

# Guilhem Poy

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## Current Research

I am a Marie Skłodowska Curie Research Fellow working with Slobodan Žumer in the Soft Matter team of the Faculty of Physics and Mathematics at the University of Ljubljana. We want to develop a new research direction by combining knowledge from photonics and topological soft matter to find novel ways of guiding light using chiral birefringent media. The non-linear optical response of these media allows a laser beam to be self-confined and to propagate over long distances, leading to what is called spatial optical solitons. Our primary objective is to develop a complete model of optical solitons in chiral birefringent media and examine how these light solitons can be steered and controlled using topological solitons — localized and tunable perturbations of the molecular orientational field which cannot be continuously deformed into the uniform state. Our methodology is based on the theoretical and numerical modeling of the non-linear equations for the propagation of light in chiral birefringent media, combined with collaborative experiments.

## Professional experience

- 04/2019 – **Marie Skłodowska-Curie individual fellowship**, *Faculty of Mathematics and Physics, University of Ljubljana*.  
03/2021 *Interacting optical and topological solitons in frustrated cholesterics*
- 01/2018 – **Postdoc in Physics**, *Faculty of Mathematics and Physics, University of Ljubljana*.  
03/2019 *Light deviation effect in cholesteric and nematic droplets*.
- 09/2014 – **PhD in Physics**, *Laboratoire de Physique ENS de Lyon*.  
12/2017 *Lehmann rotation of cholesteric and achiral nematic droplets driven by heat flux*.
- 04/2014 – **Research internship**, *Institute of Condensed Matter and Complex System, Edinburgh University, Scotland*.  
07/2014 *Shear thickening in dense suspensions*.
- 05/2013 – **Research internship**, *Centre de Recherche d'Astrophysique de Lyon, École Normale Supérieure de Lyon*.  
07/2013 *Numerical and analytical study of the stability of relativistic jets*.
- 06/2012 – **Research internship**, *Physics Lab ENS Lyon*.  
07/2012 *Measurement of the surface rotational viscosity of a nematic sample with planar sliding anchoring*.

## Education

- 2012 – 2014 **Master in Physics**, *École Normale Supérieure de Lyon (France)*.  
*Specialisation in out-of-equilibrium physics, Summa Cum Laude*.
- 2011 – 2012 **Bachelor in Physics**, *École Normale Supérieure de Lyon (France)*.  
*Summa Cum Laude*.
- 2009 – 2011 **Preparatory School for the grandes écoles**, *Lycée Aux Lazaristes (France)*.  
*Specialisation in Physics/Chemistry*.

2006 – 2009 **Baccalauréat**, *Lycée de Saint Bonnet de Gallaure (France)*.  
Science major, specialisation in Mathematics, Summa Cum Laude.

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## Skills

- **Programming:** C/C++, Perl, Python, Matlab, Mathematica, Latex.
- **Libraries:** Deal.II, TikZ, PGFPlots, Beamer.
- **Applications:** Blender, Inkscape, Labview, Office.
- **Supervised projects:** numerical project in python (40h), lab works (106h), internship (4 months).
- **Tutoring:** signal processing (16h), classical electromagnetism (4h), analytical mechanics (28h).

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## Interests

I played Ultimate Frisbee at university level (silver medal at the national academic championship in 2016) and federal level, and currently enjoy bouldering.

I enjoy listening music (classical, jazz, metal). I like to build things with microcontroller boards, such as Arduino and Raspberry Pi.

