

# Emmanouela Filippidi

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University of Crete  
Affiliated Researcher, IESL, FORTH

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## EDUCATION

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- 09/2007–05/2014 **Ph.D.** in Physics, Center for Soft Matter Research, New York University, New York, NY  
*Thesis: Random Organization: Out-of-equilibrium phase transitions in periodically driven suspensions.* Advisor: Prof. David J. Pine. Committee members: P. Chaikin, A. Grosberg, A. Donev, J. Morris
- 09/2005–09/2007 **Master of Science**, Dept. of Biomedical Engineering, Boston University, Boston, MA  
*Thesis: Controlled biopolymer assembly in microfluidic devices.* Advisor : Prof. Joyce Y. Wong
- 09/2001–06/2005 **Bachelor of Science** in Engineering, Cum Laude, Harvard University, Cambridge, MA  
*Thesis: Protein preservation in sugar glasses.* Advisor : Prof. Mehmet Toner
- 06/2001 **Apolytiro**, Athens College, Greece (19.6 / 20)

## ACADEMIC APPOINTMENTS / EMPLOYMENT

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- 9/2020 - present **Assistant Professor**, Department of Materials Science and Technology, University of Crete. and Affiliated member, Institute of Electronic Structure and Laser, FORTH, Greece.
- 1.6.2021 - 31.8.22 Maternity leave
- 06/2021 - present **Max Planck Society Partner Group Leader** in association with the Hyman lab at the MPI for Molecular Cell Biology and Genetics, Dresden.
- 05/2019–09/2020 **Postdoctoral Scholar**, MPI for Molecular Cell Biology and Genetics and **visiting scientist**, MPI for the Physics of Complex Systems, Dresden. Advisors: Anthony A. Hyman and Frank Jülicher. *“The role of sequence in biomolecular phase separation”*.
- 07/2018–05/2019 **Affiliate Scientist**, Mechanical Engineering, University of California, Santa Barbara, CA.
- 07/2016–06/2018 **Otis Williams Postdoctoral Scholar in Bioengineering**, Dept. of Mechanical Engineering and Materials Research Laboratory (MRL), University of California, Santa Barbara, CA. Independent project on *“Novel biocompatible but non-biodegradable medical adhesives”*. Starting point: coacervation of peptide-mimetic polyelectrolytes.
- 05/2014–06/2018 **Postdoctoral Scholar**, Materials Research Laboratory (MRL), University of California, Santa Barbara, CA. *Structure and mechanics of adhesive, byssal mussel plaques, design of supra-molecular tough mussel-inspired elastomers* Advisor: Prof. Megan T. Valentine
- 06–08/2010 **Intern at Unilever’s R&D** Department of Food Structural Design, Vlaardingen, Netherlands. Investigated water-in-oil emulsions for food structuring and synthesized oil core - zein shell particles for food and cosmetic applications with Dr. Ashok Patel under the supervision of Dr. Krassimir Velikov.
- 03/2007 Attended the 4-week HERCULES theoretical and experimental course on **Synchrotron Radiation for Condensed Matter Studies** at ESRF and Soleil synchrotrons and ILL neutron source, France.
- 07–08/2006 **Visiting student** Max Planck Institute for Dynamics and Self-Organisation, Göttingen, Germany. Collagen I assembly via hydrodynamic focusing and in situ, real-time X-ray investigation of collagen packing. Advisor: Prof. Thomas Pfohl.
- 06-08/2005 **Visiting student**, Polymer Group, Foundation for Research and Technology Hellas (FORTH), Heraklio, Greece. Determined the size-dependence of particle Brownian diffusion close to a polymer brush by evanescent wave dynamic light scattering.
- 06/2003-05/2004 **Undergraduate researcher**, Harvard Research Experience for Undergraduates (REU), Cambridge, MA. Study of the rheological behavior of collagen I gels and the mechanical properties of expanding glioblastoma tumors in collagen I gels. Supervisors: Clifford Brangwynne, Vernita Gordon and Laura Kaufman, under the supervision of Prof. David A. Weitz.

