SoftComp
SOFT MATTER COMPOSITES
Network of Excellence
www.eu-softcomp.net
news letter
No. 13 · 2015

Editorial

Major topics in science and research change constantly. New fields emerge and grow, while others mature and move from basic research to development and technology. This also poses the question to SoftComp: "Quo vadis, Soft Matter?" Some directions are clearly visible, while others remain shrouded in the fog of the future. The physics of biological systems, applications of biological construction principles to artificial "biomimetic" systems, and the combination of biological and synthetic components in biohybrid materials, will certainly continue to grow and expand in the near future. Similarly important will be the development of "soft functional matter", which can be adaptive, responsive, self-healing, and self-cleaning. Finally, "active matter", which ranges from the non-equilibrium active behaviour of biological molecules and cells, to the motion of active Janus colloids should be mentioned. SoftComp is a well-placed forum to anticipate all these promising future directions of soft-matter science. The 2015 IFF Spring School on "Functional Soft Matter " at Forschungszentrum Jülich covered one of these focus areas.

The idea of the SoftComp topical workshops is to focus on topics of particular interest to the network, but to be open to all interested researchers. Two topical workshops have taken place in 2015, one, on "Ring polymers: Advances and Perspectives", in Aldemar, (Crete, Greece), the other on the "Rheology of Dense Suspension Flow", in Edinburgh (Scotland, UK). More details about these workshops can be found on page 7.

The main scientific article of the current newsletter, "Bursting mechanism of dilute emulsion-based liquid sheets", investigated at Laboratoire Charles Coulomb, CNRS and Université de Montpellier, France, features a remarkable anti-drift suppression for agricultural sprays.

The International Soft Matter Conference ISMC, initiated in 2007 by SoftComp, has meanwhile become a well-established international soft-matter forum. The 4th ISMC will take place in September 2016 in Grenoble, France, with about 800 registered abstracts. For details see page 8.

Hugo Bohn & Gerhard Gompper

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Bursting mechanism of dilute emulsion-based liquid sheets: anti-drift application for agricultural sprays

Clara Vernay, Laurence Ramos & Christian Ligoure. SoftComp partner: Laboratoire Charles Coulomb CNRS and Université de Montpellier, 34095 Montpellier Cedex 05 France

Figure 1

The photo shows a crop spraying aircraft during the application of agricultural pesticides. Using dilute oil-in water emulsions (anti-drifts adjuvant) as a carrier fluid for pesticide sprays means a reduction of the proportion drops of the spray wth a diameter smaller than 150 microns of about 70%.

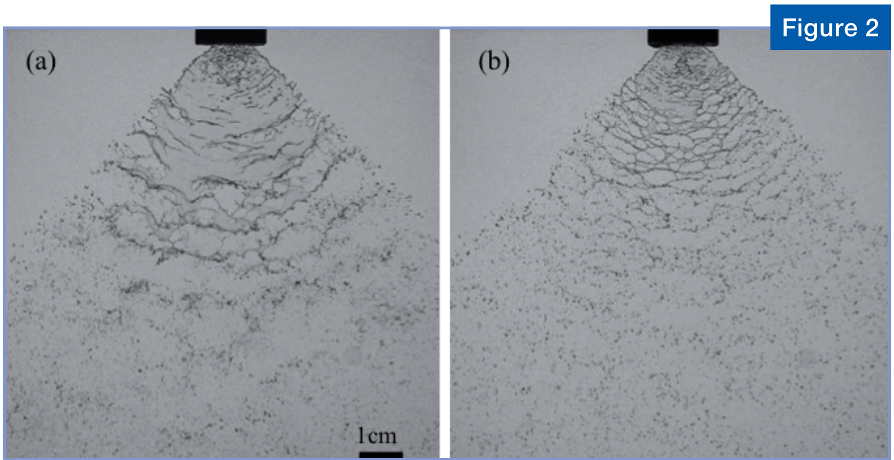
One of the major environmental issues related to the spraying of pesticides on cultivated crops is the drift phenomenon. Because of the wind, small droplets may drift away from the targeted crop and cause contamination. A drop with a diameter of 5 μm will travel a distance of 5 km while falling 2 m with a 5 km/h wind whereas a drop with a diameter of 1000 μm will only travel a distance of 1.4 m [1]. One way to reduce the drift is to decrease the proportion of the smallest drops in the spray (typically drops with a diameter smaller than 150 μm). In this context, anti-drift additives have been developed including dilute oil-in-water emulsions. When sprayed through the nozzle, dilute emulsions increase the volume median diameter of the drops issued from the spray and decrease the volume fraction of small drops [1-3]. Dilute emulsions also increase the spray angle which is a noticeable advantage compared to other classes of anti-drift carrier fluid available as a dilute water-soluble polymer solution [4]. Agricultural spraying involves atomizing a liquid stream through a hydraulic nozzle. At the exit of the nozzle, a free liquid sheet is formed, which is subsequently destabilized into ligaments that break into droplets (Figure 2a). In a seminal publication, Dombrowski and Fraser [5] observed for the first time that liquid sheets of dilute emulsions experience a supplementary specific destabilization process, which consists of perforation events (Figure 2b): holes nucleate in the liquid sheet and grow until a network of ligaments is formed, which then fragments into droplets.

