BP 22: Posters: Cytoskeletal filaments

Time: Tuesday 14:00–16:00 Location: Poster A

BP 22.1 Tue 14:00 Poster A

Novel class of microtubules regulates the forces present in the mitotic spindle — •Maja Novak[1], Janko Kajtez[2], Anastasia Solomatina[2], Matko Glunčić[1], Iva M. Tolić[2,3], and Nenad Pavin[1] — [1]Department of Physics, Faculty of Science, University of Zagreb, Croatia (Hrvatska) — [2]Max Planck Institute of Molecular Cell Biology and Genetics, Germany — [3]Division of Molecular Biology, Rudjer Bošković Institute, Zagreb, Croatia (Hrvatska)

During cell division, the cell forms a spindle in which k-fibers, microtubules that connect chromosomes with the spindle poles, exert forces on the chromosomes via protein complexes termed kinetochores. However, the forces acting on k-fibers and kinetochores are not known. We introduce a simple model in which pairwise k-fibers are described as elastic slender rods, with their tips being connected in a freely joint manner. Model includes a novel class of microtubules, termed bridging microtubules, that extend between the opposite spindle poles and laterally connect k-fibers. This is consistent with our experimental finding in which microtubules between kinetochores have been observed. Our model predicts, for the biologically relevant region of parameters, that the forces acting on k-fibers are compressive despite of the fact that kinetochores are under the tension, which we confirmed by our experiments. The model also predicts that kinetochores are typically located outwards with respect to the bridging microtubules, as we confirmed experimentally, thereby showing the role of the novel class of microtubules in the mitotic spindle.

BP 22.2 Tue 14:00 Poster A

Small Angle X-ray Scattering and Scanning X-Ray Nano-Diffraction on Keratin: Structural Changes Induced by Ions — •Clément Hémonnot[1], Oliva Saldanha[1], Rita Graceffa[1], Harald Herrmann[2], Britta Weinhausen[3], Manfred Burghammer[3], and Sarah Köster[1] — [1]Institute for X-Ray Physics, University of Göttingen, Germany — [2]Division of Molecular Genetics, DKFZ, Heidelberg, Germany — [3]ESRF, Grenoble, France

Keratin intermediate filament proteins play an important role for cell mechanics as they form extended filaments and complex, highly ordered intracellular networks, which provide integrity and stability to epithelial cells. We present bulk small angle X-ray scattering (SAXS) experiments as well as scanning X-ray nano-diffraction of bundles on Si3N4 windows, where we analyze single diffraction patterns with respect to orientation and ordering. We find that the addition of K+ or Mg2+ initiates bundle formation of the keratin filaments. As SAXS is a very sensitive technique that reveals structures on the nanometer length scale, we investigate the impact of K+ and Mg2+ ions on the internal structure of keratin filaments and assemblies. We demonstrate that the filaments assembled in presence of K+ or Mg2+ are similar and the evolution of the radius of core filaments is following a linear trend with the ion concentration. However, the effect of Mg2+ occurs at smaller concentrations than for K+, which could be due to ionic strength, and additionally leads to slightly thicker filaments. These experiments provide new insights into keratin assembly induced by K+ and Mg2+ on the nanometer scale.

BP 22.3 Tue 14:00 Poster A

Object-adapted trapping and shape-tracking to probe a bacterial protein chain motor — •Julian Roth, Matthias Koch, and Alexander Rohrbach — Albert-Ludwigs-Universität Freiburg

The helical bacterium Spiroplasma is a motile plant and anthropod pathogen which swims by propagating pairs of kinks along its cell body. As a well suited model system for bacterial locomotion, understanding the cell's molecular motor is of vital interest also regarding the combat of bacterial diseases. The extensive deformations related to these kinks are caused by a contractile cytoskeletal protein ribbon representing a linear motor in contrast to common rotary motors as, e.g., flagella. We present new insights into the working of this motor through experiments with object-adapted optical traps and shape-tracking techniques. We use the given laser irradiation from the optical trap to hinder bacterial energy (ATP) production through the production of O2 radicals. The results are compared with experiments performed under the influence of an O2-Scavenger and ATP inhibitors, respectively. Our results show clear dependences of the kinking properties on the ATP concentration inside the bacterium. The experiments are supported by a theoretical model which we developed to describe the switching of the ribbon's protein subunits.