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| 06/2004          | Attended the <b>Computing Beyond Silicon Summer School</b> , California Institute of Technology, Pasadena, CA. Month-long program consisting of lectures on DNA, molecular, quantum and nanoscale computing. Team project of our choice on “Stereovision and Synchronization of Spiking Neurons”. |
| 03/2004, 07/2001 | <b>Shadowed</b> breast cancer removal (Atlanta, GA) and vascular <b>surgeries</b> (Athens, Greece) as part of career exploration programs.  |

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## INVITED PRESENTATIONS

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- 10 “Networks with covalent and metal-coordination cross-links.” **Summer School on ‘Double Dynamics for design of new responsive polymer networks and gels’**, DodyNet Initial Training Network, Capri, July 2019
- 9 “From mussel adhesion to novel materials: toughening elastomers with mussel-inspired metal coordination complexes.” **Institute of Nanoscience and Nanotechnology of NCSR ‘Demokritos’**, Athens, February 2019
- 8 “From mussel adhesion to novel materials: toughening elastomers with mussel-inspired metal coordination complexes.” **National Hellenic Research Foundation**, Athens, November 2018
- 7 “From mussel adhesion to novel materials: toughening elastomers with mussel-inspired metal coordination complexes.” **Department of Materials Science and Technology**, University of Crete, Heraklio, October 2018
- 6 “Toughening elastomers using covalent and mussel-inspired metal coordination complexes.” **Polymat seminar**, University of the Basque Country, Donostia-San Sebastián, April 2018
- 5 “Controlling toughness and dynamics of polymer networks via mussel-inspired dynamical bonds.” **APS March Meeting**, New Orleans, March 2017
- 4 “From mussels to mussel-inspired materials.” **Soft Matter Symposium**, Univ. of Florida, Gainesville, Oct 2016
- 3 “Random Organization : from reversibility to irreversibility in non-Brownian sheared suspensions.” Workshop on flow of granular materials, **Centro Argentino-Frances de Ciencias de la Ingenieria (CAFCI)**, Buenos Aires, September 2016
- 2 “Random Organization : from reversibility to irreversibility in non-Brownian sheared suspensions.” **Physics Department, Harvard University**, Cambridge, MA, May 2016
- 1 “Critical phenomena in periodically-sheared suspensions.” **Chaos, Complexity and Transport Conference**, Marseille, France, May 2011

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## CONTRIBUTED CONFERENCE PRESENTATIONS

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- 23 **Filippidi E.**, Jülicher F., Hyman A.A., “*Experimental determination of binodal compositions of protein and peptide solutions*” (talk) APS March Meeting, Denver, CO, March 2020 (online session due to COVID-19 cancellation)
- 22 **Filippidi E.**, Palles D., Cristiani T.R., Eisenbach C.D., Kamitsos E.I. “*Tough polymer networks with covalent and catechol-iron coordination bonds: correlation of binding stoichiometry with mechanical performance*” (poster) European Polymer Congress EPF, Hersonissos, Greece, June 2019
- 21 **Filippidi E.**, Patterson A., Danielsen S., Eisenbach C., Fredrickson G., Segalman R., Valentine M.T. “*Effect of Charge Density and Topology on Polyelectrolyte Complex Coacervation*” (talk) APS March Meeting, Los Angeles, CA, March 2018
- 20 Bartz C.G., DeMartini D., Waite J.H., **Filippidi E.**, Valentine M.T. “*Effects of physical parameters on structural maturation of marine mussel adhesive plaques*” (poster) APS March Meeting, Los Angeles, CA, March 2018
- 19 **Filippidi E.**, DeMartini D.G., Bartz G.C., Valentine M.T., Waite J.H., “*Effect of seawater pH and composition on the structural maturation of marine mussel adhesive plaques.*” (talk) 6<sup>th</sup> World Congress and 41<sup>st</sup> Annual Meeting of the Adhesion Society, San Diego, CA, February 2018
- 18 **Filippidi E.**, Patterson A.L., Davidson E.C., Wonderly W.R., Waite J.H., Segalman R.A., Valentine M.T. “*The effect of charge density on peptoid coacervation.*” (poster) 10<sup>th</sup> Peptoid Summit, Lawrence Berkeley National Laboratory, July 2017
- 17 **Filippidi E.**, Cristiani T., Eisenbach C., Ahn B.K., Waite J.H., Israelachvili J.N., Valentine M.T. “*Toughening elastomers using mussel-inspired catechol-metal coordination complexes.*” APS March Meeting (talk) and US-Brazil Young Physicists Forum (poster). Baltimore, MD, March 2016

