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Geometric phases in soft materials

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PROPOSITIONS
accompanying the thesis
GEOMETRIC PHASES IN SOFT MATERIALS



1. Zeroth order acoustic Landau levels in a mechanical honeycomb lattice can be considered as special cases of domain-bound modes, and therefore, are sublattice polarized. [Chapter 2 of this thesis]
2. An inhomogeneity in the induced Pancharatnam-Berry phase of light modifies its refraction, and therefore can lead to effects similar to the ones that are caused by a spatially varying refractive index, such as a transverse confinement of light. [Chapter 3 of this thesis]
3. A photonic waveguide that is implemented through a director field patterning in a liquid crystal is a step towards making such waveguides by self-assembly. [Chapter 3 of this thesis]
4. For a high-frequency Floquet tight-binding Hamiltonian on a honeycomb lattice one needs the breaking of both the time-reversal and a point-group C_3 symmetries in order to be able to map it to the Haldane model. [Chapter 4 of this thesis]
5. A nontrivial Zak phase in the linearized regime of a nonlinear system can hint towards the quantization of a generalized Zak phase for the fully nonlinear theory. [Chapter 5 of this thesis]
6. Slussarenko et al. use a set of geometric phase liquid crystal lenses to realize a photonic waveguide. Coupling of such waveguide in these setups is a subject for further experimental investigations.

[S. Slussarenko et al., doi:10.1038/nphoton.2016.138]



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7. The empirical observations by Favier and Knobloch on rotating Rayleigh-Bénard convection systems are indicative of a nontrivial topological index associated with the nonlinear wall modes they observe in their numerical simulations. [B. Favier, and E. Knobloch, doi: 10.1017/jfm.2020.310]

 8. Tuloup and co-authors notice that nonlinearity can induce *effective domain-walls* in the bulk. The mechanism for breaking of the bulk-boundary correspondence in these nonlinear systems is yet to be explored and compared to other mechanisms which lead to such effects, such as in continuum models.
[T. Tuloup et al., doi: 10.1103/PhysRevB.102.115411]
[C. Tauber et al., doi: 10.1103/PhysRevResearch.2.013147]

 9. In their review of topological active matter, Shankar et al. sketch the robustness of topological states to biologically relevant perturbations as a theoretical challenge for future explorations. Understanding topological states for non-Hermitian and nonlinear models is an inevitable task for these investigations. [S. Shankar et al., arXiv:2010.00364]

 10. Following the sometimes detailed structural changes from the developed societies amounts probably more to a deviation from rather than to a path of small steps towards needed changes in some less developed societies.



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LEIDEN, 27 JANUARY 2021