BP 22.4 Tue 14:00 Poster A

Investigation of vimentin assembly and aggregation in continuous and segmented flow by small angle X-ray scattering — •Oliva Saldanha, Martha Brennich, Clément Hémonnot, Rita Graceffa, and Sarah Köster — Institute for X-ray Physics, Uni Göttingen

Intermediate filaments (IFs) are fibrous cytoskeletal proteins, which provide mechanical support in metazoan cells. These proteins (along with actin filaments and microtubules) play a crucial role in cell mechanics and stability. In cells, IFs form distinct bundle and network structures but the precise assembly mechanisms are not yet fully understood. *In vitro*, rod-like IF monomers self-assemble in a hierarchical manner to form filaments with a diameter of about 10 nm and, subsequently, bundles and networks. In vitro, upon the addition of divalent salts (such as MgCl2), bundling and network formation is initiated. We employ small angle X-ray scattering (SAXS) to study vimentin assembly and network formation on millisecond to second time scales in continuous microflow as well as in microfluidic droplets. Microfluidics offers the possibility to mix in different types of ions successively and with precise control. Droplet microfluidics enables us to encapsulate the micro-reaction in a unique aqueous-in-oil environment. Both complementary approaches ensure decreased radiation damage and higher signal-to-noise ratio by longer accumulative exposure times. Given the sensitivity of SAXS measurements to the size of the molecular aggregates, we can distinguish between different stages of the assembly process and relate the results to the flow conditions in the device.

BP 22.5 Tue 14:00 Poster A

Molecular assembly studied in microfluidic channels using fluorescence cross correlation spectroscopy — •Viktor Schroeder[1], Bernd Nöding[1], Harald Herrmann[2], and Sarah Köster[1] — [1]Institute for X-Ray Physics, Georg-August-Universität Göttingen, Germany — [2]Division of Molecular Genetics, German Cancer Research Center (DKFZ), Heidelberg, Germany

We present a combination of microfluidic diffusive mixing and single wavelength fluorescence cross correlation spectroscopy (SW-FCCS) to study rapid molecular assembly processes. In SW-FCCS, information about diffusing fluorescent particles is retrieved by analyzing the (cross-)correlation of intensity fluctuations. One laser line is used to excite two different fluorescent dyes with separated emission spectra. To overcome the limited temporal resolution of SW-FCCS, we use continuous flow microfluidic tools to map the temporal evolution to a spatial axis. The macromolecules of interest flow down a channel and data are collected at different positions along the channel. To get a narrow distribution of first contact times, the central jet is hydrodynamically focused to a thin sheet. Molecular assembly processes are initiated by the diffusion of trigger molecules into the central stream of macromolecules. As an example, we employ this method for studying the assembly of intermediate filament proteins like vimentin.

BP 22.6 Tue 14:00 Poster A

Microrheological Properties of Keratin 8/18 Networks — •Tobias Neckernuss[1], Ines Martin[1], Katinka Mertens[1], Tobias Paust[1], Harald Herrmann[2], Michael Beil[3], and Othmar Marti[1] — [1]Institute for Experimental Physics, Ulm University — [2]Division of Molecular Genetics, German Cancer Research Center, Heidelberg — [3]Internal Medicine I, Ulm University

The cytoskeleton of epithelial cells consists of three types of filament systems: microtubules, intermediate filaments and actin filaments. In our work, we have a closer look on intermediate filament networks consisting of keratin 8/18 and the crosslinker $MgCl_2$. With an optical tweezers we are able to determine mechanical properties of the network by trapping and exciting an embedded polystyrene bead to oszillations. The moving bead exerts a force which is transferred via the network to response beads in the surrounding. Correlating the motion of the excited beads with the ones of the response beads allows us to determine the isotropy of the network. In this context we take a deeper look on the conversion of the mean squared displacement (MSD) into the shear modulus and compare the results for active and passive multi-particle

microrheology.