- 16 **Filippidi E.**, DeMartini D.G., Malo de Molina P., Danner E.W, Kim J., Helgeson M.E., Waite J.H. and Valentine M.T., “*The mussel attachment plaque: a load-bearing protein scaffold.*” (talk) Biophysical Society Annual Meeting, Los Angeles, CA, February 2016
- 15 **Filippidi**, DeMartini D.G., Waite J. H., Valentine M.T. “*The adhesive mussel plaque as a force distribution mechanism.*” (poster) Materials Research Outreach Program Symposium, MRL, UC Santa Barbara, February 2016
- 14 **Filippidi E.**, DeMartini D., Malo de Molina P., Danner E.W, Kim J., Helgeson M.E., Waite J.H. and Valentine M.T., “*Mussels: an inspiration for underwater glue. The microscopic structure of adhesive plaques.*” Gordon Research Seminar (talk) and Gordon Research Conference (poster) on Science of Adhesion, Mount Holyoke College, South Hadley, MA, July 2015
- 13 **Filippidi E.**, DeMartini D., Malo de Molina P., Ewert K., Danner E.W, Kim J., Eisenbach C., Helgeson M.E., Waite J.H., Valentine M.T., “*Novel view: the adhesive mussel plaque as a porous material.*” NSF MRSEC site visit to UC Santa Barbara, May 2015
- 12 **Filippidi E.**, DeMartini D., Danner E.W, Kim J., Helgeson M.E., Waite J.H. and Valentine M.T., “*Network structure of the mussel plaque and its significance for load bearing and adhesion.*”, APS March Meeting, San Antonio, TX, March 2015
- 11 **Filippidi**, DeMartini D.G., Danner E.W., Kim J., Helgeson M.E., Waite J. H., Valentine M.T., “*A novel view of the porous structure and mechanics of adhesive mussel plaques.*” (poster) Materials Research Outreach Program Symposium, MRL, UC Santa Barbara, February 2015
- 10 **Filippidi E.**, Lerner E., Chaikin P.M., Pine D.J., “*Random Organization of Suspensions: Geometry versus Hydrodynamics.*” APS March Meeting, Denver, CO, March 2014
- 9 **Filippidi E.**, Pine D.J., “*Criticality of non-colloidal suspensions under periodic shear.*” APS March Meeting, Baltimore, MD, March 2013
- 8 **Filippidi E.**, Pine D.J., “*Application of the generalized fluctuation-dissipation theorem on a sheared suspension.*” APS March Meeting, Boston, MA, February 2012
- 7 **Filippidi E.**, Franceschini A., Chaikin P.M. and Pine D.J., “*Critical phenomena in sheared suspensions.*” (poster) at Gordon Research Seminar and Gordon Conference on Soft Matter Far from Equilibrium, Colby-Sawyer College, New London, NH, August 2011
- 6 **Filippidi E.**, Franceschini A. Chaikin P.M. and Pine D.J., “*Particle and fluid diffusivity of non-colloidal suspensions.*” APS March Meeting, Dallas, TX, March 2011
- 5 **Filippidi E.**, Ramos L., Chaikin P., Pine D., “*Critical Phenomena in Periodically-Sheared Suspensions.*” APS March Meeting, Portland, OR, March 2010
- 4 **Filippidi E.**, Pine D., Chaikin P., “*Self-organised criticality in sheared suspensions.*” (poster), at the Conference on Flowing Complex Fluids: Rheological measurements and constitutive modeling at the Institute of Mathematics and its Applications, University of Minnesota, September 2009
- 3 **Filippidi E.**, Corte L., Chaikin P., Ramos L., Pine D., “*Self-organised Criticality in Periodically-Sheared Sedimenting Suspensions.*” APS March Meeting, Pittsburgh, PA, March 2009
- 2 **Filippidi E.**, Corte L., Chaikin P., Ramos L., Pine D., “*Self-organised Criticality in Periodically-Sheared Sedimenting Suspensions.*” 3rd I2CAM/FAPERJ School on Condensed Soft Matter Physics, Rio de Janeiro, Brazil, May 2009
- 1 Kinahan M.E., **Filippidi E.**, Köster S., Evans H., Pfohl T., Kaplan D. and Wong J.Y., “*A Novel Microfluidic Method to Fabricate Regenerated Bombyx Mori Silk Fibers for Tissue Engineering Applications.*” Materials Research Society Fall Meeting 2008

## GRANTS, AWARDS AND FELLOWSHIPS

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| 06/2021 - present | Max Planck Society Partner Group Leader in association with the Hyman lab at the MPI for Molecular Cell Biology and Genetics, Dresden.   |
| 06/2020           | Proposal “Polymer networks with improved mechanical properties” by Ministry of Development, hosted at FORTH with Prof. D. Vlassopoulos and Dr. S. Alexandris. (€47,000 for 15 months)                                    |
| 09/2019           | European Soft Matter Infrastructure (EUSMI) proposal “Ageing and slow dynamics of bulk biomolecular condensates” for feasibility study of ageing via multi-speckle dynamic light scattering at FORTH, Crete (E190800325) |

