BP 5: Posters: Biopolymers and Biomaterials

Time: Monday 17:15–20:00 Location: Poster B1

BP 5.1 Mon 17:15 Poster B1

Interactions between proteins and thermoresponsive microgels — •Nicole Welsch[1] and Matthias Ballauff[1,2] — [1]Soft Matter and Functional Materials, Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, 14109 Berlin — [2]Department of Physics, Humboldt University Berlin, 12489 Berlin

The interface of materials science and biology is emerging as a major research focus and especially nanomaterials in medicine and biotechnology are considered to accelerate the progress in these fields. However, nanoparticles entering the bloodstream initially become coated with proteins and the contact to these particles may induce misfolding of the protein structure and the perturbation of the function of the bound proteins. Therefore, this *nano-bio* interface has to be understood in detail for new applications to evolve. Particles based on poly(N-isopropylacrylamide) (PNiPA) exhibit lower critical solution behaviour close to the physiological temperature and therefore have potential to be applied in biotechnology. For deeper insight into the interactions of biomolecules to PNiPA microgels the adsorption of proteins with different surface properties is investigated. Thereby, SAXS experiments elucidate the spatial distribution of the proteins within the polymer network. Furthermore, the activity of immobilized enzymes is investigated temperature-dependent to analyse the impact of the immobilization on the catalytic activity. By using FT-IR spectroscopy changes of the secondary structure of adsorbed proteins and the formation of interactions towards the carrier particles can be analysed.

BP 5.2 Mon 17:15 Poster B1

Probing the components of nacre by contact angle measurements — •Malte Launspach, Fabian Heinemann, and Monika Fritz — Pure and Applied Biomineralisation, Biophysics Institute, University Bremen, Germany

Nacre of some molluscs is a highly structured polymer/mineral composite, which has been brought to perfection by evolution over millions of years. Densely packed mineral platelets are interdispersed by a few nanometer of organics. The order and the dimension of the platelets lead to astonishing mechanical properties. Soluble and insoluble proteins are involved in the formation of the aragonite platelets; some are attached to a chitin core - the organic matrix. Here the surface energy properties are probed by contact angle measurements to quantify the adhesive strength between the mineral and organic phase and to investigate the relevance of the organic matrix during platelet formation. Measurements were conducted with a home-made device. The demineralised insoluble organic matrix in a native state and after enzymatic treatment were probed as well as the (001) surface of geological aragonite. The (001) surface of aragonite is not a cleavage plane and had to be processed in a special way. The surface free energy of the organic matrix was calculated using semi-empirical approaches. Three different models yield a total surface free energy between 40 and 44 mJ/m^2 for the native matrix and a value between 51 and 59 mJ/m^2 after enzymatic treatment. In the case of the minerals the obtained values could not be used for further calculations since the influence of the preparation process was to dominant.

BP 5.3 Mon 17:15 Poster B1

Phase behaviour and structure of enzyme containing skin friendly microemulsions for decontamination — •Ralf Stehle[1], Christoph Schulreich[1], Stefan Wellert[2], Christina Diederich[1], Andre Richardt[3], Marc-Michael Blum[4], and Thomas Hellweg[1] — [1]Universität Bayreuth, Physikalische Chemie I, Universitätsstr. 30, D-95444 Bayreuth — [2]Helmholtz-Zentrum Berlin für Materialien und Energie GmbH, Glienicker Str. 100, D-14109 Berlin — [3]Armed Forces Scientific Institute for NBC-Protection, Humboltstr. 1, D-29633 Munster — [4]Bundeswehr, Wissenschaftliche Dienste, Ledererstr. 23, D-80331 München

Microemulsions are promising media for decontamination. Various toxic chemicals and most chemical warfare agents are hydrophobic and can only be solubilized in organic solvents, while most degradation agents are water soluble. Microemulsions allow both, the solubilisation of the lipophilic toxins and their corresponding hydrophilic degradation reagents. For human skin decontamination microemulsions have to be skin friendly.

In this contribution, a system composed of a sugar surfactant and an oil, commonly used in cosmetics, is presented.

Unlike other systems based on skin friendly oils, the bicontinuous phase of this microemulsion contains much lower concentration of sugar surfactant. The phase behaviour is studied and the structure of the bicontinuous phase is characterized by small angle neutron scattering (SANS), and dynamic light scattering (DLS). Properties of the enzyme and its effect on the microemulsion are investigated.

BP 5.4 Mon 17:15 Poster B1

Deep UV Raman spectroscopy on sensory rhodopsin — •Andreas Bröermann, Nils Priesnitz, Bernd Walkenfort, Johann Klare, Heinz-Jürgen Steinhoff, and Sebastian Schlücker — Fachbereich Physik, Universität Osnabrück, Barbarastr. 7, 49076 Osnabrück

The light-driven membrane pigment sensory rhodopsin II (SR II) consists of the protein opsin and the cofactor retinal. SR II is responsible for the negative phototaxis of halobacteria. Incident photons induce an isomerization of the retinal chromophore, which leads to a conformational change of opsin and, by means of a signalling cascade, finally controls the flagellar motor and thereby the swimming behavior of the cells.

The nano- to millisecond conformational dynamics of SR II can be probed by time-resolved UV resonance Raman scattering (UV RR) in a pump(VIS)-probe(deep UV) experiment with kHz repetition rate. The sample is excited by a frequency-doubled Nd:YAG laser (532 nm, 10 ns pulse length). After a variable time delay, the photo-excited SR II molecules are probed with deep UV laser radiation (195 nm, 10 ns pulse length). The deep UV Raman spectrum is recorded by a triple monochromator equipped with a gated image intensifier.

BP 5.5 Mon 17:15 Poster B1

Optical properties of light-harvesting systems determined by molecular dynamics simulations — •Carsten Olbrich[1], Jörg Liebers[1], Michael Schreiber[2], and Ulrich Kleinekathöfer[1] — [1]Jacobs University Bremen, Campus Ring 1, 28759 Bremen, Germany — [2]TU-Chemnitz, Reichenhainer Str. 70, 09126 Chemnitz, Germany

Harvesting sun light to gain energy for life is initially done by light-harvesting antenna complexes containing chlorophyll and carotenoid molecules. Starting from the available crystal structure of the light-harvesting systems 2 (LH2) of purple bacterium, we applied all-atom classical molecular-dynamics (MD) simulations to the LH2 ring embedded in a membrane. Thus obtained thermal fluctuations of the nuclear positions provide the input for quantum chemical calculations. To obtain the energies of the Q_y excited states of the single Bacteriochlorophyll (BChl) molecules, the semi-empirical ZINDO/CIS method is used to be able to analyze longer time series as was previously possible with the CIS method [1,2]. To include solvent effects to the excited state dynamics, the surrounding atoms of the BChls are treated as classical point charges in the QM calculations. Using the nuclear motion and the obtained energy differences between ground and Q_y excited states with a time-dependent Hamiltonian, we are able to calculate optical properties of the analyzed system.

