la complexité de leur prise en compte par le droit à l'âge des réseaux sociaux et de la fulgurance numérique (II).

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Pattern recognition with a magnon-scattering reservoir

An important challenge in nanotechnology today is to develop physical devices whose functions are inspired by the human brain to process complex data, like pattern recognition in noisy data sets. In this talk, we explore a paradigm of reservoir computing, a type of recurrent neural network, utilising nonlinear spin wave processes in thin film ferromagnets. Unlike other reservoirs, the spin wave system maps connections between nonlinear nodes in reciprocal space, enabling high node connectivity that is difficult to achieve in real space. We demonstrate this concept through pattern recognition using a magnetic vortex in a micron-sized disc, where three-wave scattering between vortex spin wave modes of different symmetries can be used to classify temporal sequences of binary frequency pulses. Additionally, we will discuss extending this concept to other magnetic systems and offer insights into how such spin wave “neurons” can be trained.

Takis Kontos
ENS Paris

A hybrid cavity-superconducting qubit-magnon haloscope for dark matter detection in the microwave range.

In this talk, I will present our original setup for detecting axion dark matter using quantum microwaves. In particular, I will describe how we can use the resources of superconducting qubits and cavity photons hybridized with magnons in order to downconvert possible axions signals. In addition, I will discuss how magnetic modes of magnetic materials can be used for enlarging the mass scanning range for axion dark matter search.

Jean-Claude Serge Lévy
MPQ UMR

UPC

Introduction : modéliser c'est classer

Dans l'échange entre disciplines, la langue est un unificateur efficace. Ainsi les sens multiples de « frustration, émergence-transition, ségrégation-agrégation » entrecroisent les disciplines. Les modèles que nous échafaudons sur ces thèmes explorent la structure de l'espace et du temps. Leur degré de simplicité a pour conséquence le niveau de classement qu'il crée : un modèle simple donne de nombreuses classes, un modèle précis des classes restreintes. C'est un corollaire du principe de falsification de Popper. Ainsi nous classons les individus par leur interaction, les structures par leur taille et leur forme, leur niveau de complexité. Quelques exemples types de modèles et donc de classement seront rappelés: la rigidité des atomes, des membres d'un groupe, leur attraction et répulsion ; des arrangements cristallins, quasi-cristallins ou d'un ordre intermédiaire ; des blocs, des îlots, des ghettos (modèle de Schelling), des agrégats, des molécules ; la dynamique de leur interaction peut aussi alterner différents processus (glissement-collage).

Introduction: Modeling means classifying

Language strongly links disciplines together. For instance the words frustration, emergence-transition or segregation-aggregation interweave different disciplines, different meanings. All disciplines use models in order to deal with entities. The level of sophistication of these models induces a size effect in their object classification according to Popper's rules. Rough models give rise to large classes while sophisticated ones are more specific and lead to restricted classes. A few examples of models and classes: individual stiffness made of an attractive – repulsive interaction; crystalline, quasicrystalline and intermediate networks; islands, ghettos, clusters and molecules; friction dynamics with stick-slip motions

Jean-Claude Serge Lévy, Michel Perreau
UPC

Représentation fractale des nuages

Les nuages sont des structures relativement stables dans leur ensemble. Essentiellement composés de gouttelettes d'eau de différentes tailles en suspension dans l'air, de faible densité, ils ont des propriétés optiques évidentes de diffusion de la lumière. Ces milieux très lacunaires, des phases intermédiaires en quelque sorte, semblent donc de bons sujets pour une représentation par des fractales aléatoires. La gravité et aussi la présence de vents, au moins lors de la formation des nuages, brisent l'isotropie de l'espace. La représentation fractale des nuages définit différentes classes de nuage selon les propriétés de connectivité de leurs structures [1]. On développera cette étude dans ce cadre particulier. Finalement le classement déduit permet de retrouver les principales lignes de la classification expérimentale des nuages.

1. Randomness in fractals, connectivity dimensions and percolation, M. Perreau and J.C.S. Lévy, Phys. Rev. A **40**, 4460 (1989)

Fractals for clouds

Clouds are rather stable extended structures made of variously sized water droplets floating in the air. Their observation from light scattering leads to a well-known experimental

classification among several classes. Such media with a high level of lacunae and a global homogeneity sound to be good candidates for random fractal representation. Gravity and the existence of winds break the 3D isotropy of such fractal representations. Connectivity properties of these fractal structures lead to a cloud classification, here compared to the experimental one. A fitted version of the general connectivity approach of fractals is developed [1].