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| 06/2019         | Springer Poster Award, European Polymer Congress for “ <i>Tough polymer networks with covalent and catechol-iron coordination bonds: correlation of binding stoichiometry with mechanical performance</i> ” by Filippidi E., Palles D., Cristiani T.R., Eisenbach C.D., Kamitsos E.I. |
| 07/2016-07/2018 | Otis Williams Postdoctoral Fellowship in Bioengineering for supporting the project “Novel Biocompatible but Non-Biodegradable Medical Adhesives” (\$150,000)  |
| 05/2016         | Doctoral Thesis Award of the Circle of Hellenic Academics in Boston (\$1000)  |
| 03/2016         | Dow Materials institute & MRL Travel Fellowship to attend the APS March Meeting   |
| 2009–2012       | Alexander S. Onassis Foundation fellowship for four years of graduate studies   |
| 2007            | Eleni Gatzoyiannis Scholarship, Boston University   |
| 2005            | MRSEC REU conference presentation award, REU conference at Univ. Southern Mississippi   |
| 2003–2004       | Harvard College Research Grant and Radcliffe externship for career exploration  |
| 2005            | Certificate of Recognition, Harvard Foundation for Intercultural and Race Relations   |
| 2002            | Parents’ Award to recent alumni, Athens College   |

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## SERVICE

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| 2016–present    | <b>Referee</b> for <i>Nature Communications</i> , <i>Macromolecules</i> , <i>Soft Matter</i> , <i>ACS Applied Materials &amp; Interfaces</i> , <i>ACS Chemistry of Materials</i> , <i>RSC’s Polymer Chemistry</i> , <i>Journal of Rheology</i> , <i>Polymers</i> and <i>Marine Drugs</i> . |
| 07/2015         | <b>Discussion leader</b> for the Gordon Research Seminar on the Science of Adhesion, Mount Holyoke College, South Hadley, MA.  |
| 2006, 2010–2012 | Elected board member at the <b>Hellenic Bioscientific Association of the USA</b>   |
| 2002–2004       | Treasurer and then <b>President of the Harvard Hellenic Society</b>  |

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## TEACHING

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| Fall 2021       | <b>Co-taught</b> “Introduction to Materials Science” (year 1) and “Soft Matter Lab” (year 3)  |
| Spring 2021     | <b>Taught</b> “Transport Phenomena (Heat, Mass, Momentum) (year 3)  |
| 2008–2009       | <b>Instructor of Record</b> , New York University. Duties included teaching the laboratory class, error analysis; lab report and problem set grading; assignment of final grades                  |
| Fall            | Physics III laboratory (Electricity-Magnetism-Optics), 2 credits  |
| Spring          | Physics II laboratory (Mechanics), 2 credits  |
| Fall 2007       | <b>Teaching Fellow</b> , General Physics I (Mechanics). New York University.  |
| Fall 2006       | <b>Teaching Fellow</b> , Introduction to Fluid Mechanics. Boston University.  |
| 09/2002–06/2005 | <b>On-Call Peer Tutor</b> , Bureau of Study Counsel, Harvard University. Tutoring undergraduates in mathematics and physics: linear algebra, differential equations, complex analysis, mechanics. |

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## MENTORING

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| 09/2021–present | UoCrete undergraduate Ioannis Sampson on “Quantifying mussel plaque porosity”  |
| 01/2021–present | UoCrete undergraduate Athina Karasavvidi on “ <i>In vivo</i> stress granule formation in HeLa cells”   |
| 05/2018–present | UCSB undergraduate student Justin Bernstein funded by the Summer Undergraduate Research Fellowship (SURF). Justin’s manuscript has been published in <i>Soft Matter</i> .  |
| 06/2016–05/2018 | Mentored undergraduate student Chandler Bartz, funded by the UCSB Research Internships in Science and Engineering (RISE) program. Both Justin and Chandler work(ed) on the determination of <i>M. californianus</i> ’ mussel plaque formation and structural maturation via electron microscopy. |
| 05/2015–05/2016 | Mentored undergraduate student Grant Antalek, funded by the UCSB RISE program. Building an automated system for imaging plaque formation using Arduino/Raspberry Pi. Currently, works as a chemist at LeChat Nails, CA.  |
| 09/2014–05/2015 | Mentored undergraduate student Noah Rubin, funded by the UCSB RISE program. Decoupling mechanical properties of the mussel plaque from those of the thread. Noah is currently a PhD Student at the Joint Biomedical Engineering program at UNC/NC State.   |

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06-08/2008 | Mentored UMass Amherst student Sean Paradiso during the summer REU at NYU. Sean went on to receive his PhD in Chemical Engineering from UCSB /Fredrickson group, working on polymer simulations. Currently works at Citrine, CA.