In a spray, the thickness of the sheet, h, decreases inversely to the distance from the nozzle. The size of drops resulting from the Rayleigh-Plateau destabilization of a ligament scales with the diameter of the ligament, which itself is expected to scale with h. Consequently, the drops resulting from the sheet destabilization will be larger as the sheet is thicker [6]. Perforations cause the sheet to be destabilized closer to the nozzle, yielding bigger droplets, as observed experimentally [5]. However, up to now, the physical origin of the perforation remains

Bursting mechanism of dilute emulsion-based liquid sheets: anti-drift application for ... (continued)

Clara Vernay, Laurence Ramos & Christian Ligoure. SoftComp partner: Laboratoire Charles Coulomb CNRS and Université de Montpellier, 34095 Montpellier Cedex 05 France

Figure 2



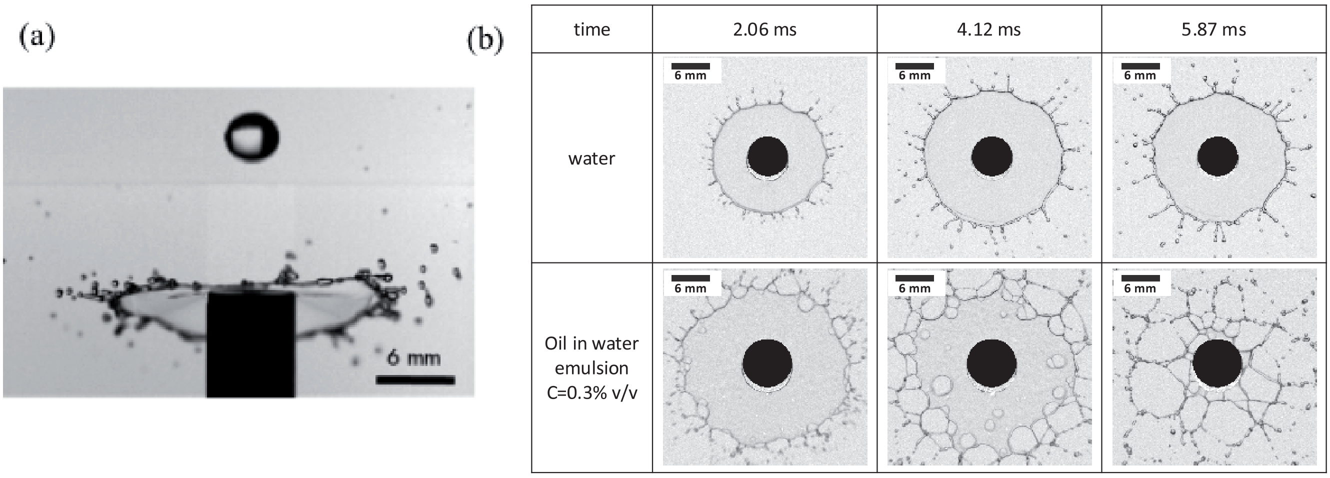
(a) Liquid sheet of pure water formed from a flat fan hydraulic nozzle. The liquid sheet destabilizes into ligaments that subsequently destabilize into droplets. (b) Liquid sheet of a dilute oil-in-water emulsion. Note the formation of holes in the sheet that are specific to emulsion-based carrier fluid. Courtesy of R. Goyal (Solvay Novecare).

controversial. Two main mechanisms have been invoked: (i) dewetting an inclusion by the fluid when the inclusion size exceeds the sheet thickness, so that inclusions cause perforation by puncturing both interfaces, and (ii) spreading an oil droplet at the air/film interface inducing a thinning of the film by a Marangoni effect leading ultimately to the film rupture [4]. These mechanisms have never been confronted to robust experimental facts.

To address this question we have used a milli-fluidic experiment based on the collision of one tear of liquid on a small solid target to produce and visualize free liquid sheets using a fast camera [7,8]. Upon impact, the tear flattens into a sheet, radially expanding in the air and bound by a thicker rim (Figure 3), exhibiting destabilization mechanisms similar to those of liquid sheets formed by hydraulic nozzles (Figure 3b). A very good correlation between the number of perforation events in a liquid sheet in the milli-fluidic experiment and the proportion of small drops in the spray is obtained, demonstrating that the single-tear model experiment is appropriate to investigate and gain an understanding of the physical mechanisms governing the spray drop size distribution of anti-drift formulations [8]. What is more, the total number of perforation events that occur in the single-tear experiment is directly correlated to the number of emulsion droplets present in the sheet, proving unambiguously that the emulsion droplets are at the origin of the perforation events [8].

