DY 31: Poster: Statistical Physics

Time: Wednesday 15:00–18:00 Location: Poster C

DY 31.1 Wed 15:00 Poster C

Localisation in one-dimensional random tight-binding models — •Luca Schäfer and Barbara Drossel — Technische Universität Darmstadt, Darmstadt, Germany

We compare the localisation characteristics of three different one-dimensional disordered quantum systems described by the tight-binding model, using exact and partial diagonalisation of the Hamiltonian to obtain the eigenvalue spectrum and the associated participation ratios (P), and the transfer-matrix method to determine the localisation length (ξ). The degree of localisation is evaluated based on the scaling of P and ξ with the system size. The first model is the well-known Anderson model (AM) featuring on-site disorder, for which all states are localised. The second model has no on-site disorder, but random couplings (RCM). In this scenario, solely the state with $E = 0$ is extended, and ξ increases proportional to the negative logarithm of E. We show that the eigenstate in the band centre can be mapped on a random walk, thus explaining its properties. The third model can be represented as a harmonic chain with random coupling (HCM), where the on-site potential is correlated with the coupling strengths such that the model has a conserved quantity. This choice is motivated by applications in ecological and diffusion networks. We find, in agreement with existing analytical calculations, that the number of extended states for $E \approx 0$ grows proportional to the square root of the system size, and we related this power law to the power laws that characterise the statistics of P and E and ξ and the relation between them.

DY 31.2 Wed 15:00 Poster C

Inferring hidden dynamics from empirical densities and currents of projected observables — •Francesco Malcangi and Aljaz Godec — Max Planck Institute for Multidisciplinary Sciences, Göttingen, Germany

Single-molecule experiments typically probe one-dimensional projections of complex high-dimensional dynamics, lumping many distinct microscopic configurations into the same observable state. The projection induces memory in the evolution of the observable but otherwise buries features of the underlying potential landscape. We show how the sample-to-sample fluctuations of functionals of projected paths may be utilized to infer hidden features of the landscape such as hidden intermediates and buried free energy barriers.

DY 31.3 Wed 15:00 Poster C

Acoustic properties of phononic crystal defect Lieb Lattices and the time evolution of its compactly localised states — •Katarzyna E. Sopińska, Peter Thomas, and Rudolf A. Römer — University of Warwick, Coventry, CV 7AL, United Kingdom

Lieb lattices are known to support so-called compactly localized states (CLS) in degenerate electronic flat-bands. As a wave phenomenon, CLS should also exist for acoustic waves. We model eigenstates of the acoustic wave equation in macroscopic Lieb lattice-like arrangements of steel rods arranged in air. Alternatively, we also consider the possibility of ultrasound CLSs in metal plates with air holes in Lieb lattice-like geometry. Both situations have obvious experimental realizations. We investigate the conditions for the existence of the CLS. We study frequency dependence as well as pressure amplitudes.

DY 31.4 Wed 15:00 Poster C

Analysis of the Mpemba effect in magnetic systems — •Janett Prehl and Martin Weigel — Technische Universität Chemnitz, Chemnitz, Deutschland

The Mpemba effect, first discovered by Mpemba and Osborne for water [1], is observed when a hot sample cools faster than an initially colder one, when both are refrigerated in the same thermal reservoir. During the last years this effect has also been found to take place in the general context of magnetic phase transitions of different orders. Here, we investigate and discuss the occurrence of this non-equilibrium process for different ferromagnetic models exhibiting a phase transitions at a critical temperature T_c. We aim to analyze how different initial temperatures, structural properties or updating dynamics influence the time behavior of quantities such as energy E or the average domain length l in order to get a deeper insight in the occurring mechanism of the Mpemba effect for the systems under consideration.

