BP 10: Posters DY - Fluid Physics, Active Matter, Complex Fluids, Soft Matter and Glasses (joint session DY/BP)

Time: Monday 14:00–16:30 Location: DYp

BP 10.1 Mon 14:00 DYp

Jerky active matter: a phase field crystal model with translational and orientational memory* — •Michael te Vrugt, Julian Jeggle, and Raphael Wittkowski — Institut für Theoretische Physik, Center for Soft Nanoscience, Westfälische Wilhelms-Universität Münster, D-48149, Münster, Germany

Most field theories for active matter neglect effects of memory and inertia. However, recent experiments have found inertial delay to be important for the motion of self-propelled particles. A major challenge in the theoretical description of these effects, which makes the application of standard methods very difficult, is the fact that orientable particles have both translational and orientational degrees of freedom which do not necessarily relax on the same time scale. In this work, we combine modern mathematical methods from particle physics and nonlinear dynamics to derive the general mathematical form of a field theory for soft-matter systems with two different time scales. This allows to obtain a phase field crystal model for polar (i.e., nonspherical or active) particles with translational and orientational memory. Notably, this theory is of third order in temporal derivatives and can thus be seen as a spatiotemporal jerky dynamics. An analysis of the model reveals interesting effects of memory on the dynamics of active systems.

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BP 10.2 Mon 14:00 DYp

Dynamic role of coherent structures in two-dimensional Navier-Stokes turbulence — •Jiahan Wang[1], Wolf-Christian Müller[1], and Jörn Sesterhenn[2] — [1]Technische Universität Berlin, Berlin, Germany — [2]Universität Bayreuth, Bayreuth, Germany

Turbulent coherent structures can phenomenologically be described as regions in a flow exhibiting a high level of spatio-temporal correlation. Although these structures are ubiquitously observed in nature, providing a universal and rigorous definition of them is not a straightforward task. Therefore the choice of a suitable structure detection method is generally not unique and problem-dependent. We are interested in structures appearing in statistically isotropic Navier-Stokes turbulence. For this purpose, direct numerical simulations (DNS) of a two-dimensional flow, forced at small spatial scales, are employed to compare different definitions of structural coherence. This setup inherently forms large scale structures due to the inverse cascade of energy. Detection methods such as the identification of Lagrangian coherent structures (LCS), dynamic mode decomposition (DMD) and wavelet denoising are all capable of splitting physical fields into coherent and incoherent contributions. Based on that, the analysis of the scale-to-scale decomposed energy flux yields a physical interpretation for the influence of those structures onto the overall inverse cascade dynamics. As a result, the decomposed fluxes gained from LCS and DMD are related, whereas the wavelet decomposition shows no similarity at all.

BP 10.3 Mon 14:00 DYp

Magnetic helicity inverse transfer in supersonic isothermal MHD turbulence — •Jean-Mathieu Teissier[1,2] and Wolf-Christian Müller[1,2,3] — [1]Technische Universität Berlin, ER3-2, Hardenbergstr. 36a, D-10623 Berlin, Germany — [2]Max-Planck/Princeton Center for Plasma Physics — [3]Berlin International Graduate School in Model and Simulation Based Research

Magnetic helicity is an ideal invariant of the magnetohydrodynamic (MHD) equations which exhibits an inverse transfer in spectral space. Up to the present day, its transport has been studied in direct numerical simulations only in incompressible or in subsonic or transonic flows. Inspired by typical values of the turbulent root mean square (RMS) Mach number in the interstellar medium, this work presents some aspects of the magnetic helicity inverse transfer in high Mach number isothermal compressible turbulence, with RMS Mach numbers up to the order of ten:

1) a clear Mach-number dependence of the spectral magnetic helicity scaling but an invariant scaling exponent of the co-spectrum of the Alfvén velocity and its curl,

2) the approximate validity of a dynamical balance relation found by incompressible turbulence closure theory,

3) a characteristic structuring of helically-decomposed nonlinear shell-to-shell fluxes that can be disentangled into different spectrally local and non-local transfer processes.