We have obtained conclusive results [9] thanks to time- and space-resolved measurements of the thickness of a dyed sheet [7]. We have found that each perforation event is systematically preceded by the formation of a pre-hole that thins out the sheet and widens with time (Figure 4) up to the film rupture, whereas the velocity and thickness fields of the sheet outside the pre-hole and holes are not perturbed. The growth kinetics of pre-holes and holes differ (Figure 5). The opening dynamics of holes obeys the Taylor-Culick law [10], predicted for the rupture of a soap film, with a constant opening velocity $V_C = \sqrt{2\gamma/\rho h}$ with ρ, the density of the liquid, γ its surface tension, and h the film thickness. The growth dynamics of the pre-holes follows the law theoretically predicted for a liquid

Figure 3



(a) Side view of the single tear experiment. A liquid tear of diameter d_0=3.7 mm impact on a target of diameter d_t =6 mm with a velocity u_0=4 m/s, yielding a free radially expanding liquid sheet. (b) Liquid sheet destabilization mechanisms. Comparison between the destabilization of a pure water sheet and a liquid sheet made of dilute oil-in-water emulsion of concentration C=0.3%v/v. The origin of the time is taken at the impact of the tear on the target.

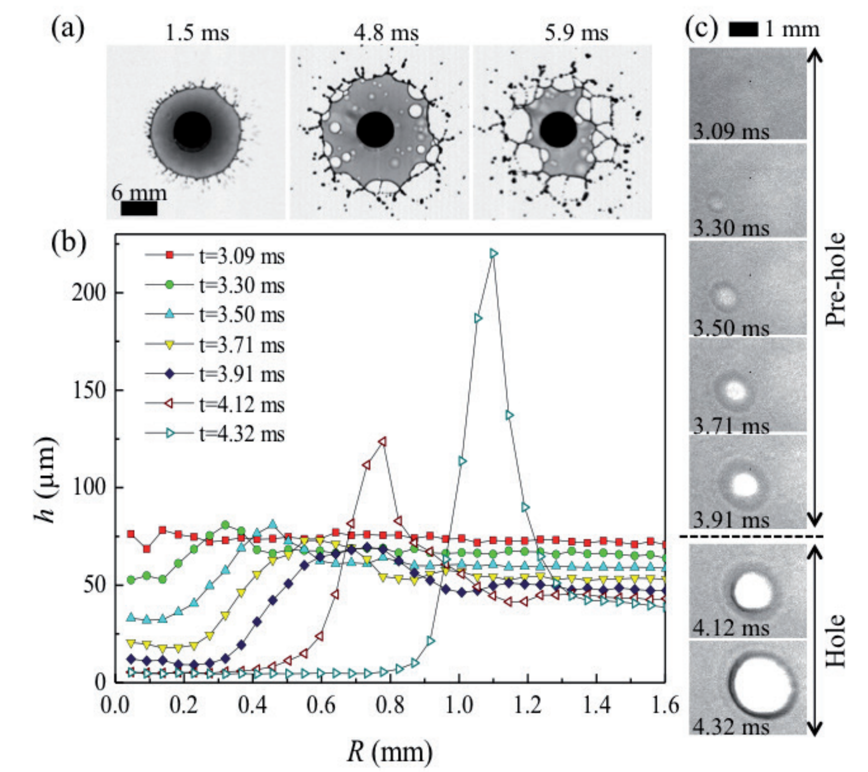
Bursting mechanism of dilute emulsion-based liquid sheets: anti-drift application for ... (continued)

Clara Vernay, Laurence Ramos & Christian Ligoure. SoftComp partner: Laboratoire Charles Coulomb CNRS and Université de Montpellier, 34095 Montpellier Cedex 05 France

spreading on another liquid of higher surface tension due to Marangoni stress: $R = kt^{3/4}$. The driving stress due to the surface tension gradient, $\nabla\gamma$, associated with the presence of an oil drop at the air/liquid interface induces the spreading of the oil. It results in a viscous shear stress that causes the liquid in the film to flow along $\nabla\gamma$ yielding a deformation of the interface with a localized thinning of the film. Classical Marangoni spreading experiments quantitatively corroborate our findings. Note finally that pre-hole formation occurs when the thickness of the sheet (in the range 40-65μm) is significantly larger that the size of the oil droplets (~ $20\mu m$) definitely ruling out a puncture mechanism.

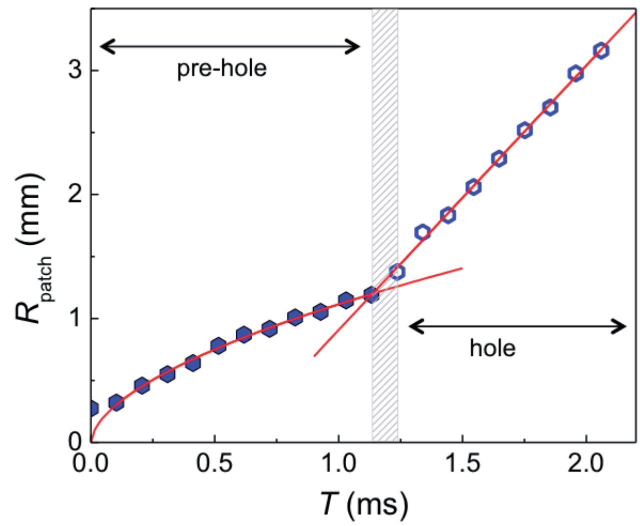
Based on the process of Marangoni spreading, we have proposed a perforation mechanism as a sequence of two necessary steps: the emulsion oil droplets (i) enter the air/water interface, and (ii) spread at the interface. The formulation of the emulsion is a critical parameter to control the perforation. The addition of salt [11] or amphiphilic copolymers in the aqueous phase of emulsions stabilized by water-soluble ionic surfactants can kinetically trigger or completely inhibit the perforation mechanism. We have shown that the entering of oil droplets at the air/aqueous phase interface is the limiting step of the mechanism. Thin-film forces such as electrostatic or steric repulsion forces stabilize the thin film formed between the interface and the approaching oil droplet, preventing oil droplets entering the interface and so inhibiting the perforation process [12].

