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## **This is life: some thoughts on self-organized structure formation in active liquids and biological systems**

Hoffmann, L.A.

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# List of Publications

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- \* A. Chardac, L. A. Hoffmann, Y. Poupart, L. Giomi, and D. Bartolo. *Topology-Driven Ordering of Flocking Matter*. Phys. Rev. X **11**, 031069 (2021).  
Chapter 2
- \* L. A. Hoffmann, K. Schakenraad, R. M. H. Merks, and L. Giomi. *Chiral stresses in nematic cell monolayers*. Soft Matter **16**, 764 (2020).  
Chapter 3
- \* L. A. Hoffmann and L. Giomi. *Transition to Homochirality in Vicsek Model*. In preparation.  
Chapter 4
- \* L. A. Hoffmann, L. N. Carenza, J. Eckert, and L. Giomi. *Theory of defect-mediated morphogenesis*. Sci. Adv. **8**, eabk2712 (2022).  
Chapter 5
- \* L. A. Hoffmann, L. N. Carenza, and L. Giomi. *Tuneable defect-curvature coupling and topological transitions in active shells*. Soft Matter **19**, 3423 (2023).  
Chapter 6
- \* S. Riedel, L. A. Hoffmann, and D. Kraft. *Activity-induced cluster formation of colloids with continuously tuneable shape*. In preparation.
- \* J. Rojo González, L. N. Carenza, A. de la Cotte, L. A. Hoffmann, L. Giomi, and A. Fernandez-Nieves. *Defect-populated configurations in nematic solid-tori*. In preparation.



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# Acknowledgements

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Despite only one name appearing on the cover of a thesis, it is always a collective effort. Created by a network, only some names appear explicitly.

Thank you Luca for giving me the opportunity to pursue a PhD in your group in Leiden. When I started, I knew from the very beginning that switching from general relativity to soft matter, and moving to Leiden, was the right call, and I never regretted my decision. Working with you over the last four years has been a pleasure. I am grateful for your guidance and all the things you have taught me.

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I had the pleasure to collaborate with a few others during my time in Leiden. Amélie and Denis, despite the difficult circumstances, it was interesting to solve the mystery of how to explain these beautiful structures you saw. It definitely made the initial part of the pandemic more bearable. To Denis a special thanks for the encouragement, and the reference letter that got me a job. Even though I was not there on this day, I am very happy you decided to complain about your buckling cell sheets, Julia. Your experiments certainly enriched the project a lot. Apart from this I am very happy for all the coffee breaks, where we could complain about all the annoying academia things. Similarly randomly, I found your poster, Solenn, about bananas. At first glance it looked quite interesting, and the interest never faded. Trying to figure out how bananas cluster has been a lot of fun, and, I believe, a nice example of what scientific research should look like. I am happy that you and Daniela trusted me with developing the theory for your project. Lastly, Alberto, despite spending much time staring at them, I am still not quite sure I understand the Schlieren textures. But I am happy I worked on this interesting project, and your curiosity and enthusiasm are both infectious and admirable.

Wim, your approach to teaching, and the freedom you gave me, made TAing feel much more like a pleasure than the burden it could easily have been. I learned a lot from you and the course. I also want to thank Fran, Leonardo, and the supporting staff in general, I appreciate your help during the last years, and I hope I was not too annoying.

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# Curriculum Vitæ

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I was born in Delaware County, PA, USA in 1995, but grew up in Germany. In 2013 I finished high school and decided to give studying physics a try. I graduated with a Bachelor of Science in physics from Leipzig University in 2016. My bachelor thesis, written in the group of K. Kroy, was concerned with shear-induced nematic order in polymer networks. I would return to very similar topics during my PhD. However, during the master I first veered towards more abstract topics. My master thesis investigated the question if general relativity is well defined in higher dimensions. Specifically, I proved, under the supervision of S. Hollands, the positive mass theorem in dimensions  $d > 5$ . After submitting the thesis, I graduated in 2019 from Leipzig University. During this time I was also a teaching assistant for an introductory mathematics course for bachelor students of biology, biochemistry, and pharmaceuticals. While the mathematical aspects of general relativity were rather appealing, the abstract physical applications grew to be less attractive to me. I therefore tried to find a field of research that combined differential geometry with more applied and experimentally accessible applications. While wrapping up my master thesis I became aware of some research investigating different geometric aspects in soft matter. This caught my attention and, with a lot of luck, I discovered that the group of L. Giomi was working on these topics, and had an open PhD position. During my PhD I then worked on several aspects of geometry applied to soft matter, as well as on some projects on active matter in flat space. During this time I had the pleasure to collaborate with the experimental groups of D. Bartolo (Lyon), A. Fernandez-Nieves (Barcelona), and D. Kraft (Leiden). I attended various schools, including the Arnold-Sommerfeld School (Munich, Germany, 2019) and the IOP Advanced School of Soft Condensed Matter (Cambridge, UK, 2019), as well as workshops and conferences. I presented my work, for example, at the spring meetings of the APS (2021, 2022, 2023) and DPG (2021, 2023), and at the International Liquid Crystal Conference (Lisbon, Portugal, 2022). I was a teaching assistant for the courses Soft and Biomatter Theory (2019-2022) and Physics of Life (2022/23).

On the non-scientific side I was, from 2021 to 2023, a member of the PhD Council of the Leiden Institute of Physics (LION), a member of the Institute Council of LION, and the representative for Leiden University in the PhD Council of the Dutch Research School for Theoretical Physics.

In April 2023 I was awarded the Rubicon grant by the Dutch Research Council (NWO). I will join the group of L. Mahadevan at Harvard University in September 2023 as a postdoctoral fellow for two years.