BP 10.4 Mon 14:00 DYp

Molecular dynamics of janus polynorbornenes: glass transitions and nanophase separation — •Mohamed A Kolmangadi, Paulina Szymoniak, Martin Böhning, and Andreas Schönhals — Bundesantalt für Materialforschung und -prüfung (BAM), Berlin, Germany

For the first time, dielectric and calorimetric investigations of a homologous series of Janus polynorbornenes with rigid main backbones and flexible Si(OR)3 side groups of differing length alkyl chains (R = propyl, butyl, hexyl, octyl, and decyl) is reported.Two dielectrically active processes are observed at low temperatures, denoted as β- and α-relaxation. The former can be assigned to localized fluctuations, while the latter is related to the glassy dynamics of the flexible Si(OR)3 side groups, creating a nanophase separation in both the alkyl chain-rich and backbone-rich domains. This is confirmed through temperature-modulated differential scanning calorimetry (TMDSC) measurements and X-ray scattering experiments. The glass transition temperatures of the backbone rich domains, which are beyond or near to their degradation temperatures in terms of conventional DSC, are determined for the first time using fast scanning calorimetry employing both fast heating and cooling rates. This is complemented with scattering experiments that show how the size of the alkyl chain-rich domains increases with the side chain length. Alongside these results, a significant conductivity contribution was observed for all poly(tricyclononenes) with Si(OR)3 side groups, which is interpreted in terms of a percolation model

BP 10.5 Mon 14:00 DYp

Classical Density Functional Theory for Particles with Hard Cores and Soft Square Shoulders — •Markus Hoffmann, Robert F. B. Weigel, and Michael Schmiedeberg — Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany

Classical density functional theory is an excellent tool to investigate classical many-body systems from fundamental principles, in particular soft matter systems. We consider particles with hard cores and soft square shoulders in two dimensions. The hard-core is implemented by using a variant of the Fundamental Measure Theory that probably is the best mean field approach to hard particles.

The hard core-square shoulder interaction possesses two independent length scales namely the diameter of the hard core and the diameter of the square shoulders. We observe the expected crystallization transitions into a triangular phase for both very weak shoulders where the hard cores dominate and for strong shoulders effectively leading to a soft sphere system.

However, the most interesting cases are expected when the two length scales of the systems are competing. As a result, not only square patterns are observed but we also want to explore quasicrystals. Note that previous mean field descriptions of quasicrystals (like Phase Field Crystal approaches) usually consider cluster crystals and so far have not been able to explain the formation of quasicrystals for particles with hard cores.

BP 10.6 Mon 14:00 DYp

Organizing bacterial vortex lattices by periodic obstacle arrays — •Henning Reinken[1], Sebastian Heidenreich[2], Markus Bär[2], and Sabine H. L. Klapp[1] — [1]Technische Universität Berlin, Germany — [2]Physikalisch-Technische Bundesanstalt, Berlin, Germany

Recent experimental studies have shown that the turbulent vortex structures emerging in bacterial active fluids can be organized into regular vortex lattices by weak geometrical constraints such as small pillars [1]. Using a continuum-theoretical approach [2,3], we show how these artificial obstacles reorganize self-induced topological defects which guides the flow profile of the active fluid and enables the stabilization of vortex patterns with tunable properties. Beyond the stabilization of square and hexagonal lattices, we also provide a striking example of a chiral, antiferromagnetic lattice induced by arranging

the obstacles in a Kagome-like array [3]. In this setup, the interplay of lattice topology, activity and length-scale selection generates a net rotational flow. Further, we explore the connections between the stabilized non-equilibrium vortex patterns and equilibrium phase transitions in classical spin lattice models, e.g., the Ising model.