Figure 4



(a) Formation and destabilization of a dyed emulsion-based liquid sheet. The origin of time t is taken at the drop impact. (b) Thickness profiles of the pre-hole/hole as a function of the radial distance from the patch centre for different times. Open (resp. close) symbols correspond to a pre-hole (resp. hole). (c) Sequence of events of the patch dynamics.

Figure 5



Evolution of the radius of the patch (filled symbols: pre-hole, open symbols: hole) with the time elapsed since the formation of the pre-hole for the patch shown in Fig 3. The solid lines are the best power law fit, resp. linear fit, for the pre-hole, resp. hole, dynamics

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Financial support from Novecare-Solvay is acknowledged. We thank Jean-Christophe Castaing, Rajesh Goyal and Jean-Paul Douzals for discussions.

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SoftComp Network Research Highlights 2015

Real-time observation of nonclassical protein crystallization kinetics

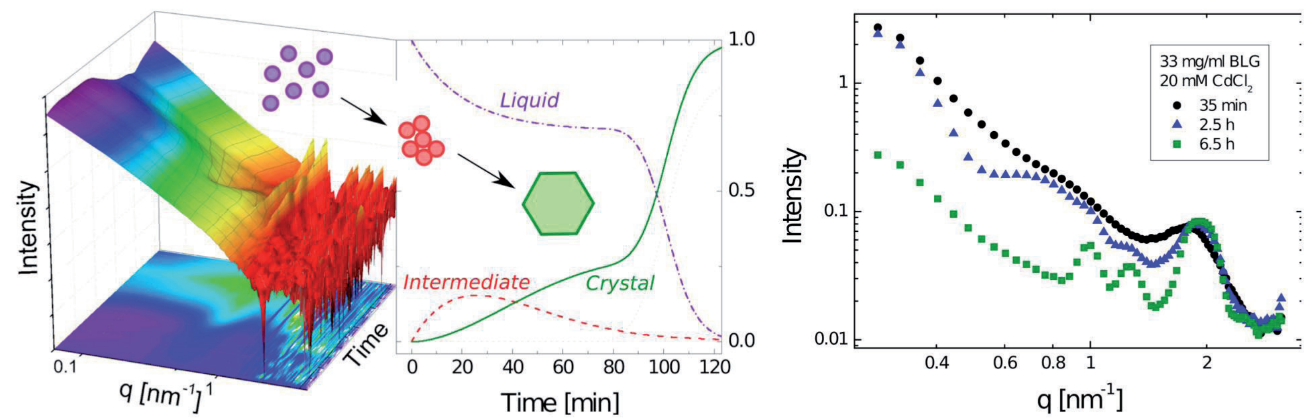
Sauter et al., JACS 137, (2015), 1485 and Faraday Discussions (2015), in print

The crystallization of proteins is a major bottleneck of many projects in structural biology. While classical nucleation theory predicts the reversible aggregation of solute molecules and the formation nuclei with the density and structure of the crystals, features beyond the classical view have been proposed in the crystallization of proteins, colloids or clathrate hydrates.

A real-time study of protein crystallization using the model protein bovine β-lactoglobulin in the presence of CdCl2 has been performed using small-angle scattering (X-rays and neutrons) and optical microscopy.

The observation of the non-trivial crystallization kinetics can be explained by the following multistep mechanism: An intermediate structure within protein aggregates is formed first (indicated by a broad peak at ~0.7 nm-1 in the scattering data), followed by the formation of crystals within this intermediate phase. In this stage, the number of crystals increases with time while the crystal growth is rather slow within the dense intermediate phase due to the low mobility of proteins. In the next step, the intermediate phase is consumed by the nucleation of crystals and their growth. Finally, the crystals get exposed to the dilute phase. In this stage, the number of crystals stays almost constant, whereas the growth is more rapid due to the access to free protein molecules in the surrounding dilute phase.

Figure 1



Left: 3D plot of real-time SAXS data of a sample with 20 mg/ml BLG and 15 mM CdCl2. The intermediate structure shows in the broad peak at ~0.7 1/nm, Bragg peaks become visible later, whereas the broad peak disappears again. Middle: Area under the broad peak („intermediate"), area under the Bragg peaks („Crystal") and 1 minus the other two contributions („Liquid") as a function of time. Right: SANS data of a sample with 33 mg/ml BLG and 17 mM CdCl2. Again, a broad peak becomes visible first, indicating the formation of a non-crystalline precursor-structure inside the protein aggregates. Subsequently, Bragg peaks become visible.