[1] A. Damjanovic, I. Kosztin, U. Kleinekathöfer, and K. Schulten, Phys. Rev. E 65, 031919 (2002)

[2] L. Janosi, I. Kosztin, and A. Damjanovic, J. Chem. Phys. 125, 014903 (2006)

BP 5.6 Mon 17:15 Poster B1

Coarse Grained Simulations of a Small Peptide: Effects of Finite Damping and Hydrodynamic Interactions — •Tihamer Geyer — Zentrum für Bioinformatik, Universität des Saarlandes, D-66123 Saarbrücken

In the coarse grained Brownian Dynamics simulation method the many solvent molecules are replaced by random thermal kicks and an effective friction acting on the particles of interest. For Brownian Dynamics the friction has to be so strong that the particles' velocities are damped much faster than the duration of an integration timestep. Here we show that this conceptual limit can be dropped with an analytic integration of the equations of damped motion. In the resulting Langevin integration scheme our recently proposed approximate form of the hydrodynamic interactions between the particles [1] can

be incorparated conveniently, leading to a fast multi-particle propagation scheme, which captures more of the short-time and short-range solvent effects than standard BD. Comparing the dynamics of a bead-spring model of a short peptide, we recommend to run simulations of small biological molecules with the Langevin type finite damping and to include the hydrodynamic interactions [2].

We also present our recently released "Brownmove" simulation package for coarse-grained many-particle simulations incorporating the above explained propagation techniques.

[1] Geyer, Winter, J. Chem. Phys., 130 (2009) 114905
[2] Winter, Geyer, J. Chem. Phys. 131 (2009) 104102

BP 5.7 Mon 17:15 Poster B1

Microhydration of two polyalanine-based peptides — •Sucismita Chutia, Mariana Rossi, Volker Blum, and Matthias Scheffler — Fritz Haber Institute, Berlin, Germany

Microsolvation studies are an important approach for analysing the influence of the solvent environment on peptides. Two small peptides have been the subject of such experimental studies in the recent years: Ac-Ala$_5$-LysH$^+$ [1] and Ac-Phe-Ala$_5$-LysH$^+$ [2]. The aim of this work is to theoretically identify the lowest-energy conformers of these peptides and carry out microhydration studies to find the preferred water binding sites on these conformers. We first use a molecular dynamics calculation with the OPLS-AA force-field potential in the TINKER package to scan the potential energy surface for a wide variety of candidate conformers. We then use the all-electron electronic structure code *FHI-aims* [3] to follow up these structures with van der Waals corrected density functional theory to determine the energy hierarchy, and vibrational frequencies for direct comparison with experiment. Our findings indicate that both helical and "non-helical" conformers are present among the low-energy conformers of Ac-Phe-Ala5-LysH+, similar to the case of Ac-Ala5-LysH+. We find that, for both Ac-Phe-Ala$_5$-LysH$^+$ and Ac-Ala$_5$-LysH$^+$, the water molecule binds to the protonated lysine end in the lowest energy conformer. We also address the accuracy of the pre-screening forcefield compared to DFT-vdW. [1] M. Kohtani and M.F.Jarrold, *JACS*, **126**, 8454-8458 (2004) [2] J.A. Stearns *et al*, *PCCP*, **11**, 125-132 (2009) [3] V. Blum *et al*, Comp. Phys. Comm. **180**, 2175 (2009).

BP 5.8 Mon 17:15 Poster B1

Comparison of nanomechanical properties of in vivo and in vitro keratin networks — •Anke Leitner[1], Tobias Paust[1], Harald Herrmann[2], Michael Beil[3], and Othmar Marti[1] — [1]Institute of Experimental Physics, Ulm University — [2]Division of Molecular Genetics, German Cancer Research Center, Heidelberg — [3]Department of Internal Medicine I, Ulm University

The mechanical properties of epithelial cells are mainly determined by the cytoskeleton. The cytoskeleton consists of three different protein networks, microtubules, the transport pathways of the cell, actin filaments, responsible for the movement, and intermediate filaments that provide the stiffness and response to mechanical stimuli. In order to find out more about the mechanical properties of the intermediate filament keratin cytoskeleton it is useful to have a look on in vitro assembled keratin filaments. In the work presented here we compare the mechanical properties of the extracted keratin cytoskeleton of pancreatic carcinoma cells with the mechanical properties of in vitro assembled keratin 8/18 networks. For this purpose we use microrheology measurements with embedded tracer beads. This method is a suitable tool, because the size of the beads compared to the meshsize of the network allows us to treat the network as a continuum. Observing the beads motion with a CCD-High-Speed-Camera then leads to the dynamic shear modulus. We draw conclusions on the network topology of the authentic isolated cellular networks and the recombinant in vitro assembled K8/18 filament systems based on the mechanical behaviour.

BP 5.9 Mon 17:15 Poster B1

Force-generation by growing microtubules — •Björn Zelinski[1] and Jan Kierfeld[2] — [1]Physics Department, TU Dortmund University, Dortmund, Germany — [2]Physics Department, TU Dortmund University, Dortmund, Germany

In many cellular processes polymerization forces play an important role. We investigate force generation for growing microtubules undergoing dynamic instability using a two-state Monte-Carlo simulation. We find that the maximum force generated by a single microtubule strongly depends on the catastrophe- and rescue-dynamics. We also study cooperative effects in force generation by an ensemble of N microtubules.