[1] D. Nishiguchi, I. S. Aranson, A. Snezhko, and A. Sokolov, Nat. Commun. **9**, 4486 (2018)
[2] H. Reinken, S. H. L. Klapp, M. Bär, and S. Heidenreich, Phys. Rev. E **97**, 022613 (2018)
[3] H. Reinken, D. Nishiguchi, S. Heidenreich, A. Sokolov, M. Bär, S. H. L. Klapp, and I. S. Aranson, Commun. Phys. **3**, 76 (2020)

BP 10.7 Mon 14:00 DYp

Active mobile oscillators: Density fluctuations and phase ordering — Astik Haldar[1], •Swarnajit Chatterjee[2], Apurba Sarkar[3], Raja Paul[3], and Abhik Basu[1] — [1]Saha Institute of Nuclear Physics, Kolkata, India — [2]Center for Biophysics & Department for Theoretical Physics, Saarland University, Saarbrücken, Germany — [3]Indian Association for the Cultivation Of Science, Kolkata, India

We consider the collective motion of nearly phase-ordered active oscillators on a substrate. The dynamics include activity-induced couplings between the local phase with the concentration of the mobile oscillators on the interface. We show that such a system can be stable over a wide range of model parameters. When stable, the system can also show a variety of orders. In different regions of the phase space, the system can show phase ordering that is stronger than the conventional quasi long-range order (QLRO) together with hyperuniform number fluctuations, or phase ordering weaker than QLRO together with giant number fluctuations, or even QLRO with uniform density fluctuations. In other parameter regimes, the system becomes unstable with the eventual loss of any phase ordering beyond a finite (small) system size. We have also constructed an appropriate agent-based lattice-gas model. Numerical simulations of this model corroborate the analytical predictions and validate the results on the phase fluctuations.

BP 10.8 Mon 14:00 DYp

Structural and dynamical properties of gel networks — •Matthias Gimperlein and Michael Schmiedeberg — Institut für theoretische Physik 1, FAU Erlangen-Nürnberg

Gelation is connected to a slow-down in dynamics, the onset of percolation and an increasing number of neighboring particles. The slow-down occurs on different time scales depending on the studied length scales.

Using Brownian Dynamics simulation for a system of colloidal particles interacting due to a modified square well and Yukawa potential we investigate the structural properties of gel networks on different time and length scales depending on system parameters as the strength of attraction or repulsion respectively.

The square well potential is modified by introducing an interaction range α to flatten the walls of the square well. The phase diagram was determined by fitting the vapour-liquid binodal. In the square well limit ($\alpha \to 0$) results from the literature are recovered. Structural properties as node distribution or link lengths are extracted from minimal networks which allow an easier analysis of the underlying network structure.

Further research includes distinguishing dynamic regimes or structures on different length and time scales, investigating the history/protocol dependency of the development (i. e. starting from different initial configuration) and finding stable or metastable structures to describe the evolution of gel networks not on the particle level anymore, but on a coarse grained level.

BP 10.9 Mon 14:00 DYp

Simple model for drops on elastic substrates — •Christopher Henkel[1], Uwe Thiele[1], and Jacco Snoeijer[2] — [1]Institut für Theoretische Physik, WWU-Münster, Germany — [2]Fac. of Science and Technologie, University Twente, Netherlands

The investigation of the wetting behavior on viscoelastic or elastic substrates is of great interest. In this talk we present a simple model for steady liquid drops on fully compressible elastic substrates and show that a double transition of contact angles appears under variation of the substrate softness, similar to the one described in [1]. We further discuss whether these angles agree with the Neumann and Young-Laplace conditions in the liquid-liquid and liquid-solid limit respectively and how the transitions depend on drop size. Finally, we employ a gradient dynamics model in the long-wave limit and show first results of direct time simulations.

[1] Lubbers, L. A., Weijs, J. H., Botto, L., Das, S., Andreotti, B., and Snoeijer, J. H., (2014). Drops on soft solids: free energy and double transition of contact angles. *Journal of fluid mechanics*, 747.