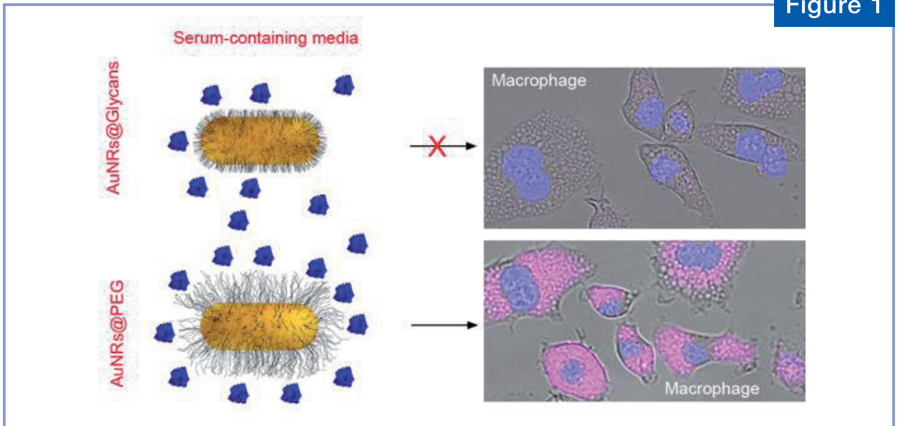
Glycans as Biofunctional Ligands for Gold Nanorods: Stability and Targeting in Protein-Rich Media

I. García, A. Sanchez-Iglesias, M. Henriksen-Lacey, M. Grzelczak, S. Penades, and L. M. Liz-Marza
SoftComp partner: CIC biomaGUNE (BioNanoPlasmonics Group Prof. Liz-Marzán), Spain
J. Amer. Chem. Soc., JACS 137, (2015), 3686–3692

Poly(ethylene glycol) (PEG) has become the gold standard for stabilization of plasmonic nanoparticles (NPs) in biofluids, because it prevents aggregation while minimizing unspecific interactions with proteins. Application of Au NPs in biological environments requires the use of ligands that can target selected receptors, even in the presence of protein-rich media. We demonstrate that the stabilizing effect of low-molecular-weight glycans on both spherical and rod-like plasmonic NPs under physiological conditions, as bench-marked against the well-established PEG ligands. Glycan-coated NPs are resistant to adsorption of proteins from serum-containing media and avoid phagocytosis by macrophage-like cells, but retain selectivity toward carbohydrate-binding proteins in

SoftComp Network Research Highlights 2015 (continued)

Figure 1



The Figure depicts the natural targeting specificity of Au NRs decorated with glycan conjugates in spite of protein corona formed in serum media.

protein-rich biological media, such as tumoral cells. Given that mammalian lectins play an important role in a number of biological processes (innate immunity, leukocyte trafficking, modulation of cell-cell interactions, cell growth, etc.) our results support the idea that structures of complex and antigenic glycans onto plasmonic, anisotropic nanoparticles are suitable candidates for photothermal therapy on highly metastatic tumor cells, for instance, by blocking Gal-3 downstream biological processes.

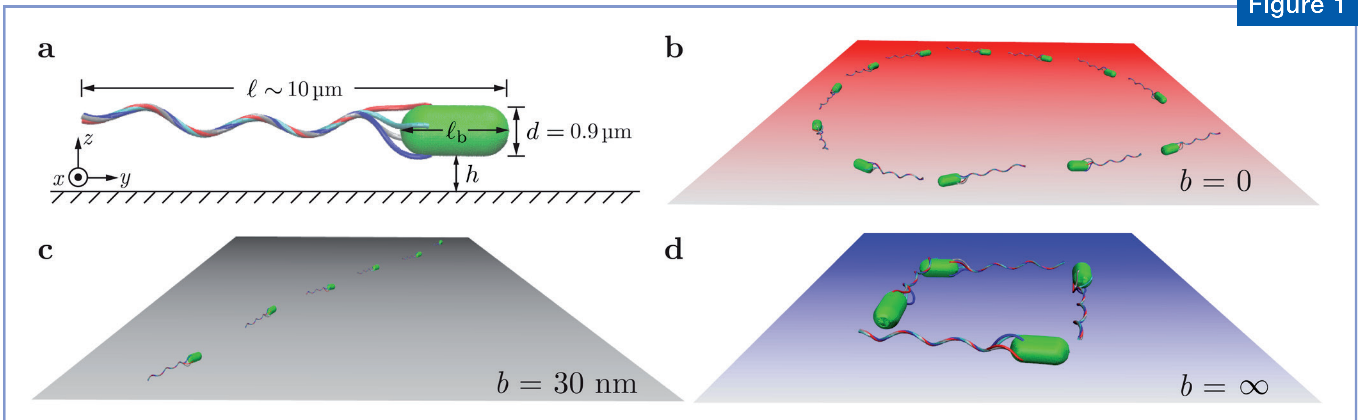
These results open the way toward the design of efficient therapeutic/diagnostic glycan-decorated plasmonic nanotools for specific biological applications.