BP 5.10 Mon 17:15 Poster B1

Optical tweezers to investigate receptor/ligand interactions on a single contact level — •Carolin Wagner[1], David Singer[2], Mathias Salomo[3], Ralf Hoffmann[2], and Friedrich Kremer[1] — [1]University of Leipzig, Department for molecule Physics, Leipzig, Germany — [2]University of Leipzig, Institut Institut für bioanalytische Chemie, Leipzig, Germany — [3]Fraunhofer-Institut für Zelltherapie und Immunologie, Leipzig, Germany

The extraordinary features of optical tweezers having a nm- resolution in positioning a micron-sized colloid and an accuracy of (+/-50 fN) in measuring the forces acting on it, enable one to study the interaction within a single receptor/ligand-contact. By use of dynamic force spectroscopy (DFS), the specific binding of the monoclonal antibody HPT-110 to a synthetic doubly phosphorylated tau-peptide is investigated on a single contact level. Amongst others, the massive accumulation of tangles that mainly consist of hyperphosphorylated tau-proteins is characteristic for Alzheimer's disease. Single-molecule DFS enables the investigation of the energy landscape of the bond and benefits from the fact that only minimal amounts of the sample are necessary. It is demonstrated that the rupture force depends on the loading rate. This effect is well known in the literature and the data obtained were found to be in good agreement with an already published theoretical model. By use of this model, the off-rate at zero force of 0,54 s-1 is determined.

BP 5.11 Mon 17:15 Poster B1

The Nanostructure of the Tracheid Wood Cell Wall — •Malte Ogurreck[1], Pekka Saranpää[2], Manfred Burghammer[3], Sebastian Schoeder[3], Christina Krywka[4], and Martin Müller[1,4] — [1]GKSS Research Centre Geesthacht, Germany — [2]The Finnish Forest Research Institute METLA, Vantaa, Finland — [3]ESRF, Grenoble, France — [4]University of Kiel, Germany

Tracheid wood cell walls are mainly composed of cellulose nanocrystals (microfibrils) embedded in an amorphous matrix. These microfibrils are helically wound around the cell axis and are arranged in several layers.

While the structure of tracheid wood cells has been a research topic for many decades now and the structure on the biological and molecular level are well known, the detailed structure on intermediate length scales is still largely unknown.

Here, we present results of nanodiffraction experiments carried out at the nano-/microfocus beamline ID13, ESRF. Tracheid cross sections have been scanned with a position resolution of down to 200 nm. These detailed diffraction data allows us to map the local structure in the cell wall with a very high resolution.

The comparison of wood grown under normal conditions with wood grown using special treatments (irrigation, fertilizers) allows to reach conclusions about how environmental influences affect the structure of wood.

BP 5.12 Mon 17:15 Poster B1

Entropy assists cell's contraction — •Carsten Schuldt and Josef Käs — Universität Leipzig, Germany

Cell migration is an inherent quality of life. Considering the motility of cells the current model is based on three constitutive processes: first, cytoskeletal extension at the leading edge; second, adhesion to the envirnonment to convey traction; and third, retraction at the rear. Polymerization of the cytoskeletal scaffold accounts for the extension and transmembrane proteins facilitate traction. The process of retraction is still debated.

Muscle-like actomyosin contractions were supposed to accomplish back retraction, originally. But myosin knock-out cells were still capable to migrate [1]. Alternatively, the depolymerization of cytoskeleton was proposed to cause contractile forces only by a gain in entropy in the absence of molecular motors. This concept was demonstrated on polymer meshworks of nematode's major sperm protein [2].

We intend to probe these forces in bundles of actin, which is one of the principal components of cytoskeletal biopolymer networks using optical tweezers.

[1]De Lozanne et. al., Science 236(4805)
[2]Wolgemuth et. al., Biophys. J. 88(4)

BP 5.13 Mon 17:15 Poster B1

Feeling for Cells with Light: Illuminating the Role of Biomechanics for Tumor Progession — Anatol Fritsch, Franziska

Wetzel, David Nnetu, Tobias Kiessling, Mareike Zink, and •Josef A. Käs — Division of Soft Matter Physics, Institute for Experimental Physics I, University of Leipzig

Light has been used to observe cells since Leeuwenhoek's times; however, we use the forces caused by light described by Maxwell's surface tensor to feel for the cellular cytoskeleton. The cytoskeleton, a compound of highly dynamic polymers and active nano-elements inside biological cells, is responsible for a cell's stability and organization. The optical stretcher exploits the nonlinear, thus amplified response of a cell's mechanical strength to small changes between different cytoskeletal proteomic compositions as a high precision cell marker that uniquely characterizes different cell types. Consequentially, the optical stretcher detects tumors and their stages with accuracy unparalleled by molecular biology. As implied by developmental biology the compartmentalization of cells and the epithelial-mesenchymal transition that allows cells to overcome compartmental boundaries strongly depend on cell stiffness and adhesiveness. Consequentially, biomechanical changes are key when metastatic cells become able to leave the boundaries of the primary tumor.

BP 5.14 Mon 17:15 Poster B1

Volume imaging of collagen fibrils within cortical bone — •Stephanie Röper[1], Nadine Drechsel[1], Anke Bernstein[2], and Robert Magerle[1] — [1]Chemische Physik, TU Chemnitz, D-09107 Chemnitz — [2]Experimentelle Orthopädie, Martin-Luther-Universität Halle-Wittenberg, D-06097 Halle/Saale

Biological materials such as bone and teeth are nanocomposites of a soft organic matrix (mainly type I collagen) that is reinforced by a stiff inorganic component (hydroxylapatite). Scanning probe microscopy (SPM) based nanotomography is a novel approach to image these materials on the sub-micrometer scale. For SPM based nanotomography the specimen is ablated layer-by-layer by stepwise wet chemical etching and imaged with tapping mode SPM after each etching step. Here, we focus on human cortical bone which was first mechanically grinded and polished, then stepwise etched with formic acid and sodium hypochlorite and finally flushed to stop the etching process. In the resulting series of SFM images we mapped the position and orientation of the collagen fibrils with the typical D-band periodicity of 67 nm and reconstructed a volume image of natural collagen fibrils embedded in cortical human bone. These results are compared with reassembled collagen fibrils deposited on a solid substrate.

BP 5.15 Mon 17:15 Poster B1

Dynamical stretching response of a biopolymer held by an optical trap — •Sebastian Sturm and Klaus Kroy — Institut für theoretische Physik, Universität Leipzig, Vor dem Hospitaltore 1, 04103 Leipzig

The dynamical nonequilibrium response of stiff and semiflexible polymers to external stimuli has been a subject of intense theoretical research during the last decade. Whereas pioneering works on the subject catered to very specific experimental scenarios, a subsequently developed multiple-scale (MSPT) analysis unified the previous approaches under a systematic and rigorous mathematical framework. Building on this MSPT theory, a large number of different external perturbations have found theoretical treatment, with BD simulation data corroborating the analytical results [1]. To allow for direct experimental verification of the abovementioned MSPT theory, we extend it to the practically relevant case of a semiflexible polymer held by means of an optical trap.