[1] Mpemba, E.B. and Osborn, D.G., *Phys. Educ.* **4**, 172 (1969)

DY 31.5 Wed 15:00 Poster C

Controlling Uncertainty of Empirical First-Passage Times in the Small-Sample Regime — •Rick Bebon and Aljaz Godec — Max Planck Institute for Multidisciplinary Sciences, Göttingen, Germany

Central to the kinetics of target-search processes, first-passage phenomena find successful applications across virtually all scientific domains. Here, we address the challenge of controlling uncertainty of empirical first-passage times $\overline{\tau}_n \equiv \sum_{i=1}^{n} \tau_i/n$, i.e., the sample-mean inferred from under-sampled experimental or simulation data. Understanding the ramifications of the small-sample regime, such as non-Gaussian fluctuations, is crucial for obtaining trustworthy estimates but yet remains a daunting task not amenable to standard error-analysis techniques. Consequently, we outline a non-asymptotic theory that enables robust error control in empirical first-passage times of reversible Markov processes regardless of sample-size under minimal assumptions. Key results include concentration inequalities that bound deviations of the sample-mean from the true mean first-passage time from above and sharp two-sided bounds on the expected maximum and minimum deviation from the mean in any given sample.

DY 31.6 Wed 15:00 Poster C

Stress fluctuations and adiabatic speed of sound in liquids: A simple way to estimate it from simulations — Taras Bryk[1,2], Giancarlo Ruocco[3,4], and •Ari Paavo Seitsonen[5] — [1]Institute for Condensed Matter Physics of National Academy of Sciences of Ukraine, Lviv — [2]Institute of Applied Mathematics and Fundamental Sciences, Lviv National Polytechnic University, Lviv — [3]Centre for Life Nano Science @Sapienza, Istituto Italiano di Tecnologia, Rome — [4]Dipartimento di Fisica, Università di Roma La Sapienza — [5]Département de Chimie, École Normale Supérieure, Paris

One of the fundamental quantities in dynamics of the liquid state, the adiabatic speed of sound c_s, is difficult to predict from computer simulations, especially in simulations where the electronic structure is explicitly solved during the simulation, like the density functional theory-based molecular dynamics (DFTbMD). Here we derive an expression for the instantaneous correlator of fluctuations of longitudinal component of stress tensor, which contains c_s along with others quantities easy accessible via computer simulations. We show that the proposed methodology works well in the case of Lennard-Jones and soft-sphere simple fluids, Kr-Ar liquid mixture in connection with simulations with effective pair interactions as well as for liquid Sb, fluid Hg and molten NaCl from DFTbMD simulations.

DY 31.7 Wed 15:00 Poster C

Discovery of the Rapid Increase of Distances in the Early Universe Via Temperature — •Philipp Schöneberg[1], Hans-Otto Carmesin[1,2,3], Jannes Ruder[1], and Phil Immanuel Gustke[1] — [1]Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — [2]Hohenwedeler Weg — [3]Universität Bremen, Fachbereich 1, Postfach 330440, 28334 Bremen

Using general relativity, we derive the following astonishing property of the early universe: The Planck temperature is reached even though the corresponding size of the Hubble radius is still many orders of magnitude larger than the Planck length. Accordingly, the Hubble radius as a function of time must have increased rapidly in the early universe, in a manner not described by general relativity. That era of rapid increase of distances is usually called 'cosmic inflation'. We derive consequences about the era of 'cosmic inflation'.

Literature: Carmesin, H.-O. (2023): Geometrical and Exact Unification of Spacetime, Gravity and Quanta, Berlin: Verlag Dr. Köster.

DY 31.8 Wed 15:00 Poster C

The Macroscopic Dynamics of the Big Bang is Derived from the Microscopic Dynamics — •Hans-Otto Carmesin — Gymnasium Athenaeum, Harsefelder Straße 40, 21680 Stade — Studienseminar Stade, Bahnhofstr. 5, 21682 Stade — Universität Bremen, Fachbereich 1, Postfach 330440, 28334 Bremen

The Schwarzschild metric describes the microscopic dynamics at an object in general relativity. With it, the Friedman Lemaitre equation of the macroscopic dynamics of the Big Bang is derived. Thereby, the flatness problem is solved.