Directing Bacterial Motion by Structured Surfaces and Wall Slip

J. Hu, A. Wysocki, R.G. Winkler, and G. Gompper – SoftComp partner: FZJ Gompper
Sci. Rep. 5, 9586 (2015), DOI: 10.1038/srep09586

The study and detailed understanding of the behavior of biological microswimmers, such as sperm, bacteria, and algae, is interesting for a better control and manipulaton of their motion, but also for the construction and optimization of artificial microswimmers for a variety of medical and technical tasks. Peritrichousbacteria, such as Escherichia coli and Salmonella, are propelled by abundle of rotating helical flagella. Hydrodynamic interactions imply circular trajectories near surfaces. We have constructed a detailed mechanical model of such a bacterium.Its motion in a fluid near a wall is studied by mesoscale hydrodynamics simulations.The curvature and orientation (clockwise, counterclockwise) of the trajectory depend on the fluid boundary conditions at the surface. A quantitative study reveals its quantitative dependence on the boundary slip length. These results are then employed to propose a novel approach to directing bacterial motion on striped surfaces with different slip lengths, which implies a transformation of the circular motion into a snaking motion along the stripe boundaries. The feasibility is demonstrated by a simulation of active Brownian rods, which also reveals a dependence of directional motion on the stripe width. This approach can be used forseparating bacteria with different trajectory radii.

Figure 1



Swimming bacteria sense the fluid slip (characterized by the slip length b) of a nearby surface.

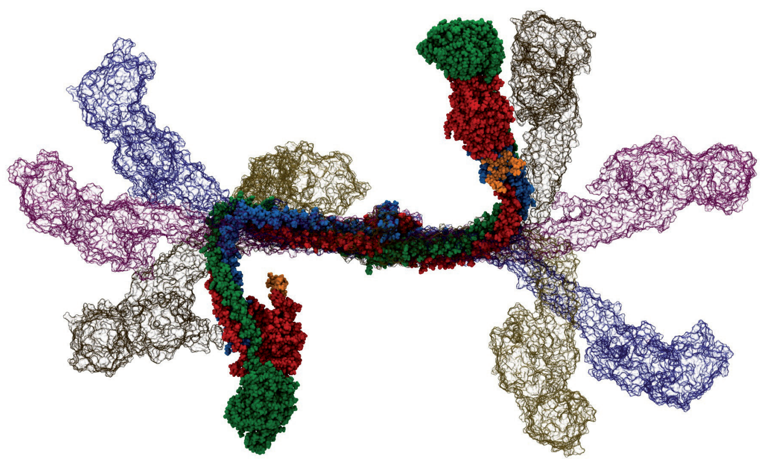
Network Activity Highlights 2015

The internal dynamics of fibrinogen and its implications for coagulation and adsorption

S. Köhler, F. Schmid, and G. Settanni, SoftComp partner, Univ. Mainz
PLOS Computational Biology, in press – DOI:10.1371/journal.pcbi.1004346

Fibrinogen is a blood protein of vertebrates which plays an importantrole in the blood coagulation cascade. When activated, it aggregatesand forms fibrin fibers, which are the basis of a blood clot. Clot persistence is regulated by plasmin, an enzyme which cuts fibrin fibers at specific places. A mechanistic understanding of fibrin degradation by plasmin is still missing. An important determinant of this process might be the flexibility of fibrinogen. For example, a great variety of conformations has been observed when fibrinogen adsorbs on material surfaces. We have performed atomistic computer simulations that have helpedto identify large bending motions occurring at specific hinges on fibrinogen.We could show how these bending motions can explain the variable conformationsobserved in experiments and how they help exposing sites where plasmincan cut fibrinogen. The bending and other cooperative effects observedin the simulations thus represent potential mechanisms for theregulation of blood clotting.

Figure 1



The figure represents several superimposed conformations of fibrinogen sampled along the simulations, highlighting the observed bending motions.

About SoftComp

SoftComp is a Network of Excellence – a tool developed under the 6th Framework Programme of the European Commission dealing with the integration of European research, with the intention of strengthening scientific and technological excellence. In particular, SoftComp aims to establish a knowledge base for the intelligent design of functional and nanoscale soft matter composites. It will do so by overcoming the present fragmentation of this important field for the development of new materials at the interface of nonliving and living matter, where the delicate principles of self-assembly in polymeric, surfactant and colloidal matter prevail. This Network of Excellence has created an integrated team that is able to activate the European potential in soft matter composite materials and thus disseminate excellence through extensive training and knowledge transfer schemes. Since December 2009, when EU funding came to an end, SoftComp has been a self-supporting consortium consisting of 40 research groups belonging to 36 different institutions.