BP 22.7 Tue 14:00 Poster A

Elastic Properties and Morphological Instability of Semiflexible Filament Networks: Application to Dendritic Actin Networks — •Thomas Stöter[1,3], Karin John[2,3], Denis Caillerie[4,5], and Chaouqi Misbah[2,3] — [1]Otto-von-Guericke Universität Magdeburg, FNW/ITP, D-39106 Magdeburg — [2]Univ. Grenoble Alpes, LIPHY, F-38000 Grenoble, France — [3]CNRS, LIPHY, F-38000 Grenoble, France — [4]Univ. Grenoble Alpes, 3SR, F-38000 Grenoble, France — [5]CNRS, 3SR, F-38000 Grenoble, France

Semiflexible filament networks form elastic materials that are ubiquitous in living cells, where they are transient, adapting to the current need of the cell to find food, escape predators etc. So, these networks grow and dissolve dynamically in response to external stimuli. We are interested in the complex interplay of network growth and mechanics that is, for example, used by the pathogen *Listeria monocytogenes* to propel itself forward inside a host cell.

We introduce a simple network model with a quasi-periodic topology and simple microscopic properties of the filaments. Despite its simplicity, this model reproduces several traits of the complex nonlinear behaviour of semiflexible filament networks observed in experiments. Combining the model with a growth law and solving the dynamics in a circular geometry on a two-dimensional disk, we find a growth instability that results from the mechano-chemical coupling of growth and mechanical stress. This instability may be interpreted as a symmetry breaking event commonly seen in biomimetic experiments of cell motility.

BP 22.8 Tue 14:00 Poster A

Drebrin-like protein (DBN-1) is a novel sarcomere component which stabilizes actin filaments during muscle contraction — Eugenia Butkevich[1], Kai Bodensiek[1], Nikta Fakhri[1], Kerstin von Roden[1], Iwan T. Schaap[1,2], Irina Majoul[3], Christoph F. Schmidt[1], and •Dieter R. Klopfenstein[1] — [1]Drittes Physikalisches Institut, Georg-August-Universität, Friedrich-Hund-Platz 1, 37077 Göttingen — [2]Center for Nanoscale Microscopy and Molecular Physiology of the Brain (CNMPB), Göttingen — [3]Institute of Biology, University of Lübeck, Ratzeburger Allee 160, 23538 Lübeck - Germany

Actin filament organization and stability in the sarcomeres of muscle cells are critical for force generation. Here, we have identified and functionally characterized a C. elegans drebrin-like protein DBN-1 as a crucial constituent of the muscle-contraction machinery in the nematode. In vitro, DBN-1 exhibited actin filament binding and bundling activity. High-resolution AFM showed single DBN-1 molecules decorating the sides of actin filaments. In vivo, DBN-1 is expressed in body wall muscles constituting an essential sarcomere component. Surprisingly, during muscle contraction, DBN-1 alternated location between myosin- and actin-rich regions of the myofilament lattice likely regulating proper spacing of alpha-actinin and tropomyosin. A loss-of-function mutation in dbn-1 resulted in the partial depolymerization of F-actin upon muscle contraction. Taken together, DBN-1 organizes the muscle contractile apparatus maintaining the spatial relationship between actin-binding proteins and strengthening actin filaments by bundling.