[1] B. Obermayer, W. Möbius, O. Hallatschek, E. Frey and K. Kroy, Freely relaxing polymers remember how they were straightened, Phys. Rev. E (2009)

BP 5.16 Mon 17:15 Poster B1

Elasticity of Fiber Networks as Function of Crosslink Density — •Susan Sporer[1], Mahyar Madadi[2], Christoph Arns[3], Klaus Mecke[1], and Gerd E. Schröder-Turk[1] — [1]Institut für Theoretische Physik, Universität Erlangen-Nürnberg, Erlangen, Germany — [2]Applied Mathemathics, The Australian National University, Canberra, Australia — [3]School of Petroleum Engineering, The University of New South Wales, Sydney, Australia

Crosslinkers determine the architecture of polymer networks and thus are of great importance for the resulting mechanical properties. A morphological model is proposed for investigating the change of the linear elastic response of 3D fiber networks when randomly disconnecting network nodes. The networks have a given volume fraction regulated by the radius of the fibers and are modeled as one body consisting of a homogeneous, locally isotropic, linear elastic material. The network nodes rigidly crosslinking fibers are randomly split into two locally unconnected fibers which causes a morphology change of the network. The effective shear modulus is studied using a voxel-based finite element method. Our results show an exponential decay of the shear modulus with decreasing number of crosslinking nodes without any signs of a percolation transition. By associating the fibers with polymer chains and all network nodes with junctions connected by a crosslinking molecule, this approach is a model for elasticity of biological networks with varying crosslinker density.

BP 5.17 Mon 17:15 Poster B1

Elastic and Morphological Properties of Porous Biomaterials — •Sebastian Kapfer, Susan Sporer, Klaus Mecke, and Gerd E. Schröder-Turk — Friedrich-Alexander-Universität, Erlangen, Germany

The relationship between effective elastic moduli and morphological properties of microstructured porous biomaterials including bone, wood, biomineralised skeletons of crustaceans, biopolymer networks and cubic lipid mesophases remains an open question. We compute effective elastic moduli and morphological properties of ordered porous media models based on triply-periodic minimal and constant-mean-curvature surfaces of cubic symmetry.

Bulk and shear moduli are computed using voxel-based finite-element method considering the solid fraction to be a homogeneous linear elastic solid. For fixed volume fraction of 50%, we find that within classes of geometrically similar media the effective bulk modulus decreases with increasing heterogeneity of the domain thickness of the solid fraction which is quantified by using euclidean distance maps and percolation critical radii. On the other hand, we find significant differences between the elastic moduli of topologically distinct classes of media. In particular, a porous medium where the solid fraction comprises a thick warped sheet separating two hollow labyrinthine network domains has larger bulk modulus than a medium where both the solid and the void fraction are represented by congruent labyrinthine domains.

BP 5.18 Mon 17:15 Poster B1

Cartilage Proteoglycan Aggrecan Self-Adhesion at the Single Molecule Level — •Alexander Harder[1], Thomas Dierks[2], Xavier Fernandez-Busquets[3], and Dario Anselmetti[1] — [1]Department of Physics, Experimental Biophysics and Applied Nanoscience, Bielefeld University, D-33615 Bielefeld, Germany — [2]Department of Chemistry, Biochemsitry I, Bielefeld University, D-33615 Bielefeld, Germany — [3]Biomolecular Interactions Team, Nanobioengineering Group, Institute for Bioengineering of Catalonia, and Nanoscience and Nanotechnology Institute, Barcelona Science Park-University of Barcelona, E-08028 Barcelona, Spain

Self-adhesion processes based on glycan-glycan interaction play an important role in cellular systems. A more detailed understanding of such a cation-mediated glycan-glycan interaction is important for aspects in embryogenesis, metastases, and other cellular proliferation processes that are mediated by glycan self-recognition. Proteoglycans which consist of a core protein with attached glycosaminoglycans are model systems for investigations of glycan-glycan interaction. The biological roles of proteoglycans are highly diversified, ranging from relatively straightforward mechanical functions to effects on more dynamic processes such as cell adhesion and motility, to more complex and still poorly understood roles in cell differentiation and development. Here, we investigated the self adhesion between highly negatively charged proteoglycan aggrecan from cartilage extracellular matrix in the presence of Ca2+ with atomic force microscopy (AFM) and single molecule force spectroscopy.

BP 5.19 Mon 17:15 Poster B1

PEG-Pillars as Force-Sensor-Arrays — •Sabri Rahmouni[1,2], Aaron Lindner[1], Tamas Haraszti[1], and Joachim Spatz[1,2] — [1]Institut für Biophysikalische Chemie, Heidelberg, Germany — [2]Max-Planck-Institut für Metallforschung, Stuttgart, Germany

The measurement of forces in biological systems is a very wide field of activity that led to a large variety of experimental approaches, e.g. optical and magnetic tweezers, atomic force microscopy, deformation of hydrogels and the bending of micropillars. All these techniques have their specific range of application, force sensitivity and resolution. In this work we present PEG (polyethylenglykol) based micropillar-force-sensor-systems for measurments in the sub nanonewton regime. When

compared to silica- or PDMS-pillars the softer PEG-pillars provide a notably higher and easily tunable force sensibility. Our novel way of construction allows a direct variation of the separation, diameter, stiffness and functionalisation of the PEG-pillars. We show first applications of different PEG-pillar-arrays for analysis of the acting forces in actin-networks.

BP 5.20 Mon 17:15 Poster B1

Active growth of actin filaments can lead to a non-exponential length distribution — •Christoph Erlenkämper and Karsten Kruse — Theoretische Physik, Universität des Saarlandes, 66123 Saarbrücken, Germany

Important properties of the actin cytoskeleton depend on the distribution of actin filament lengths. Here, we study the growth dynamics of actin filaments, taking into account addition and removal of monomers at both ends, the different phosphorylation states of the monomers and a stochastic dephosphorylation of monomers within the filaments [1,2]. The assembly of actin is active: While energy-rich ATP-bound actin monomers are readily integrated into filaments, the dephosphorylated ADP-actin monomers only have a low affinity for the filament and easily detach from it. In contrast to unregulated filament growth, we find that the active growth can lead to non-exponential length distributions. We show that they result from a stability gradient of monomers within a treadmilling filament. This is similar to a possible mechanism of length regulation by destabilizing proteins [3].