- **SoftComp partner details**
  www.eu-softcomp.net/about/part
- **Network coordinator**
  www.eu-softcomp.net/about/part
  E-mail: g.gompper@fz-juelich.de
- **Registration**
  If you would like to register for the SoftComp portal, please contact:
  E-mail: f.carsughi@fz-juelich.de
- **SoftComp Communications**
  E-mail: f.h.bohn@fz-juelich.de

Network Activity Highlights 2015 (continued)

SoftComp Topical Workshops Reporting 2015

SoftComp Topical Report: Rheology of Dense Suspension Flow Wilson Poon, June 1-3, 2015

In the words of our original proposal, the purpose of our meeting was to 'bring together researchers working on five areas ... rheology of colloids ... , rheology of pastes ... , dry granular materials ... , glassy arrest and jamming' to explore possible common themes, because we believed that 'a grand synthesis is just round the corner'. The meeting more than amply justified our expectation. It was clear from both the 16 talks and extended formal and informal discussions that a 'grand synthesis' was indeed underway, underpinned partly by a widespread acceptance that particle-particle contacts could play as important a role in dense suspensions as they have always been known to play in dry granular materials. Pleasingly, this message was not only conveyed to the experts, but also to younger researchers (14 students and 7 postdocs came), as well as a number of more experienced academics who were nevertheless new to the area. Indeed, we believe that this meeting has contributed significantly to raising the profile of this 'hot topic' within the SoftComp. We were able to attract 8 industrial scientists to the meeting (1 speaker and 1 discussion leader, 6 participants). They made it clear that the new results emerging were of very keen, direct interest for applications. They also contributed new challenging problems for future research to address. A good indicator of the success of this topical workshop is that two participants (1 speaker and 1 discussion leader) and one invitee who could not attend have now organised a similar meeting in 2016 in Washington DC. The organisers thought after the meeting that it was right to have kept the number of participants to just below 70 to preserve the 'workshop' nature of the event. Interaction between the audience and the speakers was maximised by scheduling a half hour period of chaired discussion following each pair of talks. In this context, SoftComp funding was particularly important for us to attract 8 discussion leaders from around the world. Their participation significantly enhanced the fruitfulness of the workshop.

Ring polymers: Advances and Perspectives – Hersonisos Maris Hotel, Crete July 12-15, 2015

The first meeting of its kind was successful and participants were pleased. Interesting talks, new ideas, deep discussions and exchanges, nice atmosphere, and agreement for a follow-up meeting in two years. Highlights included new synthetic approaches, the unraveling of slow modes, linking structure to dynamics and the biological implications of rings. It attracted 63 participants from Europe, USA, Japan and Australia. A total of 24 speakers (2 female) and several posters. The social program included a visit to Knossos antiquities and swimming. A total of 29 participants and 6 speakers were associated with softcomp.

SoftComp Topical Workshops Planned 2016

It is evident nowadays that the non-Newtonian response of complex fluids is linked with its microscopic structure. Thus, to establish reliable constitutive equations an in-depth understanding of molecular behaviour under shear is necessary. Especially for transient or kinetic effects, which are observed more and more for this kind of systems, the in situ combination of rheology and microscopic structure/dynamics is indispensable. The aim of the workshop is to bring together researchers working in different areas covering topics from rheology of complex systems, structure of liquids at solid-liquid interfaces, structure and dynamics of confined fluids and polymers. Particular interest will be devoted to research on transient structural reorientation of complex fluids in conjunction with the transient rheological material functions. Examples are time resolved small- and large-amplitude oscillatory rheology (SAOS and LAOS, respectively), start-up of flow, flow reversal, stress relaxation following steady shear, jump strain.

This is a satellite event of the International Soft Matter Conference 2016.

Organizers: Yuri Gerelli, Philipp Gutfreund, Pavlik Lettinga, Lionel Porcar.
Date: September 19-21, 2016
Location: Institut Laue-Langevin, Grenoble, France
Registration & information:
https://indico.ill.fr/indico/event/28/

Annual Meeting 2015

The meeting took place at Ancona, Italy, from 8 to 11 June 2015. 150 scientists from 14 european nations attended.

Belgium	7
France	16
Germany	49
Greece	6
Hungary	1
Italy	7
Luxembourg	5
Poland	5
Slovak	1
Spain	17
Sweden	2
Switzerland	6
The Netherlands	7
United Kingdom	21

To show the broad spectrum of the scientific spectrum, a list of invited papers is shown. Details are available at the SoftComp website.

- **Soft and triggerable: DNA, proteins, drops, and coffee rings**
- **Soft matter physics in plants: mechano-perception and gravisensing**
- **Self-assembled systems in evolution following their structural changes by scattering experiments**
- **Nanostructures and rafts in lipid bilayers**
- **Soft nanotubes to study how proteins deform membranes.**
- **Scalable approaches for organized plasmonic nanoparticle films.**
- **Forces in Soft Matter**
- **Field-directed assembly of anisotropic colloids.**

Personalia ...

- **Luis Liz-Marzán**, Professor and Scientific Director of CIC biomaGUNE, San Sebastian Spain, received the 2015 Rey Jaime I Award of the Valencia Foundation for Advanced Studies.

Luis Liz-Marzán was also appointment as Coeditor of the new ACS journal "ACS Omega".

- **Peter Schurtenberger**, Professor of Physical Chemistry at Lund University, Sweden, was elected as a member of the Royal Swedish Academy of Science and of the Royal Swedish Academy of Engineering.

