Diogo Estevão Pereira Pinto

Education

2012-2015 **BSc in Physics - Faculty of Sciences, University of Lisbon**

2015-2017 **MSc in Physics - Faculty of Sciences, University of Lisbon**
Thesis supervisors: Dr. Nuno Araújo and Prof. Margarida Telo da Gama.
Thesis title: *"Adsorption of colloidal particles on mobile rafts"*.

2017-Present **PhD in Physics - Faculty of Sciences, University of Lisbon**
Supervisors: Dr. Nuno Araújo and Prof. Margarida Telo da Gama.

Research

Jul-Sept 2015 **ERASMUS+ summer internship**
Under the supervision of Prof. Eduardo Garcia.
Internship developed at the Astroparticles and Nuclear Physics Group, University of Zaragosa, Spain.
Research subject: *"Dark Matter Searches in Underground Laboratories"*.

2015-2016 **Internship**
Under the supervision of Dr. Nuno Araújo.
Internship developed at the Center for Theoretical and Computational Physics, Faculty of Sciences, University of Lisbon, Portugal.
Research subject:*"Computer simulations of colloids self-organization: from nonequilibrium to relaxation towards equilibrium"*. With financial support from the Portuguese Foundation for Science and Technology (FCT) under Contract no. IF/00255/2013.

2016-2017 **MSc student**
Under the supervision of Dr. Nuno Araújo and Prof. Margarida Telo da Gama.
MSc student at the Center for Theoretical and Computational Physics, Faculty of Sciences, University of Lisbon, Portugal.

2017-2021 **PhD student**
Under the supervision of Dr. Nuno Araújo and Prof. Margarida Telo da Gama.
PhD student at the Center for Theoretical and Computational Physics, Faculty of Sciences, University of Lisbon, Portugal.
With financial support from the Portuguese Foundation for Science and Technology (FCT) under the individual fellowship no. SFRH/BD/131158/2017.

Aug-Dec 2018 **Internship**
Under the supervision of Prof. M. Lisa Manning.
Internship in the group of Lisa Manning, University of Syracuse, USA.

Publications

1. *"Kinetic control of the coverage of oil droplets by DNA-functionalised colloids"*, Darshana Joshi, Dylan Bargtail, Alessio Caciagli, Jerome Burelbach, Zhongyang Xing, André S. Nunes, **Diogo E. P. Pinto**, Nuno A. M. Araújo, Jasna Bruijc, and Erika Eiser, Sci. Adv. **2**, e1600881 (2016).

Major findings: We showed how to control the surface coverage of oil droplets using DNA-functionalized colloidal particles by exploiting the fact that, during slow adsorption, compositional arrest takes place well before structural arrest occurs. As a consequence, it is possible to prepare colloid-coated oil droplets with a "frozen" degree of loading but with fully ergodic colloidal dynamics on the droplets.

My contribution: I focused on the theoretical study of the adsorption of the colloidal particles on the oil droplets. To properly follow the dynamics, I used a simple stochastic model and implemented a kinetic Monte Carlo algorithm. We were able to identify the relevant competing timescales that control the coverage of the droplets and help understanding the experimental observations.

2. *"Random sequential adsorption on mobile patches"*, **Diogo E. P. Pinto** and Nuno A. M. Araújo, Phys. Rev. E **98**, 012125 (2018).

Major findings: An extension of the random sequential adsorption model was investigated where particles irreversibly adsorb on small patches that are diffusing on a substrate. We showed how the jammed-state coverage scales with the competing timescales of adsorption flux and patch diffusion. We supported this finding using a mean-field model. We also characterize the jammed-state morphology and report two different regimes for the functional dependence of the jammed-state coverage on the size of the particles, for low and high density of patches.
My contribution: I performed the simulation studies and developed the mean-field model. I was also involved in the writing of the paper.

3. *"The Cell Adaptation Time Sets a Minimum Length Scale for Patterned Substrates"*, **Diogo E. P. Pinto**, Gonca Erdemci-Tandogan, M. Lisa Manning and Nuno A. M. Araújo, Byophys. J. **119**, 2299 (2020).