Moreover, the microscopic dynimcs implies the Schrödinger equation and the postulates of quantum physics.

Consequences of these dynamical results are outlined. Especially, the unification of micro- & macrocosm and of general relativity & quantum physics is derived exactly, and this unification will be discussed.

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Literature:

Carmesin, H.-O. (2023): Geometrical and Exact Unification of Spacetime, Gravity and Quanta, Berlin: Verlag Dr. Köster.

Carmesin, H.-O. (2022): Explanation of Quantum Physics by Gravity and Relativity. PhyDid B, pp. 425-438.

DY 31.9 Wed 15:00 Poster C

Thermodynamic inference in partially accessible, periodically driven Markov networks using transition-based waiting time distributions — •Alexander Maier, Julius Degünther, and Udo Seifert — II. Institut für Theoretische Physik, Universität Stuttgart, 70550 Stuttgart, Germany

Infering information on the dynamics including thermodynamic quantities of an only partially accessible physical system is one of the challenges of stochastic thermodynamics. In this work, we consider distributions of waiting times between consecutive detectable transitions in partially accessible, periodically driven Markov networks. These distributions allow us to infer dynamical properties like the period of the driving and time-dependent transition rates as well as thermodynamic quantities like estimators of the entropy production rate. Moreover, we conjecture a lower bound of the entropy production rate that is operationally accessible for arbitrary periodic driving.

DY 31.10 Wed 15:00 Poster C

Inference of entropy production beyond the mean — •Julius Degünther, Jann van der Meer, and Udo Seifert — II. Institut für Theoretische Physik, Universität Stuttgart, 70550 Stuttgart, Germany

The laws of thermodynamics apply to biophysical systems on the nanoscale as described by the framework of stochastic thermodynamics. The theory provides universal, exact relations for quantities like heat or work, which have been verified for experiments where these quantities as well as the system are accessible. Complementary studies in the field consider partially hidden, coarse-grained descriptions, in which the mean entropy production typically is bounded in terms of observable quantities. In contrast, we discuss a fluctuating entropy production that applies to individual trajectories in a coarse-grained description under time-dependent driving. Thus, the concept is applicable to the broad and experimentally significant class of model systems subject to time-dependent driving in which not all relevant states can be resolved.

DY 31.11 Wed 15:00 Poster C

Entropy estimators based on waiting-time distributions for overdamped Langevin dynamics — •Ellen Meyberg and Udo Seifert — II. Institut für Theoretische Physik, Universität Stuttgart, Deutschland

Stochastic systems are usually only accessible on the meso-scale rather than on the micro-scale leading to the need of an effective, coarse-grained description that is often only partially accessible. Usually, coarse-graining is done by lumping many states together into one compound state. Recently, it has been shown that a complementary coarse-graining based on transitions between Markov states can provide bounds on the entropy production [1]. The logarithmic ratio of waiting-time distributions between two successive transitions in forward and backward direction is a measure of time-irreversibility and thus yields a lower bound on the entropy production. This bound is exact in the case of a uni-cyclic network and can be applied without knowing the steady-state distribution. How can the result obtained for Markov jump processes be applied to an overdamped Langevin dynamics? We explain how transitions can be defined for a continuous dynamics using the milestoning approach [2] and show that the entropy estimator for a uni-cyclic network based on this definition yields the full one.

[1] J. van der Meer, B. Ertel, and U. Seifert, Phys. Rev. X 12, 031025 (2022).

[2] D. Hartich and A. Godec, Phys. Rev. X 11, 041047 (2021).