BP 22.9 Tue 14:00 Poster A

Mechanical properties of single Vimentin Filaments — •Johanna Block[1], Andrea Candelli[2], Bernd Nöding[1], and Sarah Köster[1] — [1]Institute for X-Ray Physics, University of Göttingen, Germany — [2]Physics of Living Systems, VU Amsterdam, Netherlands

Intermediate Filaments (IFs) are one of the three major components of the cytoskeleton of eukaryotic cells. Research during the last decade gave evidence that the IFs play a fundamental role for the morphology and the mechanical properties of cells, especially in cells that are subjected to mechanical stress. By analyzing single vimentin IFs with optical tweezers in solution - and thus avoiding influences by substrates (AFM) or a dense network (rheology) - we expect to gain deeper insights into the mechanical properties of this important cellular building block. Simultaneously imaging the filaments ensures that we measure single filaments and provides the opportunity to relate the mechanical behavior to the structural build-up of the filaments. Our results show major differences in stability and stiffness between homogenous and polymorphous vimentin filaments. We are able to reproduce the high stretchability of vimentin filaments up to 2.5 times of their length but in contrast to what was expected from simulations with comparatively low forces (less than 1 nN). Experimental data and theoretical modeling enables us to describe the mechanical properties of single vimentin filaments.

BP 22.10 Tue 14:00 Poster A

active transport along cytoskeletal filaments in the presence of anisotropy — •zeinab sadjadi and m reza shaebani — Department of Theoretical Physics, Saarland University, Saarbrucken, Germany

Cytoskeleton consists of a variety of interconnected biopolymer networks, including filamentous actin, microtubules, and several types of intermediate filaments. Motor proteins perform directed motion along cytoskeleton due to the structural asymmetry of the filaments. The long distance intracellular transport becomes feasible through the active transport on microtubule networks which span through the entire cell. On the other hand, the dynamics is relatively slow on actin filaments which can be found e.g. near the cell membrane, and have a more random structure i.e. a more uniform polarity. One usually observes a gradual change in the cytoskeletal anisotropy from the nucleus to the cell membrane, as the relative contribution of the microtubules and actin filaments changes. We study the effect of cytoskeletal anisotropy on the transport properties of motor proteins. Different scenarios for the gradient of anisotropy are investigated in the framework of a previously developed analytical approach, and the results are compared with Monte Carlo simulations.

BP 22.11 Tue 14:00 Poster A

Cooperative Microtubule Dynamics within a closed Elastic Membrane — •Jonas Hegemann and Jan Kierfeld — TU Dortmund, 44221 Dortmund, Germany

Microtubules as an essential part of the cytoskeleton are known to interact mechanically with the cell membrane. Since local pertubations can affect the global shape, this generates a coupling between different microtubules. We investigate a simulation model of the polymerization dynamics of a microtubule ensemble confined within a closed, elastic membrane in two dimensions. This serves as a simple model for microtubules in a cell cortex. Microtubules are coupled via their growth velocities, which depend on local forces derived from an elastic energy functional. The membrane dynamically reacts to stochastic displacements produced by the microtubules. Depending on the elastic properties and the relaxation time of the membrane we find different regimes of collective microtubule dynamics. For fast relaxation times microtubule oscillations from catastrophe and rescue events synchronize. Furthermore, we show that the centrosome performs a random walk.

BP 22.12 Tue 14:00 Poster A

Active Microrheology: Mechanical Properties of Keratin 8/18 Networks — •Katinka Mertens[1], Tobias Neckernuss[1], Tobias Paust[1], Ines Martin[1], Harald Herrmann[2], Michael Beil[3], and Othmar Marti[1] — [1]Institute for Experimental Physics, Ulm University, D-89081 Ulm, Germany — [2]Division of Molecular Genetics, German Cancer Research Center, D-69120 Heidelberg, Germany — [3]Department of Internal Medicine I, Ulm University, D-89081 Ulm, Germany

Intermediate filaments are part of the cytoskeleton and increase the mechanical stability of cells. Keratin 8 and 18 are common intermediate filaments in epithelial cells. We investigate mechanical properties of keratin 8/18 networks using active multi-point microrheology. Polystyrene beads, embedded in the keratin networks, are dynamically deflected with an optical trap. Surrounding beads are excited due to the transmission of stress by the network. Correlating the motion of the beads, we determine the isotropy of networks and their force transmission. Thus, we explore the locally complex tensorial elastic response of heterogeneous networks.