1. Randomness in fractals, connectivity dimensions and percolation, M. Perreau and J.C.S. Lévy, Phys. Rev. A **40**, 4460 (1989)

Yves Pomeau

Transitions

Cet exposé tentera de raconter la science qui s'est faite à Saclay au tournant des années 80-90 dans le laboratoire de Pierre Bergé et Monique Dubois. Cette époque a vu une convergence improbable entre mathématiciens, physiciens théoriciens et expérimentateurs sur le thème général de "Transition". Un des apports des maths a été le concept de catastrophe, dû à Thom et Arnol'd. Il s'agissait de classifier les changements qualitatifs des figures d'équilibre d'une classe de systèmes dynamiques généralisant des idées déjà présentes chez Maxwell pour le cas des changements de phase thermodynamiques. La théorie des systèmes dynamiques (à nombre fini de degrés de liberté) de Ruelle et Takens a permis de découvrir les scénarios possibles pour la transition du comportement régulier à chaotique de systèmes dynamiques "génériques" bientôt mis en évidence expérimentalement dans des expériences de mécanique des fluides. Ceci laissait ouvert le cas des écoulements parallèles où, manifestement, le nombre de degrés de liberté est grand, voire infini. L'examen de ce cas a permis à. partir de réflexions basées sur les équations d'amplitude, de prédire que la transition vers la turbulence dans ces écoulements parallèles appartient à la classe d'universalité de la percolation dirigée. Ceci a été brillamment confirmé par les expériences du groupe Bergé conduites sur l'écoulement de Couette.

Lauren Riddiford

ETH Zurich PSI Schilligen

Disorder at complex oxide thin film interfaces and its impact on interfacial spin phenomena

Within materials physics, complex oxides have been studied extensively for the rich assortment of phenomena they exhibit. The ferrimagnetic spinel ferrites, including $Mg(Al,Fe)_2O_4$ (MAFO), have attracted attention for their insulating nature and low magnetic damping, leading to long-distance propagation of spin currents. By interfacing strongly spin-orbit-coupled materials with MAFO, we measure efficient conversion between spin currents and charge currents through ferromagnetic resonance and electrical transport [1]. Further, we can utilize MAFO as a magnetic reservoir to induce magnetism in a neighboring material. However, I show that in MAFO/Bi_2Se_3, a disordered interface detected through TEM can lead to spurious signals, making interpretation of magnetic profiling and Hall effect data difficult [2]. To understand

spin phenomena in magnetic heterostructures, it is vital to carefully characterize the microstructure of the interface.

[1] Riddiford, L.J. et al, *Applied Physics Letters* 115.12 (2019): 122401.
[2] Riddiford, L.J. et al, *Physical Review Letters* 128.12 (2022): 126802.

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INFORMATION ENTROPY OF CHEMICAL REACTIONS – TOWARD DIGITAL CHEMISTRY AND REACTION INFORMATICS

Previously, we developed a new theoretical approach utilizing Shannon entropy for quantifying complexity of molecular ensembles and its change in chemical reactions. Ensemble's entropy results from the contributions of constituting molecules and cooperative entropy emerging at mixing the molecules. Thus, the information entropy is not additive and, by this, reminisces the behavior of the von Neumann entropy of quantum information. We extend our approach to the systems of interdependent chemical reactions (parallel, consecutive, and catalytic) and modify Hess' law for correct connecting information entropies of elementary steps with the summative values of the process. Then we discuss a digital version of a typical chemical problem: deciphering chemical structure based on its chemical properties. In our approach, structural features of the molecules are deducible from the information-entropy descriptors of their chemical reactions. We exemplify it with the processes of endofullerene formation through incorporating guest atoms into the empty fullerenes.

Jacob Szeftel

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Current-induced Hall effect

The properties of the current-induced Hall effect are analyzed, for which the static magnetic field, supplied by an external source in the traditional experiment, is created by the current itself. The special experimental setup, needed for its observation, is described. It is shown how, combined with the skin effect, it could permit to measure the concentration of conduction electrons in superconductors. It is then applied to the study of the Meissner effect, in order to illustrate its potential.