DY 31.12 Wed 15:00 Poster C

Ein Statistischer Algorithmus für Makroskopische Koeffizienten aus Mikroskopischen Parametern — •Bin Su — Institut fuer Theoretische Physik, TU-Berlin, Germany

Dieser Artikel präsentiert einen Algorithmus aus der dynamischen Statistik, um makroskopische Koeffizienten eines Systems zu erhalten, das sich nicht nur in der Nähe vom Gleichgewicht (wenn das wirkende Außenfeld konstant ist) sondern auch fern vom Gleichgewicht (in Form der nichtlinearen Abhängigkeit von dem Außenfeld) befindet. Die konkrete Anwendung des Algorithmus im Artikel ist die nichtlinear optische Suszeptibilität der Zähflüssigkeit, deren mikroskopische Bestandteile aus anisotropieförmigen Teilchen moduliert wird. Die in den Ergebnissen erscheinenden makroskopischen Koeffizienten bestehen aus einer Reihe der Nichtlineare von dem Außenfeld. Die höheren Ordnungen der Koeffizienten entsprechen mehrfach der einfallenden Frequenz als zweite harmonische Generation usw. und Summenfrequenzgeneration. Der vorliegende statistische Algorithmus würde hier dazu beitragen, bei der Konstruktion eines Teilchensystems, ein homogenes Modell für Plasmas, zu entwickeln und die makroskopischen Messwerte zu erklären.

DY 31.13 Wed 15:00 Poster C

Far-from-equilibrium relaxation in long-range interacting stochastic few-body systems — •Felipe Pereira-Alves and Aljaž Godec — Mathematical bioPhysics group, Max Planck Institute for Multidisciplinary Sciences, Göttingen 37077, Germany

The dynamics of non-equilibrium systems in the presence of long-range interactions still pose great challenges for theory. A paradigm for such systems is Dyson's Brownian motion, for which exact calculations of certain physical observables and correlations are feasible. In our work, we interrogate the relaxation dynamics of the Dyson model prepared by a far-from-equilibrium temperature quench. It was predicted and recently experimentally confirmed that the relaxation, in the form of heating and cooling for an optically trapping colloidal particle, is fundamentally asymmetric. Here, we investigate the corresponding dynamical regimes and underlying (a)symmetries of heating versus cooling of a Dyson chain of trapped Brownian particles interacting with a long-range logarithmic potential.

DY 31.14 Wed 15:00 Poster C

Lane formation in gravitationally driven colloid mixtures consisting of up to three different particle sizes — •Kay Hofmann[1], Marc Isele[2], Artur Erbe[3], Paul Leiderer[2], and Peter Nielaba[2] — [1]Universität, Mainz, Deutschland — [2]Universität, Konstanz, Deutschland — [3]Helmholtz-Zentrum, Dresden, Deutschland

We utilized Brownian dynamics simulations to investigate segregation phenomena of gravitationally driven colloids in two-dimensional confined channels. In the present work, we introduce a third particle species to further our understanding of colloidal systems. The interaction between the colloids is modeled by the Weeks-Chandler-Andersen potential, and the confinement of the colloids is realized by hard walls. A difference in the driving force is established through variation in colloid sizes while maintaining a constant mass density. We observe for binary and ternary systems that a driving force difference induces a transition to lanes. In ternary systems, we investigate the tendency for lane formation in dependence of the medium-sized colloid diameter. Here, we find an optimal ratio between colloid diameters for lane formation in ternary systems. Moreover, we examine the interaction between colloids of varying sizes at the channel walls. Recently, we found that driven large colloids displace smaller ones towards the walls, leading to the formation of small particle lanes during the early stages of simulation. Additionally, we discover that these thin lanes are unstable and gradually dissolve over extended time frames.

DY 31.15 Wed 15:00 Poster C

Heat exchange fluctuation relation for the transition from a micro-canonical to a canonical ensemble in a classical harmonic oscillator — Leonel F. Ardila[1], Nicolás Torres-Domínguez[2], José D. Muñoz[1], and •Carlos Viviescas[2] — [1]Simulation of Physical Systems Group and Center of Excellence in Scientific Computing: CoE-SciCo, Department of Physics, Universidad Nacional de Colombia, Bogotá, Colombia. — [2]Departamento de Física, Universidad Nacional de Colombia, Bogotá, Colombia.