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## Conferences and seminars

- 2019 **Invited seminar at the LOMA**, Bordeaux, France.  
Chirality in soft matter: from out-of-equilibrium physics to non-linear optics.
- 2019 **Optics of Liquid Crystals (oral presentation)**, Quebec city, Canada.  
A new operator-splitted beam propagation method with application to non-linear optics in liquid crystals
- 2019 **European Conference on Liquid Crystals (oral presentation)**, Wrocław, Poland.  
Nemaktis: a numerical platform for light propagation in liquid crystals
- 2018 **Workshop on Liquid Crystals for Photonics (oral presentation)**, Jastrzębia Góra, Poland.  
Simulation of polarized optical micrographs including light-deviation effects in long pitch cholesteric structures.
- 2018 **International Liquid Crystal Conference (oral presentation)**, Kyoto, Japan.  
Improved ray-tracing for slowly varying birefringence:Simulation of polarized optical micrographs of nematic and cholesteric droplet.
- 2018 **Invited seminar at the UL FMF**, Ljubljana, Slovenia.  
On the pertinence of the thermomechanical model in the Lehmann rotation of cholesteric and nematic droplets.
- 2017 **PhD defense**, Lyon, France.  
Sur la pertinence du modèle thermomécanique dans la rotation Lehmann des gouttes cholestériques et nématiques.
- 2017 **Visit of the Gulliver laboratory at the ENS (seminar)**, Lyon, France.  
Thermomechanical coupling in an achiral liquid crystal.
- 2017 **Liquid Matter Conference (poster)**, Ljubljana, Slovenia.  
Texture of cholesteric droplets: finite element simulations and experiments.
- 2016 **International Liquid Crystal Conference (invited talk)**, Kent, Ohio.  
Lehmann effect: The end of the Leslie paradigm.
- 2016 **StatPhys (poster)**, Lyon, France.  
Heat-flux-driven rotation of nematic and cholesteric twisted bipolar droplets.
- 2015 **17ème Colloque sur les systèmes anisotropes auto-organisés (oral presentation)**, Autrans, France.  
Du nouveau sur l'effet Lehmann thermique dans des gouttes cholestériques.

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## Publications

- [1] P. Oswald, A. Dequidt, and G. Poy. Lehmann effect in nematic and cholesteric liquid crystals: a review. *Liquid Crystals Reviews*, 7(2):142–166, July 2019.
- [2] G. Poy and S. Žumer. Ray-based optical visualisation of complex birefringent structures including energy transport. *Soft Matter*, 15(18):3659–3670, May 2019.
- [3] P. Oswald and G. Poy. Role of impurities in the Lehmann effect of cholesteric liquid crystals: Towards an alternative model. *Physical Review E*, 98(3), Sept. 2018.
- [4] P. Oswald and G. Poy. Dislocations dynamics during the nonlinear creep of a homeotropic sample of smectic-A liquid crystal. *The European Physical Journal E*, 41(6), June 2018.
- [5] G. Poy and P. Oswald. On the existence of the thermomechanical terms of Akopyan and Zel’dovich in cholesteric liquid crystals. *Liquid Crystals*, pages 1–15, Mar. 2018.
- [6] G. Poy, F. Bunel, and P. Oswald. Role of anchoring energy on the texture of cholesteric droplets: Finite-element simulations and experiments. *Physical Review E*, 96(1):012705, July 2017.
- [7] P. Oswald, G. Poy, and F. Vittoz. Fredericksz transition under electric and rotating magnetic field: application to nematics with negative dielectric and magnetic anisotropies. *Liquid Crystals*, pages 1–8, Feb. 2017.
- [8] P. Oswald, G. Poy, and A. Dequidt. Lehmann rotation of twisted bipolar cholesteric droplets: role of Leslie, Akopyan and Zel’dovich thermomechanical coupling terms of nematodynamics. *Liquid Crystals*, pages 1–20, Nov. 2016.
- [9] M. Hermes, B. M. Guy, W. C. K. Poon, G. Poy, M. E. Cates, and M. Wyart. Unsteady flow and particle migration in dense, non-brownian suspensions. *Journal of Rheology*, 60(5):905–916, Sept. 2016.
- [10] A. Dequidt, G. Poy, and P. Oswald. Generalized drift velocity of a cholesteric texture in a temperature gradient. *Soft Matter*, 12(36):7529–7538, Aug. 2016.
- [11] J. Ignés-Mullol, G. Poy, and P. Oswald. Continuous rotation of achiral nematic liquid crystal droplets driven by heat flux. *Physical Review Letters*, 117(5):057801, July 2016.
- [12] G. Poy and P. Oswald. Do lehmann cholesteric droplets subjected to a temperature gradient rotate as rigid bodies? *Soft Matter*, 12(9):2604–2611, Jan. 2016.
- [13] P. Oswald and G. Poy. Droplet relaxation in hele-shaw geometry: Application to the measurement of the nematic-isotropic surface tension. *Physical Review E*, 92(6):062512, Dec. 2015.
- [14] P. Oswald and G. Poy. Lehmann rotation of cholesteric droplets: Role of the sample thickness and of the concentration of chiral molecules. *Physical Review E*, 91(3):032502, Mar. 2015.
- [15] P. Oswald, G. Poy, F. Vittoz, and V. Popa-Nita. Experimental relationship between surface and bulk rotational viscosities in nematic liquid crystals. *Liquid Crystals*, 40(6):734–744, June 2013.