BP 10.10 Mon 14:00 DYp

Flocking and reorientation transition in the q-state active Potts model — •Matthieu Mangeat[1], Swarnajit Chatterjee[1,2], Raja Paul[2], and Heiko Rieger[1] — [1]Saarland University, Saarbrücken, Germany — [2]IACS, Kolkata, India

We study the q-state active Potts model (APM) on a two-dimensional lattice in which active particles have q internal states corresponding to the q directions of motion. A local alignment rule inspired by the ferromagnetic q-state Potts model and self-propulsion via biased diffusion according to the internal particle states leads to a collective motion at high densities and low noise. We formulate a coarse-grained hydrodynamic theory with which we compute the phase diagram of the APM and explore the flocking dynamics in the region, in which the high-density (polar liquid) phase coexists with the low-density (gas) phase and forms a fluctuating band of coherently moving particles. As a function of the particle self-propulsion velocity, a novel reorientation transition of the phase-separated profiles from transversal to longitudinal band motion is found, which is absent in the Vicsek model [1] and the active Ising model [2]. The origin of this reorientation transition is revealed by a stability analysis: for large velocities the transverse diffusion constant approaches zero and then stabilizes longitudinal band motion. Computer simulations corroborate the analytical predictions of the flocking and reorientation transitions and validate the phase diagrams of the APM.

[1] T. Vicsek *et al.*, Phys. Rev. Lett. **75**, 1226 (1995).
[2] A. P. Solon and J. Tailleur, Phys. Rev. Lett. **111**, 078101 (2013).

BP 10.11 Mon 14:00 DYp

Cell fitness in growth driven active matter: decoupling turnover rate and homeostatic pressure predictors — •Yoav G. Pollack[1], Philip Bittihn[1], and Ramin Golestanian[1,2] — [1]Max Planck Institute for Dynamics and Self-Organization (MPIDS), Goettingen, 37077, Germany — [2]Rudolf Peierls Centre for Theoretical Physics, University of Oxford, Oxford, OX1 3PU, UK

In growth-driven dense cellular active matter, cell dynamics and competition are governed by the intricate relations between growth, proliferation, removal (e.g. death, extrusion) and mechanical interactions. Though the rates at which a cell proliferates or dies have already been established as a significant factor for fitness, homeostatic pressure was recently suggested as an equivalent predictor of fitness and one that can be more easily measured. Here we show that this equivalence in not universal and can be broken. By introducing an additional timescale that governs the duration of the single-cell removal process in a simple growing dumbbell model of cells, the homeostatic pressure is partially decoupled from the turnover rate, leading to a distinct prediction for each. When the two factors are modulated in this way in a simulated competition assay of a mixture of two cell species in a closed 1D channel, we show that while the homeostatic pressure does not predict well which species triumphs, the turnover rate does. A good fitness measure is important in studies of tumor growth, bacterial evolution, etc. and this result is a first step in understanding for which scenarios is the homeostatic pressure a valid predictor.

BP 10.12 Mon 14:00 DYp

Unjamming of Active Rotators — •Linda Ravazzano[1], Silvia Bonfanti[1], Maria C. Lionetti[1], Maria R. Fumagalli[1], Roberto Guerra[1], Oleksandr Chepizhko[2], Caterina A. M. La Porta[1], and Stefano Zapperi[1] — [1]Center for Complexity and Biosystems, University of Milan, Italy — [2]Leopold-Franzens-Universität Innsbruck, Austria

Active particles assemblies are of peculiar interest thanks to the richness of dynamical phases they can undergo varying internal parameters such as density, adhesion strength or self-propulsion. Most theoretical studies of active matter consider self-propelled particles driven by active forces. The observation of the motion of Chlamydomonas reinhardtii algae, in which the active particles have also the ability to self-rotate, suggests, however, that active torques may also play an important role. Inspired by this example, we simulate the dynamics of a system of interacting active 2D disks endowed with active torques and self-propulsive forces. We studied this model system of active rotators in different conditions: at low packing fractions, where adhesion causes the formation of small rotating clusters, at higher densities,

where our simulations show a jamming to unjamming transition promoted by active torques and hindered by adhesion, and in presence of both self-propulsion and self-rotation, studying the interplay between those quantities and deriving a phase diagram. Our results yield a comprehensive picture of the dynamics of active rotators, highlighting the importance of the internal degrees of freedom of active particles in determining the collective behavior of the system.