- **Prof. Dieter Richter**, retired former SoftComp Network Coordinator of the Jülich Centre for Neutron Science and the Institute of Complex Systems has been awarded the Staudinger-Durrer Prize for his work in the area of soft matter.

Changes ...

- **Dr. Andrew M Howe FRSC**, former Schlumberger works now for Aqdot on „smart encapsulation technology" using host-guest chemistry see: *http://www.aqdot.com*

- **Prof. Dr. Reinhard Strey**, Institut für Physikalische Chemie, Köln, Germany, retired and handed over his membership to Annette Schmidt.

- **New editor of SoftComp Newsletter:**
Newsletter editing and communications:
Angela Wenzik, Contact:
Telephone: *+49 2461 616048*
Web: *www.fz-juelich.de/ics/*
e-Mail: *a.wenzik@fz-juelich.de*

ESMI Info ...

- **ESMI approached at the end of 2015 a five years EU-funding period**

Looking back to successful transnational access, networking and joint research activities. The users requested more than ninety percent of the originally planned access resources. this demonstrates that the European community of soft matter scientists needs an infrastructure such as ESMI to remain competitive. A new application for EU-funding of a follow-up infrastructure programme is in progress. However, in the meantime, ESMI will keep the transnational access activities running in a modified way.

Coming Up ...

Soft Matter related international conferences / courses / workshops / schools ...

2016

- 4 - 8 April 2016
NaNaX7
The Organizers: Ramon Alvarez Puebla, Antonios Kanaras, Wolfgang Parak, Victor Puntes
Location: Philipps University Marburg, Germany
http://www.nanax7.com

- 16 - 20 May 2016
7th Laboratory Course on Dielectric Spectroscopy
The course is open to researchers and graduate students in Physics, Chemistry, and Material Science or Biology.
Location: San Sebastián, Spain
www.sc.ehu.es/sqwpolim/PSMG/BDSLC/

- 6 - 9 June 2016
SoftComp Annual Meeting 2016
Location: Ancona, Italy
Dr. Flavio Carsughi

- 12 - 18 June 2016
AMPERE NMR SCHOOL 2016
Location: ZAKOPANE, Poland
S. Jurga
www.10times.com/ampere-nmr-school

- 20 - 27 June 2016
13th European Summer School on 'Scattering Methods Applied to Soft Condensed Matter'
Location: Vacation centre »Les Bruyères«, in Bombannes, France
Dr. Peter Lindner
https://www.ill.eu/press-and-news/events/bombannes-2016/

- 27 June - 1 July 2016
Out-of-Equilibrium & Active Soft Matter
Location: Roscoff, France

- 3 - 7 July 2016
EUROMAR 2016
Location: Aarhus, Denmark
http://www.euromar2016.org

- 4 - 6 July 2016
NANOPARTICLES WITH MORPHOLOGICAL & FUNCTIONAL ANISOTROPY: FARADAY DISCUSSION
Location: Glasgow, UK
http://www.rsc.org/ConferencesAndEvents/RSCConferences/FD/Anisotropy-FD2016/index.asp

- 8 - 13 August 2016
ICR 2016 – 16th International Congress on Rheology
ICR takes place every 4 years.
Location: Kyoto, Japan
http://icr2016.com

- 4 - 9 September 2016
ECIS 2016 – 30th Conference of The European Colloid and Interface Society
Location: Rome, Italy
https://ecis2016.org

- 5 - 9 September 2016
17th TNT Conference – Trends in Nanotechnology International Conference (TNT2016)
Location: Fribourg, Switzerland
http://www.tntconf.org/2016/index.php?conf=16

- 5 - 16 September 2016
JCNS Laboratory Course 2016
Location: Jülich & Garching, Germany
R. Zorn · *reiner.zorn@gmail.com*

- 12 - 16 September 2016
ISMC 2016 – 4th International Soft Matter Conference
Location: Grenoble, France
http://www.ismc2016.org

- 19 - 21 September 2016
SoftComp Topical Workshop
Transient structural reorientation of complex fluids in conjunction with the transient rheological material functions.
Location: ILL, Grenoble, France
https://indico.ill.fr/indico/event/28/

2017

- 4 - 6 April 2017
AERC – Annual European Rheology Conference
Location: Kopenhagen, Dänemark
http://www.discongress.com/conference-list/event/66-aerc-annual-european-rheology-conference/

- November 2017
Jülich Soft Matter Days
Location: Seminaris Hotel,
Alexander-von-Humboldt-Str. 20,
53604 Bad Honnef, Germany
Information: *www.seminaris.de/badhonnef*
J. Dhont, D. Richter, G. Gompper
http://www.fz-juelich.de/ics/jsmdays/

For more frequently updated information, please see also the SoftComp Homepage: *www.eu-softcomp.net*

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Editorial Details

Editors:
Friedrich Hugo Bohn, Gerhard Gompper
SoftComp Consortium · Forschungszentrum Jülich GmbH · 52425 Jülich · Germany

Contact:
Telephone: +49 2462 90 50 73
Mobile: +49 175 24 16 123
f.h.bohn@fz-juelich.de
www.eu-softcomp.net

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