BP 22.13 Tue 14:00 Poster A

Stochastic mechanochemical simulation of microtubule dynamics — •Matthias Schmidt and Jan Kierfeld — Lehrstuhl für Theoretische Physik I, Technische Universität Dortmund

Microtubules are filaments in eukaryotic cells made of alpha-beta-tubulin heterodimers which display a complex polymerization dynamics involving catastrophe and rescue events. This dynamics is a result of the interplay of polymerization, hydrolysis, and mechanical forces within the microtubule, which arise from dimer-bending due to hydrol-

ysis.

We implement a stochastic simulation model by combining the mechanics of the microtubule structure on the tubulin dimer level with the chemical processes of polymerization and hydrolysis into a mechanochemical model. In this model, we introduce local, dimer-dependent depolymerization and hydrolysis rates, which depend on the mechanical forces acting on each dimer. We investigate parameter estimation from polymerization and depolymerization rates and features of the hydrolysis behavior.

BP 22.14 Tue 14:00 Poster A

Contraction dynamics of active actin networks — •Dominic Jourdain[1], Anne Bernheim[2], and Karsten Kruse[1] — [1]Universität des Saarlandes, Saarbrücken, Germany — [2]Ben Gurion University, Israel

Recent in vitro experiments on actin filaments together with myosin motors reveal characteristic contraction patterns for such networks. The contraction speed increases linearly at first, before it decays exponentially. For asymmetric initial x-y-aspect-ratios, the contraction seems to follow this asymmetry. Using a continuous elastic model for the filaments combined with a stress dependent extra term to take the motor activity into account, we are able to qualitatively reproduce the asymmetric contraction and the contraction speed curves.

BP 22.15 Tue 14:00 Poster A

Composite networks of actin and intermediate filaments — •Tom Golde[1], Martin Glaser[1], Carsten Schuldt[1], Jörg Schnauss[1], Harald Herrmann[2], and Josef Käs[1] — [1]University of Leipzig, Faculty of Physics, Soft Matter Physics Division, Leipzig, Germany — [2]German Cancer Research Center, Division of Molecular Genetics, Heidelberg, Germany

Cell deformability is mainly determined by cytoskeletal filaments like actin and intermediate filaments. Rheological network properties are quite well understood for networks composed of a single filament type. Actin networks are described by common models for semiflexible polymer networks. In contrast, some intermediate filaments like keratin show a high elastic modulus at low protein concentration that cannot be explained with these simple models. Cells contain not only one but several types of filament networks. Their rheological behavior cannot simply be deduced from single type network properties.

We want to address this problem with a two-step in vitro approach. First, we will study actin, keratin, and vimentin networks with shear and microrheology under comparable boundary conditions. The next step in understanding cell deformability is the investigation of composite networks made of these previously examined filament types.

BP 22.16 Tue 14:00 Poster A

Mechanisms of microtubule nucleation in spindles — •Franziska Decker[1,2], Joachim Rosenberger[1,2], and Jan Brugués[1,2] — [1]Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany — [2]Max Planck Institute for the Physics of Complex Systems, Dresden, Germany

Spindles segregate DNA into daughter cells during cell division. They mainly consist of microtubules and microtubule binding proteins. Microtubules are polymers with two different ends. The minus ends are stable while the plus ends grow and shrink rapidly. Microtubules and associated proteins turn over within 20s while the overall structure remains stable longer. Therefore, the spindle requires constant nucleation of microtubules. How microtubules are nucleated in spindles is, however, largely unknown. The site of microtubule nucleation corresponds to the position of the minus ends in spindles when microtubules do not move. The only technique that allows measuring the minus ends in microtubule structures is laser ablation. Cut microtubules depolymerize from the newly created plus ends to their minus ends. Quantification of this microtubule depolymerization reveals the density of minus ends throughout the spindle, therefore revealing the nucleation profile. We found that the nucleation profile within microtubule transport inhibited spindles depends on the position within the structure. One reason for this dependence could be that pre-existing microtubules promote nucleation of new microtubules, also known as microtubule branching. To test this possibility, I will study the dependence of microtubule nucleation on microtubule dynamics on perturbed spindles.