BP 10.13 Mon 14:00 DYp

The thermodynamics and kinetics of protein crystallization probed by isothermal microcalorimetry — Lorena Hentschel, •Jan Hansen, Florian Platten, and Stefan U. Egelhaaf — Condensed Matter Physics Laboratory, Heinrich Heine University, Düsseldorf, Germany

During a first-order phase transition, a thermodynamic system releases or absorbs latent heat. Despite their fundamental importance, the heat or enthalpy change occurring during protein crystallization has been directly measured only in a few cases, and the associated entropy change can only be determined indirectly. Here, the thermodynamics and kinetics of tetragonal lysozyme crystallization are studied for various physicochemical solution parameters. Direct microcalorimetric and indirect van't Hoff enthalpy determinations quantitatively agree, suggesting a two-state crystallization process. Assuming that crystals are electrostatically neutral, the weak dependences of the crystallization enthalphy and entropy on salt concentration and pH value are explained by a Poisson-Boltzmann model. Furthermore, the calorimetric signal is related to the concentration change during nucleation and growth, from which the induction time and the growth rate are inferred. Their dependences on the chemical potential are in line with previous findings and can be modelled by classical nucleation theory and 2D growth models, respectively.

BP 10.14 Mon 14:00 DYp

Real-Time Investigations during Sputter Deposition on Polymer Thin Films — •Matthias Schwartzkopf[1], Marc Gensch[1,2], Thomas Strunskus[3], Franz Faupel[3], Peter Müller-Buschbaum[2] und Stephan V. Roth[1,4] — [1]DESY, Notkestr. 85, D-22607 Hamburg — [2]CAU zu Kiel, Kaiserstr.2, 24143 Kiel — [3]TUM, James-Franck-Str. 1, D-85748 Garching — [4]KTH, Teknikringen 56-58,SE-100 44 Stockholm

The reproducible low-cost fabrication of functional metal-polymer-nanocomposites remains a major issue in applied nanotechnology. In order to obtain full control over the evolution at the nanogranular metal-polymer interface, we employed time-resolved surface sensitive X-ray scattering during sputter deposition of gold on thin polystyrene films [1] and SiOx [2]. We correlate the evolution of the metallic layer morphology with changes in the key scattering features. This enabled us to identify the impact of atomic deposition rate on the growth regimes with their specific thresholds. Our study opens up the opportunity to improve nanofabrication of tailored metal-polymer nanostructures for organic electronics like photovoltaic applications and plasmonic-based technologies. [1] Schwartzkopf et al., ACS Appl. Mater. Interfaces 7, 13547 (2015); [2] Schwartzkopf et al., Nanoscale 5, 5053 (2013).

BP 10.15 Mon 14:00 DYp

Fluid transport by metachronal waves of model cilia — •Albert von Kenne, Thomas Niedermayer, and Markus Bär — Department of Mathematical Modelling and Data Analysis, Physikalisch-Technische Bundesanstalt Berlin, Abbestraße 2-12, Berlin 10587, Germany

Motile cilia are hair-like cell extensions that undergo a cyclic motion with the purpose to transport the extracellular fluid at a low Reynolds number, providing crucial functionality of living matter such as cell locomotion and molecular transport in tissue. A striking feature of populations of cilia is a state of collective motion known as metachronal wave.

To investigate these collective states we generalize a simple phase oscillator model for the elastohydrodynamic coupling in ciliated systems [1], to include the effects due to the confined flow in proximity of a cell substrate. Our model encompasses spontaneous creation of waves as well as directed cycle-average fluid flow, yet it's simple enough to be solved analytically. We obtain analytical results for the linear stability of metachronal waves in presence of long-range hydrodynamic interactions, illustrate their properties by numerical simulations and relate the change in transport efficiency to the specific properties of metachronal waves.

[1] . Niedermayer, B. Eckhardt, and P. Lenz, Chaos **18**, 037128 (2008)

BP 10.16 Mon 14:00 DYp

Athermal Jamming for particles with exponentially decreasing repulsions — •Nicolas Wohlleben and Michael Schmiedeberg — Institut für Theoretische Physik I, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudtstraße 7, 91058 Erlangen, Germany

We study the jamming of a colloidal system where the particles interact according to a Yukawa potential, i.e., the repulsion decreases exponentially with the distance as expected for screened Coulomb interactions of charged colloids in solution. The decay occurs on a length scale given by the screening length and in addition we consider a cutoff length where the potential is set to zero in a smooth way as often used in simulation.