[1] Bindschadler et al, Biophys. J. **86** (2004) 2720.
[2] Stukalin and Kolomeisky, Biophys. J. **90** (2006) 2673.
[3] Erlenkämper and Kruse, Phys. Biol. **6** (2009) 046016.

BP 5.21 Mon 17:15 Poster B1

Microrheology: On the comparison of the pancreatic carcinoma cytoskeleton and the in vitro assembled keratin network — •Tobias Paust[1], Anke Leitner[1], Ulla Nolte[1], Michael Beil[2], and Othmar Marti[1] — [1]Institute of Experimental Physics, Ulm University — [2]Institute of Internal Medicine I, Ulm University

The intermediate filament cytoskeleton of pancreatic carcinoma cells is responsible for elasticity and stiffness of the cell and furthermore for shielding its nucleus. Therefore the mechanical properties of the cytoskeleton have to be determined. After polymerization the in vitro assembled keratin 8/18 networks should show similar mechanical properties depending on the ratio of components. By using microrheology methods both the intermediate and the assembled networks were analyzed and then the mechanical properties, the structure and the behaviour under stress were compared.
For this purpose Microrheology with embedded tracer beads is a suitable tool, because the size of the beads compared to the mesh size of the network allows to treat the network as a continuum and to use an analytical model. Observing the beads motion with a CCD-High-Speed-Camera with a time resolution better than 0.25ms leads to the dynamic shear modulus of the networks.
The measurements show storage moduli and the dissipative loss in the extracted cytoskeleton compared to the in vitro assembled network. This is related to differences in the structure of the network and the polymerization process. The results of this experiments will be discussed.

BP 5.22 Mon 17:15 Poster B1

Single molecule force measurements of single-stranded RNA-molecules with optical tweezers — •Tanja Plötz[1], Fabian Eber[2], Anna Müller[2], Christina Wege[2], Andy Sischka[1], and Dario Anselmetti[1] — [1]Experimental Biophysics and Applied Nanoscience, Faculty of Physics, Bielefeld University — [2]Department of Molecular Biology and Plant Virology, Institute of Biology, Stuttgart University

The formation of RNA secondary structures is fundamental for systems biology, because of their regulatory functions on different levels. For understanding protein interactions with single-stranded RNA secondary structures it is of special interest to gain quantitative insights into the binding mechanisms and the interplay at the single molecule scale.
Therefore, we investigated the force extension curves of single-stranded RNA for the breakup of secondary structure, in experiments using a compact single beam optical tweezers platform [1,2] with a custom-made hybridization chamber.
We will expand our experiments to investigate protein-RNA interactions in the *Tobacco mosaic virus* (TMV) ssRNA genome with viral coat protein subunits, in order to find out whether initiation of the self-assembly of the TMV nucleoprotein tube strictly depends on protein-RNA interaction at hairpin loop structures located within the RNA's origin of assembly.

[1] A. Sischka et al., *Rev. Sci. Instrum.* **74**, 4827, 2003
[2] A. Sischka et al., *Rev. Sci. Instrum.* **79**, 063702, 2008

BP 5.23 Mon 17:15 Poster B1

Analysis of multivalent effects using pyridine coordination compounds in single molecule force spectroscopy (SMFS) — •Manuel Gensler[1], Christian Eidamshaus[2], Hans-Ulrich Reissig[2], and Jürgen P. Rabe[1] — [1]Institut für Physik, Humboldt-Universität zu Berlin, Newtonstr. 15, 12489 Berlin — [2]Institut für Chemie und Biochemie, Freie Universität Berlin, Takustr. 3, 14195 Berlin

Multivalent interactions are of great importance in supramolecular chemistry, nanotechnology or biochemistry [1]. They influence binding free energies and kinetics, which leads to strongly increased interaction strengths between partners of appropriate geometry. Thus it is important to obtain a deeper understanding of the basic factors influencing multivalent interactions.

SMFS provides a direct measurement of forces [2] and is therefore an ideal tool to study multivalency on the molecular level. We synthesized pyridine nanorods and coupled them to Au covered tips and surfaces, using thiol chemistry and PEG as spacer. Force-distance measurements at different loading rates were performed to estimate associated binding properties of mono- and multivalent coordination compounds with metal salts in aqueous solutions. Our model system can be extended to various solvents and geometries and therefore provide fundamental knowledge also for more complex biological and supramolecular systems.

[1] M. Mammen et al. Angew. Chem. Int. Ed. 37 (1998) 2754-2794.
[2] M.I. Gianotti et al. ChemPhysChem 8 (2007) 2290-2307.

BP 5.24 Mon 17:15 Poster B1

The conformations of a stiff polymer in random media — •Marcel Hennes and Klaus Kroy — Institut für Theoretische Physik, Universität Leipzig, Deutschland

Stiff polymers play a crucial role in many biophysical processes. In the eukaryotic cell, they assemble to a dense meshwork, the cytoskeleton, which confers the cell its unique mechanical properties. In this highly crowded environment the conformations and dynamic properties of the biopolymers are strongly influenced by the surrounding macromolecules. The theoretical description of the resulting complicated many body problem is usually provided by a mean field Ansatz, like the tube model or the glassy wormlike chain [1].

Little attention has been paid so far to the effect of a quenched random environment on a stiff filament. We present a study of the influence of quenched random forces and a quenched random potential on the conformations of a semiflexible chain in the weakly bending rod limit. The results are obtained with the help of the replica trick, which has proved to be a successful tool in determining the characteristics of directed polymers and flexible chains in random media.

[1] K. Kroy, J. Glaser, *New J. Phys.* **9** (2007) 416.

BP 5.25 Mon 17:15 Poster B1

Microrheology: A system for the comparison of pancreatic carcinoma cells in an optical tweezers device and an electron microscope — •Tobias Paust[1], Anke Leitner[1], Ulla Nolte[1], Michael Beil[2], Paul Walther[3], and Othmar Marti[1] — [1]Institute of Experimental Physics, Ulm University — [2]Institute of Internal Medicine I, Ulm University Hospital — [3]Central Electron Microscopy Unit, Ulm University

Nowadays the studies of pancreatic carcinoma cells are very important to get a insight into the behavior, structure and properties of these cells. Optical tweezers and microrheology methods allow to measure the mechanical properties of a selected cell. By tracing incorporated nanoparticles the trajectory of this particles and then the dynamic shear modulus of the cells or the a network can be determined. Electron microscopes can be used for resolving structures down to a nanometer level and clearly depict the pancreatic carcinoma cells to gather information about the arrangement of the network in the cell. Combining both the microrheology and the pictures of the electron microscope allow to check whether the measurement at a specific cell was meaningful and the determined mechanical properties are appropriate input parameters for numeric simulations. For this purpose a method was developed for marking the position of the analyzed cell during the microrheology measurement and find again the same position in the

electron microscope to examine the structure of the network and the positions of the traced beads.