BP 22.17 Tue 14:00 Poster A

Scaling of the mitotic spindle during early zebrafish embryogenesis — •Elisa Rieckhoff[1,2], Franziska Decker[1,2], Joachim Rosenberger[1,2], and Jan Brugues[1,2] — [1]Max Planck Institute for the Physics of Complex Systems, Dresden, Germany — [2]Max Planck Institute of Molecular Cell Biology and Genetics, Dresden, Germany

During embryogenesis, a single cell gives rise to a multicellular embryo by successive rounds of cell division. Prior to every division, cells duplicate their DNA and subsequently segregate it to the daughter cells. In all eukaryotes, chromosome segregation is accomplished by the mitotic spindle - a dynamic, bipolar assembly of microtubules and associated proteins. During the first rounds of cell division, cells decrease their size several folds as divisions occur in the absence of growth. During this process, the mitotic spindle scales with cell size to ensure accurate chromosome segregation. Even though the key molecules contributing to spindle architecture have been intensively studied, the physical principles governing spindle assembly during development remain poorly understood. Furthermore, quantitative information about the detailed organization of microtubules in spindles is still lacking.

To quantitatively characterize the architectural changes of spindles during early embryogenesis, we use a method based on femtosecond laser ablation that allows direct measurement of microtubule density, polarity and length distributions. Revealing the detailed microtubule organization in spindles together with a theoretical model will help us uncover the physical principles of spindle scaling during early embryogenesis.

BP 22.18 Tue 14:00 Poster A

Scanning nanobeam SAXS on cryogenic and living *Dictyostelium discoideum* — •Marius Priebe[1], Marten Bernhardt[1], Christoph Blum[2], Marco Tarantola[2], Eberhard Bodenschatz[2], and Tim Salditt[1] — [1]Georg-August-Universität Göttingen, Institut für Röntgenphysik — [2]Max-Planck-Institut für Dynamik und Selbstorganisation, Göttingen

The amoeba *Dictyostelium discoideum* is a model system for amoeboid migration, that is enabled by a reorganization of cytoskeletal biopolymers in the cell cortex.

We have performed scanning x-ray nanobeam diffraction on single cells of *Dictyostelium discoideum* in different preparation states (freeze-dried, frozen hydrated and initially alive). The spatially resolved small angle x-ray diffraction signal shows characteristic streak-like patterns in reciprocal space, which we attribute to fibre bundles of the actomyosin network. We introduced an anisotropy parameter to characterize the pronounced local variations within the cell. The x-ray differential phase contrast is evaluated in terms of the projected electron density and additional x-ray fluorescence aquisitions provide information on the spatially resolved distribution (2D) of elements within the cell.

The x-ray results are correlated with optical microscopy (phase contrast and fluorescence microscopy of strains with labelled actin and myosin II) on live, fixed, and cryogenic cells.

BP 22.19 Tue 14:00 Poster A

Mechanical properties of branched actin filaments within lamellipodia — •Mohammadhosein Razbin[1], Martin Falcke[2], Panayotis Benetatos[3], and Annette Zippelius[1] — [1]Max Planck Institute for Dynamics and Selforganization, Am Fassberg 17 and Institute for Theoretical Physics, Georg August University, Friedrich-Hund-Platz 1, 37077 Göttingen, Germany; — [2]Max Delbrück Center for Molecular Medicine, Robert Rössle Str. 10, 13092 Berlin, and Dept. of Physics, Humboldt University, Newtonstr. 15, 12489 Berlin, Germany — [3]Department of Physics, Kyungpook National University, 80 Daehakro, Bukgu, Daegu 702-701, Korea

Cell motility is a central process in wound healing, tumor metastasis and many other aspects of life. Moving cell on a 2-dimensional substrate generates different protrusions. One of the main protrusions, which has an important role in the motion is lamellipodia. The lamellipodia generates motion by polymerizing actin network. We investigate branched actin filaments polymerized by Arp2/3. The filaments are modeled as weakly bending wormlike filaments which are grafted at actin gel with finite stiffness and form branches at a given angle. We compute the thermal fluctuation of the endpoints and the resulting forces on the membrane. The forces are shown to depend sensitively not only on the persistence length but also on the geometry of the structure such as orientation and position of the branch point. Also, we have compared the network of the branched actin filaments and the network of the linear (unbranched) actin filaments in term of forces.