Arieh Visocekas

Systemic design thinking

CONTEXT:
From use in hand manufactured to industrial products, services to social/public apparatus/organisms (family, enterprise, school, town, hospital, state), design is a holistic process centered around the user, the human being, within society and the crowd/people complexities (overlaying social matrix, internet, social networks).
Our modern world full of complexities pushed people to develop new methods such as Systemic Design following several traditional methods (creativity groups, etc..). A short research of the web leads to several canadian, scandinavian, dutch, belgian, french interesting active systemic research networks, universities, traditions. It's actual , dynamic, alive field.

CONCEPT:
We look more at Systemic Design as a Quality Process approach, to get something better or different, to be turn into algorithmic processes like any engineering matters - by opposition and on the contrary of artistic and feeling 'emotional"/based, like focusing on fictions / alternate realities/ characters / "dreams of ... / desires of ... / reality of ... " .
Such a rational methods / systemic design / can put manually activated and done by 10/12 people over several days, in a comfortable room, with good amenities , paperboards, pencil, post-it ... in similar yet much more complex way than regular Design Thinking methods.

PRODUCT:
Our theme of research is about to do Systemic Design relevantly also by computer treatments, case by case, or further, manipulating some quantities of data and simulations of complex environments, elements and evolutions.
Our question is how in synthetizing together several approaches: engineers, designers, system specialists, holistic approach (human sciences, biology, etc...), military systemic operational art and other complex mathematics modelling of systems, logistics, evolutions of chaotic and stochastic realities, into a common approach:

- With proper easy steps in the process
- with relevant graphic mapping for simple effective action
- with secure data and processes

CONTEXT OF PROBLEM / AIM FOR THE SOLUTION

If people were able in 1985 to engineer CAD (Computer Aided Design) software for drawing, after papers and pencils for drafting for hundreds of years, we can possibly also engineer SAD (Systemic Aided Design) software for solving complex stuff, with data and simulations.

The aim of the end product is an easy/relevant/practical tool for organizing data, information, thoughts, processes and actions in complex ecosystems, matters, environments.

Elena Y. Vedmedenko
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Spin revolution breaks time reversal symmetry of rolling magnets

The classical laws of physics are usually invariant under time reversal. Here, we reveal a novel class of magnetomechanical effects rigorously breaking time-reversal symmetry. These effects are based on the mechanical rotation of a hard magnet around its magnetization axis in the presence of friction and an external magnetic field, which we call spin revolution. The spin revolution leads to a variety of symmetry breaking phenomena including upward propulsion on vertical surfaces defying gravity as well as magnetic gyroscopic motion that is perpendicular to the applied force. The angular momentum of spin revolution differs from those of the magnetic field, the magnetic torque, the rolling axis, and the net torque about the rolling axis. The spin revolution emerges spontaneously, without external rotations, and offers various applications.

E. Y. Vedmedenko and R. Wiesendanger, Sci. Rep. 12, 13608 (2022).

Hervé Zwirn

"Is Past determined?"

In a recent paper, I argued against backward in time effects used by several authors to explain delayed choice experiments. I gave an explanation showing that there is no physical influence propagating from the present to the past and modifying the state of the system at a time previous to the measurement. However, though the solution is straightforward in the case of delayed choice experiments involving only one particle, it is subtler in the case of experiments involving two entangled particles because they give rise to EPR-like situations. Considering that a measurement is not an actual change of the physical state of a system and is relative to the observer allows to understand that there is neither backward in time effects nor instantaneous collapse of the second system when the first one is measured, as is often postulated. I want now to go further into the consequences of the way of considering the measurement, that I have called Convivial Solipsism. I show that even if, in the usual sense, there is no physical effect of the present or of the future on the past, we must nevertheless consider that the observer's past is sometimes not entirely determined and that it becomes determined only when certain measurements are done later. This apparent contradiction disappears if one understands that each observer builds, through her own measurements, her own world (that I call the phenomenal world in Convivial Solipsism) which is different from what we are used to consider as the common world shared by everybody.

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