BP 5.26 Mon 17:15 Poster B1

Non-Gaussian tube width distributions in entangled solutions of filamentous actin — •Inka Lauter[1], Masashi Degawa[1], Norbert Kirchgessner[1], Bernd Hoffmann[1], Rudolf Merkel[1], Margret Giesen[1], Jens Glaser[2], Dipanjan Chakraborty[2], and Klaus Kroy[2] — [1]Institute of Bio- and Nanosystems 4: Biomechanics, Forschungszentrum Jülich GmbH, 52425 Jülich — [2]Institute of Theoretical Physics, University of Leipzig, PF 100920, 04009 Leipzig, Germany

Actin is evolutionarily one of the most conserved components in eukaryotic cells. Actin filaments are interesting model systems to study the physical properties of semi-flexible polymers. One theoretical concept is the tube model which provides a simple phenomenological description of the complicated topological constraints in entangled solutions of semi-flexible polymers. Here, the tube defines the accessible space of a fluctuating filament which is topologically constrained by the presence of other filaments. Various theoretical models assume the tube width along the filament contour being constant. However, recent experiments and simulations showed substantial deviations from this assumption. We introduce a systematic extension [J. Glaser, I. Lauter et al., arXiv:0910.5864] of Morse's binary collision approximation (BCA) [D.C. Morse, PRE 63:031502 (2001)], which predicts a varying tube width along the filament contour. We measured tube width distributions of individual actin filaments as a function of filament density. Our experimental data are well described by the extended BCA model.

BP 5.27 Mon 17:15 Poster B1

Transport of a semiflexible filament in a network — •Teresa Bauer[1], Felix Höfling[1,2], Erwin Frey[1], and Thomas Franosch[1,3] — [1]Arnold Sommerfeld Center (ASC) for Theoretical Physics and Center for NanoScience (CeNS), Fakultät für Physik, Ludwig-Maximilians-Universität München, Germany — [2]Rudolf Peierls Centre for Theoretical Physics, University of Oxford, United Kingdom — [3]Institut für Theoretische Physik, Universität Erlangen-Nürnberg, Germany

The cytoskeleton of a cell is comprised of a network of various biopolymers. A prominent example is the filamentous actin, a semiflexible polymer studied extensively also *in vitro*. The transport of a single semiflexible filament in a strongly entangled network is highly directed along the confining tube formed by the surrounding network.

We have investigated the dynamics of a semiflexible filament in a plane in the presence of immobilized obstacles mimicking the constraints of the crosslinked network. The inextensibility constraints are encoded via a bead-rod-algorithm extended by a suitable collision rule and extensive simulations are performed. In particular we measure the translational and rotational diffusion investigated for a broad density range. Furthermore we discuss the role of undulations as the filament leaves its confining tube when the persistence length is varied.

BP 5.28 Mon 17:15 Poster B1

Selecting structure prediction candidates using sequence-derived structure profiles — •Katrin Wolff[1], Michele Vendruscolo[2], and Markus Porto[1] — [1]Institut für Festkörperphysik, TU Darmstadt, Germany — [2]Department of Chemistry, University of Cambridge, UK

Selection of promising structure candidates for high-resolution refinement is a crucial step in protein structure prediction. Several prediction tools rely on the generation of very many low-resolution candidates and subsequent high-resolution refinement. Only few of the structures, however, are of sufficient quality to converge in the refinement step. Due to limited computer time it is therefore important to restrict the number of candidates and select only the few good ones. As the energy function used in the coarse-grained step is not very useful for recognizing good structures, we here discuss the use of structure profiles for this task. We show that the exact profile (derived from the native structure) is very reliable in choosing candidates with low cRMSD and TMscore to the native structure and clearly outperforms other methods such as filtering by energy or clustering. These profiles can also be predicted to good accuracy from the amino acid sequence. We therefore explore the use of sequence-derived profiles and demonstrate that for sufficiently high prediction accuracy this approach is also superior to the other methods of filtering and independent of the method used for coarse-grained structure generation [1].

[1] K. Wolff, M. Vendruscolo, and M. Porto, Proteins, 2009 in print, DOI 10.1002/prot.22533.

BP 5.29 Mon 17:15 Poster B1

Interaction of Boron-Clusters with liposomes : Influence on the Zeta-potential — •Aleksandre Japaridze[1], Mathias Winterhalter[1], and Detlef Gabel[2] — [1]School of Science and Engineering, Jacobs University Bremen, Campus Ring 1,D-28759 Bremen,Germany — [2]Department of Chemistry, University Bremen, PO Box 330440, D-28334 Bremen, Germany

Boron clusters have potential for clinical use in the so-called boron neutron therapy. Therefore it is of interest to study the interaction between the clusters and the cells. In order to quantify the affinity of charged Boron cluster to lipid membranes we may use Zeta-potential measurements of liposomes. In following experiments we have been investigating the interaction of negatively charged boron-clusters with neutral POPC liposomes, focusing on the change in Zeta potential. Liposomes were used as a cell membrane model for the experiments. For example, the Zeta-potential of POPC liposomes with Na2B12I12 clusters was -47mV at pH value 7.4 .

BP 5.30 Mon 17:15 Poster B1

Dynamic measurement of the persistence length of intermediate filaments — •Bernd Nöding, Susanne Bauch, and Sarah Köster — Courant Research Centre Nano-Spectroscopy and X-Ray Imaging, University of Göttingen, Germany

The eukaryotic cytoskeleton, which is responsible for the mechanics of the cell, mainly consists of three types of fibrous proteins. While microtubules and microfilaments are highly conserved, intermediate filaments (IFs) vary from cell type to cell type. Here, we focus our study on vimentin, which occurs in cells of mesenchymal origin. Investigations of mechanical properties of individual filaments are a necessary prerequisite for a better understanding of the mechanics of biopolymer networks and eventually whole cells. The mechanical rigidity of a polymer is characterized by its persistence length L_p. In the case of vimentin, L_p was found to be on the order of one μm using atomic force and electron microscopy. However, in both cases the filaments need to be adhered to a substrate. Our aim is to perform dynamic measurements of filaments in solution without any interaction with a substrate whatsoever. To this end we fluorescently label the filaments and confine them in microchannels with a width of about one μm, thereby realizing the Odijk confinement regime. The contour of the filaments is imaged by epi-fluorescence microscopy. The purpose of the channels is twofold: the filaments are prevented from coiling and they are restrained to a single focal plane. Since IFs can be classified as semiflexible polymers we assume the worm-like-chain model for our fluctuation analysis. The channel walls are included as parabolic potential in our model.