## OUTREACH

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11/2017 | **Panelist** at the UCSB SACNAS-sponsored panel discussion “Surviving grad school”.

2015–2018 | Participate as a **regular respondent** in the UCSB, MRL-organized **ScienceLine**, where 4<sup>th</sup> to 12<sup>th</sup> grade students and their teachers ask science questions weekly. Graduate students and post-doc volunteers provide level-appropriate answers. <http://www.scienceline.ucsb.edu>

04/2015 | **Led interactive demonstrations** of electron microscopy for school-children during **Nano-Days 2015**. We shared the joy of SEM imaging by exploring natural specimens such as beetles and butterflies on a portable SEM. Event organized by the UCSB NSF-supported Nanoscale Informal Science Education and hosted by the Santa Barbara Museum of Natural History.

12/2014, 01/2015 | **Led hands-on activities for elementary school students** with UCSB’s MRL “**Solar Car**” workshop and “**It’s a material world**” teams during local elementary school Science

08/2015, 04/2017 | teams during local elementary school Science Nights. Guided students and parents

10/2017, 7/2018 | of diverse backgrounds through building solar cars, demonstrations of hydrophobic lotus leaves artificial snow, ferro fluids, memory wire, thermochromic materials.

06/2013 | **Instructor**, “Squishy Physics: Soft Matter in the House”. Summer course for high school students organized by the Hellenic-American Educational Foundation in Athens, Greece

## PROFESSIONAL AFFILIATIONS

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2009–2020 | American Physical Society

2015–2018 | Biophysical society

2017–2018 | Adhesion Society

## IN POPULAR MEDIA

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05/2020 | Interview with the Federal German Ministry for Education and Research for the brochure “Research careers in Germany”

11/2017 | **C&EN News** “Mussels’ iron grip inspires strong and stretchy polymer,” <https://cen.acs.org/articles/95/i44/Mussels-iron-grip-inspires-strong-stretchy-polymer.html>

10/2017 | “Designing tougher elastomers with ionomers,” **Brief Perspective** on Materials Science by Karen Winey, *Science*, 358 (6362), 449-450, doi: 10.1126/science.aap8114

10/2017 | “Material inspired by ocean mussels could lead to self-healing plastics,” **News Piece** by Robert Service, *Science*, doi:10.1126/science.aar3333

10/2017 | “Learning from mussels: A marine bivalve inspires researchers to make stronger polymers,” **Phys.org news**, <https://phys.org/news/2017-10-mussels-marine-bivalve-stronger-polymers.html>

08/2017 | “A tougher tooth: A new dental restoration composite developed by UCSB scientists proves more durable than the conventional material,” The **UCSB Current** newspaper <http://www.news.ucsb.edu/2017/018209/tougher-tooth>

08/2017 | “A tougher tooth: A new dental restoration composite proves more durable than the conventional material,” **ScienceDaily** <https://www.sciencedaily.com/releases/2017/08/170821154616.htm>

09/2016 | “And the winner is . . .,” The **UCSB Current**, article about the Otis-Williams Fellowship award, <http://www.news.ucsb.edu/2016/017126/and-winner?>

02/2016 | Image submission voted at the **Top 10** at the Biophysical Society Art of Science Image Contest and exhibited throughout the Annual Meeting, Los Angeles, CA

02/2016 | **Art of Science Popular Vote winner**. The competition is open to UCSB students and post-docs and is organized by the Schuller Lab, the California Nanosystems Institute (CNSI), the UCSB Library and the AD&D Museum

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03/2015 | “How Do Mussels Stick to Wet Rocks?”, **APS Physics Central Blog**  
<http://physicsbuzz.physicscentral.com/2015/03/how-do-mussels-stick-to-wet-rocks.html>  
03/2015 | “The application of physics,” **BBC’s Science in Action** podcast and radio interview

## SKILLS

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### Experimental Methods

rheology                      microfluidics                      scanning electron microscopy (SEM)    specimen sectioning techniques  
light scattering              X-ray scattering                      neutron scattering  
NMR spectroscopy              isothermal titration and differential scanning calorimetry (ITC and DSC)  
tensile testing              metal & plastic machining    laser cutting                      cell culture  
protein purification                      chromatography                      quartz crystal microbalance

### Marine Science relevant

Mussel Mariculture                      SCUBA Open Water certification, Level I    Night Diving  
Sailing (Optimist, Europe, J/22, J/24)

### Computer Programming

Matlab    Fortran    Java    AutoCad    HTML

### Languages

Greek (native)    English (fluent)    Spanish (conversational)    Portuguese (conversational)    French (DELF A)