Major findings: We showed that the fidelity of patterns to demix tissue cells depends on the relation between the diffusion (τ_D) and adaptation (τ) times. Numerical results using the Self-Propelled Voronoi model reveal that the fidelity decreases with τ/τ_D, a result that is reproduced by a continuum reaction-diffusion model. Using recent experimental results for single cells, we derived a minimal length scale for the patterns in the substrate.
My contribution: I performed the simulation studies and developed the continuum reaction-diffusion model. I was also involved in the writing of the paper.

Seminars

May 2017 — **Physics department seminar**
Faculty of Sciences, University of Lisbon, Portugal.
"Adsorption of colloidal particles on mobile rafts".

November 2018 — **Soft Matter group seminar**
University of Syracuse, USA.
"Physics@CFTC: Assembling colloidal crystals on oil droplets".

Oral communications

January 2017 — **Flowing Matter 2017**
Porto, Portugal.
"Kinetic of the adsorption of DNA-coated colloidal particles on mobile rafts".

July 2017 — **Ciência 2017**
Lisbon, Portugal.
"Kinetics of the adsorption of DNA-coated colloidal particles on mobile patches".

January 2018 — **Flowing Matter 2018**
Lisbon, Portugal.
"Kinetics of the adsorption of DNA-coated colloidal particles on mobile patches".

June 2018 — **13º Encontro Nacional de Química-Física e 2º Simpósio de Química Computacional**
Faro, Portugal.
"Kinetics of the adsorption of DNA-coated colloidal particles on mobile patches".

August 2020 — **CMD2020GEFES**
Madrid, Spain (Online).
"The cell response time sets a minimum length scale for epithelial tissues on patterned substrates". Joint conference of the Condensed Matter Divisions of the European Physical Society and the Spanish Royal Physics Society.

Posters

December 2017 **Dynamics of self-organization: from colloids to biomaterials Workshop**
Barcelona, Spain.
"Adsorption of DNA-coated colloidal particles on mobile patches".
Co-authors: Margarida M. Telo da Gama and Nuno A. M. Araújo.

May 2019 2^{nd} **Portuguese Condensed Matter Physics Meeting**
Porto, Portugal.
"Dynamics of epithelial tissues on patterned substrates".
Co-authors: Gonca Erdemci-Tandogan, M. Lisa Manning and Nuno A. M. Araújo.

July 2021 11^{th} **Liquid Matter Conference**
Prague, Czech Republic (Online).
"The cell response time sets a minimum length scale for epithelial tissues on patterned substrates".
Co-authors: Gonca Erdemci-Tandogan, M. Lisa Manning and Nuno A. M. Araújo.

Teaching experience

- **Teaching assistant at the Faculty of Sciences, University of Lisbon, Portugal**

  During my MSc and PhD, I was a teaching assistant in one class per semester. This opportunity helped me develop my communication skills not only with students but also to larger audiences. Furthermore, it also improved my planning and organization skills, not only from working with other professors but also from preparing the different classes.

  Fall 2016: Experimental Physics II (laboratory), Optics and Electromagnetism (laboratory)
  Spring 2017: Physics for Computer Science (exercises)
  Fall 2017: Numerical Methods (exercises)
  Spring 2018: Electromagnetism (exercises)
  Spring 2019: Electromagnetism (exercises)
  Fall 2019: Numerical Methods (exercises)
  Fall 2020: Numerical Methods (exercises)

Computational skills

- **Programming languages**

  C/C++: Have developed codes from scratch and also contributed to other *github* repositories. Have used for teaching.
  Python: Have developed codes from scratch. Have used for teaching.
  MATLAB: Have written simple data processing codes.

- **Contributions**

  cellGPU: Major contribution done to the CellGPU code, designed to perform GPU-accelerated simulations of Voronoi and vertex models of cells (https://doi.org/10.1016/j.cpc.2017.06.001). I implemented a GPU and multi-core Delaunay triangulation algorithm. This allowed for more than two order of magnitude speed-up when compared to the previous single core implementation and is in some cases better than the state-of-the-art GPU Delaunay triangulation implementations.

Additional Information

- **Referee**

  Physical Review E, International Journal of Modern Physics C.