In this work we present the analytical derivation and the numerical verification of an original heat fluctuation relation for a harmonic oscillator evolving at constant temperature from a micro-canonical to a canonical ensemble. We found that the probabilities $P(Q)$ and $P(-Q)$ of gaining or loosing a heat Q, respectively, are related as

$$\frac{P(Q)}{P(-Q)} = e^{-2Q/k_BT} \quad , \tag{1}$$

with T the temperature. This result is numerically validated through molecular dynamics simulations with an overdamping Langevin equation algorithm [1]. Our results give insight on the probabilistic behavior of a system undergoing thermalization and contributes to extend fluctuation relations to micro-canonical initial states [2].

[1] P. Talkner, M. Morillo2, J. Yi and P. Hänggi, New J. Phys. **15**,095001(2013).

[2] N. Goga, A.J. Rzepiela, A.H. de Vries, S.J. Marrink, and H.J.C. Berendsen, J. Chem. Theory Comput., **8** 3637-3649 (2012)

DY 31.16 Wed 15:00 Poster C

On the emergence of memory in equilibrium versus non-equilibrium systems — •Xizhu Zhao[1,2], David Hartich[1], and Aljaž Godec[1] — [1]Max Planck Institute for Multidisciplinary Sciences, Göttingen, Germany — [2]Max Planck School Matter to Life, Heidelberg, Germany

Experiments often probe observables that correspond to low-dimensional projections of high dimensional dynamics. In such situations distinct microscopic configurations become lumped into the same observable state. It is well known that correlations between the observable and the hidden degrees of freedom give rise to memory effects. However, how and under which conditions these correlations emerge remains poorly understood. Here we shed light on two fundamentally different scenarios of the emergence of memory in minimal stationary systems, where observed and hidden degrees of freedom evolve either cooperatively or are coupled by a hidden non-equilibrium current. In the reversible setting strongest memory manifests when the time-scales of hidden and observed dynamics overlap, whereas, strikingly, in the driven setting maximal memory emerges under a clear time-scale separation. Our results hint at the possibility of fundamental differences in the way memory emerges in equilibrium versus driven systems that may be utilized as a “diagnostic” of the underlying hidden transport mechanism. [1]

[1] X. Zhao, D. Hartich, & A. Godec, arXiv:2311.12788 (2023)

DY 31.17 Wed 15:00 Poster C

In pursue of the tetratic phase in hard rectangles — •Denis Dertli and Thomas Speck — Institut für Theoretische Physik IV der Universität Stuttgart, Stuttgart, Deutschland

We consider two-dimensional systems of hard rectangles motivated by the collective behavior of self-assembled DNA-based nanostructures. We investigate this system in the NPT ensemble through extensive hard-particle Monte Carlo simulations. The phase behavior is controlled by the packing fraction and the aspect ratio of the particles. Both the equation of state and free-energy profiles of order parameters point to a continuous Kosterlitz-Thouless-Halperin-Nelson-Young (KTHNY) two-step melting/freezing scenario interpolating between the smectic and isotropic phase. While rod-like particles with large aspect ratio assemble in an intervening nematic phase, a “tetratic” phase is found for moderately elongated rectangles. Our approach demonstrates the distinct properties of these phases and provides a quantitative determination of phase boundaries. Our findings can be verified in recent experiments of biological systems composed of DNA-based nanostructures.

DY 31.18 Wed 15:00 Poster C

Transgenerational trajectory statistics of dividing and interacting cells — •Leif Peters[1,2] and Philip Bittihn[1,2] — [1]Max Planck Institute for Dynamics and Self-Organization, Göttingen 37077, Germany — [2]Institute for the Dynamics of Complex Systems, Göttingen University, Göttingen 37077, Germany

In growing dense active matter, growth and mechanical interactions give rise to non-trivial single-particle trajectories and complex collective motion. However, finite particle lifetimes in such systems pose a fundamental challenge to their characterization using traditional statistical-physics approaches. We use simulations of a minimal agent-based model to describe and quantify the movement of single cells in a growing active bath. To analyze the long-term statistics, we define observables like a transgenerational mean squared displacement. We evaluate these observables for different ensembles based on ancestral relationships between cells and distinct ways to deal with trajectory multiplicity. In systems in homeostasis with random removal and therefore turnover of cells, our results show similarities between the movement of single cells and noise driven dynamics.