BP 22.20 Tue 14:00 Poster A

Mechanical properties of magnetosome filaments — •Bahareh Kiani, Damien Faivre, and Stefan Klumpp — Max Planck Institute

of Colloids and Interfaces, Potsdam, Germany

Magnetotactic bacteria swim and orient in the direction of a magnetic field thanks to the magnetosome chain, a cellular "compass needle" that consists of a string of vesicle-enclosed magnetic nano-particles aligned on a cytoskeletal filament. Here we investigate the mechanical properties of such a chain, in particular the bending stiffness. We determine the contribution of magnetic interactions to the bending stiffness and the persistence length of the chain. This contribution is comparable to, but typically smaller than the contribution of the semi flexible filament. For a chain of magnetic nanoparticles without a semi flexible filament, the linear configuration is typically metastable and the lowest energy structures are closed chains (flux closure rings) without a net magnetic moment that are thus not functional as a cellular compass. Our calculations show that the presence of the cytoskeletal filament stabilizes the chain against ring closure, either thermodynamically or kinetically, depending on the stiffness of the filament, confirming that such stabilisation is one of the roles of this structure in these bacterial cells.

BP 22.21 Tue 14:00 Poster A

Lateral Filopodial Movement in Fibroblasts on Microcontact Printed Substrates — •Julia Strübig, Erik Bernitt, and Hans-Günther Döbereiner — Institut for Biophysics, University of Bremen, Germany

Lamellipodial and filopodial protrusions play a fundamental role in cell migration. A proposed mechanism of filopodia initiation describes the collision and fusion of moving actin bundles leading to formation of filopodial precursors (Svitkina et. al., 2003). The authors of a study on neuronal growth cones proposed a simple geometric model in which the lateral filopodia velocity depends on the retrograde flow (Oldenbourg et. al., 2000). However, we also found laterally moving filopodia in the lamellipodium of fibroblasts. We are interested in testing the proposed model in this system, under a change of the retrograde flow due to inhibition of Myosin II. We force cells into well-defined morphologies using microcontact printed disc-like fibronectin patches in order to achieve reproducible conditions. This system allows us to focus on stationary cells with a round and smooth lamellipodium. Using phase contrast and fluorescent microscopy we monitor the mechanism of filopodia initiation and analyze the velocities of their movement. We find slower lateral filopodia velocities as a consequence of slowing down the retrograde flow within the geometrical model.

BP 22.22 Tue 14:00 Poster A

Modeling the dynamics of dendritic actin waves in living cells — •Vaibhav Wasnik — Universität des Saarlandes, Theoretische Biologische Physik, Saarbrucken, Germany

The actin cytoskeleton in living cells exhibits a high degree of capacity for dynamic self-organization. Recent experiments have observed propagating actin waves in Dictyostelium cells recovering from complete depolymerization of their actin cytoskeleton. The propagation of these waves appear to be dependent on a programmed recruitment of a few proteins that control actin assembly and disassembly. Such waves also arise spontaneously along the plasma membrane of the cell, and it has been suggested that actin waves enable the cell to scan a surface for particles to engulf. Based on known molecular components involved in wave propagation, we present and study a minimal reaction-diffusion model for actin wave production observed in recovering cells.

BP 22.23 Tue 14:00 Poster A

Scanning nanobeam SAXS on cryogenic and living *Dictyostelium discoideum* — •Marius Priebe[1], Marten Bernhardt[1], Christoph Blum[2], Marco Tarantola[2], Eberhard Bodenschatz[2], and Tim Salditt[1] — [1]Georg-August-Universität Göttingen, Institut für Röntgenphysik — [2]Max-Planck-Institut für Dynamik und Selbstorganisation, Göttingen

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