BP 5.31 Mon 17:15 Poster B1

Microfluidic Drops as Tuneable Bio-Environments — •Christian Dammann, Bernd Nöding, Susanne Bauch, and Sarah Köster — Courant Research Centre Nano-Spectroscopy and X-Ray Imaging, University of Göttingen, Germany

The structure and function of biological systems depends sensitively on their bio-environmental context. Here, we present a novel microfluidic device that offers the possibility to monitor the behavior of biological systems over time while tuning external parameters. We produce monodisperse aqueous emulsion drops that act as picoliter bio-compartments in a continuous oil phase. A series of drops is created and the content compositions are varied from drop to drop. The drops are then stored in the device and thus long-time observations are possible while the information about the composition of each drop is known. Possible applications for such microfluidic platforms are manifold. Here, we show the utility of the device by investigating assembly and network formation of vimentin intermediate filaments in confined geometry by imaging fluorescently tagged proteins. Vimentin assembly and network formation depends on ionic strength. Therefore, we define the salt concentration for each drop. These drop series are stored and observed over time by means of fluorescence microscopy. This study is an important step towards a better understanding of the assembly dynamics of vimentin and the final structure of the networks and demonstrates the well-defined conditions which can be established in microfluidic devices.

BP 5.32 Mon 17:15 Poster B1

Biomimetic Modelling of Cellular Morphogenesis — •Björn

Stuhrmann, Feng-Ching Tsai, and Gijsje Koenderink — FOM Institute AMOLF, Amsterdam, The Netherlands

Migration and division of living cells are ultimately generated by the coupled morphogenesis of the cell cytoskeleton and the plasma membrane. Despite impressive advances in the identification of the cell molecular inventory, the underlying processes are still poorly understood. We strive to discern biophysical principles of cytoskeletal and cell morphogenesis. To this end, we construct a biomimetic model system of the cytoskeleton by confining to liposomes cross-linked actin biopolymers driven by the active processes of polymerization and motor sliding. The key innovation of this project lies in its systematic biomimetic approach alongside quantitative morphological and mechanical examination and theoretical modelling.

BP 5.33 Mon 17:15 Poster B1

A strong structural instability in the microtubule lattice revealed by imaging and molecularly reconstructing the inside of flattened microtubules — •Jan Kleeblatt, Florian Hagene, Iwan A.T. Schaap, and Christoph F. Schmidt — Drittes Physikalisches Institut, Fakultät für Physik, Georg-August-Universität Göttingen

Microtubules (MT) are an important part of the cytoskeleton. In the living cell microtubules are non-equilibrium polymers with complex chemical and mechanical properties. These properties are likely to be strongly influenced by microtubule-associated proteins (MAPs). We have here used atomic force microscopy to image MAPs (Clip 170) and the MT fine structure. We found evidence for an intriguing structural instability in microtubules which leads to a zig-zag pattern of protofilaments in MTs that are flattened inside-out against the substrate surface. We perfomed molecular reconstructions based on the tubulin atomic structure to model our results in terms of the local arrangement of tubulin monomers in neighboring protofilaments.

BP 5.34 Mon 17:15 Poster B1

Self-assembled 3-dimensional DNA structures investigated with fluorescence microscopy — •Alexander Benkstein[1], Zhao Wang[1], Christoph Erben[2], Iwan A. T. Schaap[1], Andrew J. Turberfield[2], and Christoph F. Schmidt[1] — [1]Drittes Physikalisches Institut, Fakultät für Physik, Georg-August Universität, 37077 Göttingen — [2]Clarendon Laboratory, Department of Physics, University of Oxford, Parks Road, Oxford OX1 3PU, UK

Well established synthesis procedures and the "programmability" of DNA binding via base pairing makes DNA ideal for the design of nanostructures.

We here investigate the characteristics of self-assembled tetrahedra from DNA oligomers with dimensions smaller than 10 nm. We labeled tetrahedra with the intercalating dye YOYO-1 and imaged using total internal reflection fluorescence microscopy. We investigate the photobleaching of the dye bound to the DNA tetrahedron and estimate the number of dyes on the single structure.

BP 5.35 Mon 17:15 Poster B1

Multivariate analysis for surface-enhanced Raman scattering (SERS) probe multiplexing and imaging in biological matrices — •Andrea Matschulat[1,2], Daniela Drescher[1,2], and Janina Kneipp[1,2] — [1]Institut für Chemie, HU, Brook-Taylor-Str. 2, 12489 — [2]Bundesanstalt für Materialforschung und -prüfung (BAM), Richard-Willstätter-Str.11, 12489 Berlin

Raman Spectroscopy as a non-destructive spectroscopic technique allows the study of vibrational fingerprints by which chemical and biological compounds can be identified. An improvement of the spatial resolution on the nm-scale is provided by local optical fields surrounding plasmonic nanostructures which are excited by the incident electromagnetic field. Such so-called surface-enhancement provides more sensitive detection. SERS has therefore attracted considerable interest for its application in bioanalytical chemistry. SERS offers numerous opportunities in the study of spectral changes during molecular interactions in complex biosystems. We demonstrate a multivariate approach for SERS hybrid probe multiplexing and imaging implementing principal component analysis and cluster algorithms. As a first application, we introduced two biocompatible Raman reporter molecules attached to Au nanoaggregates into living 3T3-cells. Such a hybrid probe approach enables the identification of different SERS probes in multiplexed experiments. We present results of hyperspectral mapping analysis providing us information about the cellular uptake, localization and amount of both reporter molecules inside the biosystem.