By determining the athermal jamming transition by trying to remove overlaps we find that the transition packing fraction only depends on the cutoff length but hardly on the screening length. We also explore the radial distribution function and again confirm the importance of the cutoff length.

The picture that emerges is that the influence of a cutoff length on athermal jamming is superior to that of the screening length, although the screening length is expected to control the slowdown of the dynamics (i.e., the dynamical glass transition). As a consequence, athermal jamming (as defined by overlaps) and the glass transition obviously are unrelated in the considered system.

BP 10.17 Mon 14:00 DYp

Detection of defects in soft quasicrystals with neural networks — •Ali Döner and Michael Schmiedeberg — Institut für Theoretische Physik I, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Staudstr. 7, 91058 Erlangen, Germany

The aim of this work is to construct and employ a neural network for the detection of topological defects in dodecagonal quasicystalline patterns. Even though quasircrystals are aperiodic, they exhibit a longe-range order. Furthermore, in principle any discrete rotational symmetry can occur.

In this work, dodecagonal quasicrystalline patterns in two-dimensions with a built-in dislocation are generated and employed as input images of the neural network. The network then should figure out not only the position but also the type of the Burgers vector of the defect.

Our trained neural network is able to recognize the type of the Burgers vector perfectly. The position of the dislocation is recognized up to a mean deviation from the real position that is much smaller than the small length scale in the quasicrystals. In future, we want to train the network with patterns that contain multiple dislocations as well as phasonic excitations.

BP 10.18 Mon 14:00 DYp

Bistable vortices formed by active particles with retarded interactions - Theory — Xiangzun Wang[1], •Pin-Chuan Chen[2], Viktor Holubec[2,3], Klaus Kroy[2], and Frank Cichos[1] — [1]Molecular Nanophotonics Group, Peter Debye Institute for Soft Matter Physics, University of Leipzig, 04103 Leipzig — [2]Institute for Theoretical Physics, University of Leipzig, 04103 Leipzig, Germany — [3]Department of Macromolecular Physics, Faculty of Mathematics and Physics, Charles University, 18000 Prague, Czech Republic

In a recent experiment (see the companion contribution "Experiment", serial number DY193), thermophoretic microswimmers were observed to self-assemble into a bistable mode of circular collective motion. We explain the underlying mechanism qualitatively by deriving a coarse-grained Langevin model for active Brownian particles with retarded interactions. For a single microswimmer attracted to an immobile attractive sphere, it can be broken down to an effective model for the angular degree of freedom. The reduced one-dimensional overdamped Langevin equation features a virtual potential for the angular velocity, self-generated by the retarded propagation of the interaction. We work out the quantitative analytical predictions for the delay-dependent bifurcation scenario and the Kramers rates and numerical results for spontaneous transitions between the degenerate chiral modes of angular motion, beyond the bifurcation point. Our theoretical predictions are found to agree well with the experimental observations and simulations.

BP 10.19 Mon 14:00 DYp

Bistable vortices formed by active particles with retarded interactions - Experiment — •Xiangzun Wang[1], Pin-Chuan Chen[2], Viktor Holubec[2,3], Klaus Kroy[2], and Frank Cichos[1] — [1]Molecular Nanophotonics Group, Peter Debye Institute for Soft Matter Physics, Universität Leipzig, 04103 Leipzig, Germany — [2]Institute for Theoretical Physics, Universität Leipzig, 04103 Leipzig, Germany — [3]Department of Macromolecular Physics, Faculty of Mathematics and Physics, Charles University, 18000 Prague, Czech Republic

Rotating formations of living species are frequently observed in nature from bacterial systems and insects to larger animals like fish or birds. The ubiquity of this behavior suggests universal underlying principles. One could be related to inevitable delays caused by sensimotoric feedback. We explore experimentally the influence of a delayed interaction between individual self-thermophoretic microswimmers on their collective behaviour. Our microswimmers are gold nanoparticle decorated melamine resin colloids, which are propelled by self-thermophoresis due to a local heating of the gold nanoparticles with a focused laser. Using a feedback algorithm we are able to introduce time-delayed virtual interactions with other particles or targets. We find for a single swimmer attracted to an immobilized particle, a transition from a diffusive to a rotating state with two possible rotation directions. This behavior is captured by a simple theoretical model (see companion contribution). This bifurcation is also observed in ensembles of multiple particles where the rotational phase of the ensemble is synchronized by particle collisions.