DY 31.19 Wed 15:00 Poster C

Effect of burst packages on coding by primary sensory afferents in weakly electric fish — •Maria Schlungbaum[1,2], Alexandra Barayeu[3,4], Jan Grewe[3,4], Jan Benda[3,4], and Benjamin Lindner[1,2] — [1]Physics Department, Humboldt University Berlin — [2]Bernstein Center for Computational Neuroscience Berlin — [3]Institute for Neurobiology, Eberhard Karls Universität Tübingen — [4]Bernstein Center for Computational Neuroscience Tübingen

How burst spikes influence the coding of time-dependent signals is not well understood. We study the impact of burst packages on the output statistics of sensory neurons, namely the first- and second-order response functions, the spike train power spectrum, and the coherence function. Burst packages modulate these response functions in a frequency-dependent manner; they can have either an increasing or diminishing effect (low frequencies) or no effect at all (large frequencies) on all these statistics. In particular, we demonstrate that bursting can boost the nonlinear response in certain frequency regions. Assuming a random number of burst spikes endowed with a temporal jitter, we calculate theoretical formulas for the spectral statistics. In this framework, we do not take stimulus-driven effects on bursting into account. We compare our analytical results to spike train data from P-unit electroreceptors of the electric fish *Apteronotus leptorhynchus* and inspect how well our theoretical results can describe the differences between coding with and without burst spikes in these cells.

DY 31.20 Wed 15:00 Poster C

Large-deviation simulation of the Brownian Bee model — •Hartmut Schoon and Alexander K. Hartmann — Institut für Physik, Carl von Ossietzky Universität Oldenburg, 26111 Oldenburg, Germany

The Brownian Bee model is a version of Branching Brownian motion, evolving into a nonequilibrium steady state. The model consists of N particles performing independent Brownian motion. Every particle has the ability to randomly branch and create a new particle at the same position. At those branching events the farthest particle from its origin will be deleted, resulting in a conservation of the particle count. Berestycki *et al.* [1] showed that at long times the particles form a spherical steady state with radius l_0 which depends on the spatial dimension d. Meerson and Sasorov [2] investigated the probability $\mathcal{P}(l, N, T)$ of the maximum distance l of a particle from the origin within a very large time interval $0 < t < T$. They concluded, that this probability follows a large-deviation form $-\ln \mathcal{P}(l, N, T) \simeq NTR_d(l)$. Asymptotics for the rate function $R_d(l)$ were provided for $l \ll l_0$ and $l \gg l_0$ and a full analytical solution is given for $d = 1$. We implemented Brownian Bees numerically and computed $\mathcal{P}(l, N, T)$ by a large-deviation simulation [3] for various dimensionalities d which allowed us to obtain the distribution down to exponential small probability densities like $\mathcal{P} \sim 10^{-100}$.

[1] J. Berestycki, et al., Ann. Prob. **50**, 2133-2177 (2022)

[2] B. Meerson and P. Sasorov, Phys. Rev. Lett., **103**, 032140 (2021)

[3] A.K. Hartmann, Phys. Rev. E , **89**, 052103 (2014)

DY 31.21 Wed 15:00 Poster C

Josephson diode as a heat engine — •Konstantinos Kontogeorgiou[1], Inanc Adagideli[2,3,4], and Fabian Hassler[1] — [1]Institute for Quantum Information, RWTH Aachen University, Germany — [2]Faculty of Engineering and Natural Sciences, Sabanci University, Orhanli-Tuzla, Istanbul, Turkey — [3]MESA+ Institute for Nanotechnology, University of Twente, 7500 AE Enschede, The Netherlands — [4]TUBITAK Research Institute for Fundamental Sciences, 41470 Gebze, Turkey

Non-reciprocal superconducting elements, called Josephson diodes, have received increased attention in the past years. Here we explore the possibility of utilizing the reciprocity breaking to realize a thermal engine. To this end, we study the system coupled to two reservoirs at different temperatures. We investigate the influence of the different parameters in order to maximize the efficiency.