BP 5.36 Mon 17:15 Poster B1

***In situ* actin bundling and network formation using microfluidics** — Siddharth Deshpande[1], Dagmar Steinhauser[2], and •Thomas Pfohl[1,2] — [1]Chemistry Department, University of Basel, Basel, Switzerland — [2]Max Planck Institute for Dynamics and Self-Organization, Göttingen

The approach is to use microflow devices consisting of microchambers connected to a main channel through narrow connecting channels. High flow conditions can be achieved in the main channel to control the concentration and composition of aqueous solution while the transport within the microchambers and connecting channels is governed by diffusion. Rhodamine labeled actin monomers are used to form filamentous actin under appropriate conditions (KCl concentration). Once polymerized, the actin filaments formed inside the chamber will remain confined within it. The network formation can be induced in presence of cross-linking proteins. Fluorescence microscopy is used to study these phenomena. This *in situ* study will help us in understanding the mechanisms of bundle and network formation with increasing hierarchy and complexity.

BP 5.37 Mon 17:15 Poster B1

Testing the elastic anisotropy of microtubules by leveraged bending experiments — •Fabian Stiewe and Christoph F. Schmidt — Drittes Physikalisches Institut, Georg-August-Universität Göttingen

Microtubules are cylindrical protein shells with a distinct structural anisotropy, stemming from their construction from straight protofilaments that are connected more weakly laterally. This could lead to a length-dependence of the flexural rigidity and the persistence length of microtubules as reported recently. The effect is the stronger the "weaker" the connection between the protofilaments gets. We present here a method for sensitively testing this model. Two optical traps are used to suspend a microtubule with the help of two micron-sized beads. A force developed by pulling the traps apart leads to bending of the microtubule. A large difference between Young's and shear modulus should lead to a significant back-bending of the free ends of a bent microtubule, minimizing its free energy. We have used finite-element simulations to check the expected magnitude of this relaxation effect and compare the simulation results with data obtained in bending experiments using optical traps. To date we have not observed any back-bending in our experiments. Therefore we conclude that the difference in Young's and shear modulus might be too small to cause some of the reported effects.

BP 5.38 Mon 17:15 Poster B1

Structural organization and mineral distribution in load-bearing exoskeleton parts of the edible crab Cancer pagurus — Katja Huemer[1], Simone Karsten[2], Keerthika Balasundaram[2], Dierk Raabe[2], •Sabine Hild[1], and Helge-Otto Fabritius[2] — [1]Department of Polymer Science, Johannes Kepler University Linz, Altenbergerstraße 69, 4040 Linz, Austria — [2]Department Microstructure Physics and Metal Forming, Max-Planck-Institut für Eisenforschung, Max-Planck-Strasse 1, 40237 Düsseldorf, Germany

The exoskeleton of crustaceans is a structural entity formed by the cuticle. It is a hierarchically organized chitin-protein fiber based nanocomposite, organized in form of a twisted plywood that can be reinforced in the load-bearing parts with both crystalline and amorphous biominerals. During evolution, all parts of the exoskeleton were optimized to fulfill different functions according to the different ecophysiological strains faced by the animals. This is mainly achieved by modifications in microstructure and chemical composition. To understand the relationship between structure, composition, mechanical properties and function we characterized the carapace cuticle of the edible crab Cancer pagurus with light and scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDX), confocal mikro-Raman spectroscopy and nanoindentation tests. The results show local differences in structure and mineralization on the fiber level as well as the twisted plywood level resulting in a pronounced gradient of the reduced elastic modulus throughout the carapace cuticle of C. pagurus.

BP 5.39 Mon 17:15 Poster B1

Flax or Nettle? Using X-ray Microdiffraction to Identify Ancient Textile Fibres — •Stjepan Hrkac[1], Bridget Murphy[1], Martin Mueller[1], Margarita Gleba[2], Ulla Mannering[2], Marie-Louise Nosch[2], Gianangelo Bracco[3], Manfred Burghammer[4], Hans Georg Gebel[5], Bodil Holst[6], and Christian Bergfjord[6] — [1]Laboratory Institut fuer Exp. und

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Remains of cloth from one of the most famous Danish bog bodies, the Huldremose Woman (55 AD), believed to stem form a hitherto unknown garment, were investigated by a combined approach using microscopy (optical and SEM) X-ray microbeam diffraction, X-ray microbeam fluorescence and micro Raman. For identification purposes samples were compared to modern fibers. We present our preliminary results in this poster

BP 5.40 Mon 17:15 Poster B1

Network properties of an aggregate of perylene bisimide based molecules — •Carlo Di Giambattista[1], Anke Leitner[1], Masoud Amirkhani[1], Anne-Marie Saier[1], Suhrit Ghosh[3], Frank Würthner[3], Michael Beil[2], and Othmar Marti[1] — [1]Institute of Experimental Physics, Ulm University, Germany — [2]Institute of Internal Medicine I, Ulm University Hospital, Germany — [3]Institute of Organic Chemistry, Würzburg University, Germany

Due to non-covalent binding the perylene bisimide based molecules form a network able to bind a solvent. This combination of network and solvent is a so called organogel. Organogels are excellent examples of the construction of higher order self-assembled structures from properly designed small-molecule building blocks*. Because of the type of binding we are interested in the resulting network properties. We want to compare those properties to the ones of intermediate filaments. These filaments are as well assembled by small building blocks. To gain an idea of the microscopic structure of the organogels we use atomic force microscopy. Furthermore we do rheological measurement on the phase transition as well as on the final gel.

*S. Ghosh et al. Chem. Eur. J. 2008, 14, 11343-11357

BP 5.41 Mon 17:15 Poster B1

Investigation of the nanomechanical properties of the cytoskeleton protein Keratin 8/18: Force microscopy measurements and simulations — •Andreas Häussler[1], Tobias Paust[1], Anke Leitner[1], Michael Beil[2], Harald Herrmann[3], and Othmar Marti[1] — [1]Institute of Experimental Physics, Ulm University — [2]Institute of Internal Medicine I, Ulm University Hospital — [3]Division of Molecular Genetics, German Cancer Research Center, Heidelberg

The protein Keratin 8/18 is one of the major components of the cytoskeleton of pancreatic cancer cells. Assembling into intermediate filaments, the protein forms a network in the cell that is responsible for the cell stiffness. As the network is determined by its building blocks, it seems to be interesting to investigate the nanomechanical properties of single intermediate filaments. By etching we create a topographic surface lattice with a length scale of about 1 micrometer. The filaments can be suspended between two mesas and be deflected by mechanical stimuli. The force measured, related to the elongation, gives us information on the elasticity of the filaments. Moreover we simulate the filaments with a finite element model. In a first approach, we assume the filaments to be a homogeneous material and adjust our calculation to our measurement results. This should give us a hint on the averaged Young's modulus. Preliminary results will be presented.