BP 10.20 Mon 14:00 DYp

Effect of Alignment Activity on the Collapse Kinetics of a Flexible Polymer — •Subhajit Paul[1], Suman Majumder[1], Subir K Das[2], and Wolfhard Janke[1] — [1]Institut fuer Theoretische Physik, Universitaet Leipzig, Bruederstr. 16, D-04103, Leipzig, Germany — [2]Theoretical Sciences Unit, JNCASR, Bangalore- 560064, India.

Dynamics of various biological filaments can be understood within the framework of active polymer models. Keeping this in mind, we construct a bead-spring flexible polymer chain in which the active interaction among the beads is introduced via an Vicsek-like alignment rule. Following a quench from the high-temperature coil phase to a low-temperature state, we study the non-equilibrium coarsening kinetics of this model via molecular dynamics (MD) simulations. For the passive polymer case the low-temperature equilibrium state is a compact globule. Results from our MD simulations reveal that though the globular state is also expected to be the typical final state in the active case as well, the non-equilibrium pathways change due to the alignment interaction among the beads. We observe that the probability of deviation from the intermediate *pearl-necklace*-like arrangement and the formation of more elongated dumbbell- like structures increases with increasing activity. Also, there exists nonmonotonicity in coarsening with the variation of the strength of activity. In this work, our focus is on such non-equilibrium dynamics results for which we compare with those of the passive case. These are concerning scaling laws related to collapse time and growth of clusters.

BP 10.21 Mon 14:00 DYp

The parameter space of thermohaline stairs — •Axel Rosenthal and Andreas Tilgner — Institut für Geophysik, Georg-August-Universität Göttingen, Deutschland

Convection and diffusion in water can be observed when a gradient in temperature or in salinity takes effect on density in presence of gravity. Both gradients can force or stabilize the process. We conducted experiments where the salt gradient is the driving force and simultaneously the temperature gradient is stabilizing in opposite direction, observed by particle image velocimetry. The question is at which gradients, expressed by Rayleigh numbers, does the transport occure in stable so called "thermohaline stairs"? Thermohaline stairs are a sequence of two flow systems, a finger regime and a large scale circulation.

BP 10.22 Mon 14:00 DYp

Fluctuations of a driven tracer in a viscoelastic bath — •Juliana Caspers — Institut für Theoretische Physik, Göttingen

Recently, viscoelastic fluids have attracted attention as their large structural relaxation times induce a variety of new phenomena such as nontrivial back reactions of the bath on a driven probe particle. Berner *et al* [1] found particle oscillations in the linear response regime, both in theory and experiment. Moreover, Müller *et al* [2] investigated effects of nonlinear baths in equilibrium. They observed interdependencies entering the coefficients in an effective linear generalized Langevin equation. For example, the friction memory kernel depends on properties of the external trap [3] or on the bare tracer friction in the case of an overdamped setting. In [1,2], the simple model of a confined tracer particle interacting via a stochastic Prandtl-Tomlinson model with a bath particle was found to be a good candidate to mimick the properties of a nonlinear viscoelastic bath. This work focuses on the interplay of the external trap that confines the tracer particle and the nonlinearity of the bath. In a nonequilibrium situation we made a first observation of shear thickening, an increase in the microrheological friciton coefficient for a certain regime of driving velocities.

[1] J. Berner, B. Müller, J. R. Gomez-Solano, M. Krüger, and C. Bechinger. *Nat. Commun.*, 9(1):999, 2018

[2] B. Müller, J. Berner, C. Bechinger, and M. Krüger. *New J. Phys.*, 22:023014, 2020

[3] J. O. Daldrop, B. G. Kowalik, and R. R. Netz. *Phys. Rev. X*, 7:041065, 2017