DY 31.22 Wed 15:00 Poster C

Cluster percolation in the 3D $\pm J$ random-bond Ising model — •Lambert Münster and Martin Weigel — Institut für Physik, TU Chemnitz, 09107 Chemnitz, Germany

Single-replica clusters are successful in describing phase ordering in systems without frustration [1]. For models with frustration such as spin glasses where the order parameter, the overlap, is defined with respect to two replicas, it is convenient to define clusters which include multiple replicas [2]. In this work we numerically study multiple replica clusters in the 3D $\pm J$ random-bond Ising model with the fraction of ferromagnetic bonds set to $p = 0.9$ and $p = 0.5$, respectively, to investigate how different types of clusters can be used to describe phase ordering when there exists a ferromagnetic phase and when the ordering is of spin-glass type.

[1] A. Coniglio and A. Fierro, Correlated percolation, in Complex Media and Percolation Theory, edited by M. Sahimi and A. G. Hunt (Springer, New York, 2021), p. 61.
[2] J. Machta, C. M. Newman, and D. L. Stein, J. Stat. Phys. **130**, 113 (2008)

DY 31.23 Wed 15:00 Poster C

Correlation, crossover and broken scaling in the Abelian Manna Model — •Letian Chen[1], Hoai Nguyen Huynh[1,2], and Gunnar Pruessner[1] — [1]Department of Mathematics, Imperial College London, United Kingdom — [2]Institute of High Performance Computing, Agency for Science, Technology and Research, Singapore

The role of correlations in self-organised critical (SOC) phenomena is investigated by studying the Abelian Manna Model (AMM) in two dimensions. Local correlations of the debris left behind after avalanches are destroyed by re-arranging particles on the lattice between avalanches, without changing the one-point particle density. It is found that the spatial correlations are not relevant to small avalanches, while changing the scaling of the large (system-wide) ones, yielding a crossover in the model's scaling behaviour. This crossover breaks the simple scaling observed in normal SOC.

DY 31.24 Wed 15:00 Poster C

Amorphous topological insulator: towards quantum Hall criticality — •Johannes Dieplinger[1], Soumya Bera[2], and Naba P Nayak[2] — [1]Institute of Theoretical Physics, University of Regensburg, D-93040 Germany — [2]Department of Physics, Indian Institute of Technology Bombay, Mumbai 400076, India

We numerically investigate the critical properties of a topological transition in a two-dimensional lattice with randomly distributed points. The trivial to topological Anderson insulator transition belongs to the unitary class A of the ten-fold symmetry classification of non-interacting fermions. The model intrinsically breaks the time-reversal symmetry without the need for an external mag- netic field, often referred to as the Chern insulator. This transition is induced by varying the density of lattice points or adjusting the mass parameter. Using the two-terminal conductance and multi- fractality of the wavefunction, we found that the amorphous topological insulator exhibits the same universality as the integer quantum Hall transition. The localization length exponent is between $\nu = 2.55$ - 2.61 regardless of the approach to the critical point, thus pointing towards the universal nature of the transition across the topological phase boundary in the non-crystalline model. The irrelevant exponent, y for both observables, is y = 0.3(1), slightly smaller than values obtained using transfer matrix analysis in the Chalker-Coddigton network. Additionally, the analysis of the entire distribution function of the inverse participation ratio reveals a potentially non-parabolic multi- fractal spectrum at the critical point of the quantum anomalous Hall transition.