

Term-paper Topics

M. Stone, Feb 2021

Here is a short list of papers that you might find useful as inspiration for paper topics. If you can't find these papers online, I may have PDF copies.

- 1) E. Witten, *Supersymmetry and Morse Theory*, Journal of Differential Geometry **17** (1982) 661-692.
- 2) E. Witten, *Global aspects of Current Algebra*, Nucl. Phys. **B223** (1983) 422-432.
- 3) E. Witten, *Current algebra, baryons, and quark confinement* Nucl. Phys. **B 223** (1983) 433-444 (The famous Skyrmion paper).
- 4) N. D. Mermin, *The topological theory of defects in ordered media*. Rev. Mod. Phys. **51** (1979) 591. (An account of homotopy theory for physicists).
- 5) O. Alvarez, *Topological Quantization and Cohomology* Communications in Mathematical Physics, **100** (1985) 279-309. (A nice introduction to Čech cohomology that provides a proof of de Rham's theorem)
- 6) F. Wilczek, A. Zee, *Appearance of Gauge Structure in Simple Dynamical Systems*, Phys. Rev. Lett. **52** 2111-2114 (1984).
- 7) F. Wilczek, A. Zee, *Linking Numbers, Spin, and Statistics of Solitons*, Phys. Rev. Lett. **5** (1983), 2250-2252.
- 8) J. E. Avron, *et al.* *Topological invariants in Fermi Systems with Time-Reversal Invariance*. Phys. Rev. Lett. **61** (1988). 1329-1332. (A nice example of a non-abelian Berry Phase in spin systems)
- 9) R. Montgomery, *Gauge Theory of the Falling Cat*, in M.J. Enos, Dynamics and Control of Mechanical Systems, American Mathematical Society, pp. (1993) 193-218. (a link to this paper is provided in the Wikipedia entry on the Falling Cat Problem)
- 10) Xiao-Liang Qi, Taylor Hughes, Shou-Cheng Zhang, *Topological Field Theory of Time-Reversal Invariant Insulators*. arXiv:0802.3537. (Long, but full of ideas & well worth working through. Explore the cited references)
- 11) Di Xiao, Ming-Che Chang, Qian Niu, *Berry Phase Effects on Electronic Properties* Rev. Mod. Phys. **82** (2010) 1959-2007. (arXiv:0907.2021).
- 12) *Geometry of Self-propulsion at low Reynolds number*, Shapere, Wilczek, J. Fluid Mech **198** 557.
- 13) *The quantum hall fluid and non-commutative chern-simons theory*, Leonard Susskind, arXiv:hep-th/0101029

- 14) *Optical Caustics in Natural Phenomena*, Lock and Andrews, Am. J. Phys. **60** 397.
- 15) *Catastrophe optics*, Berry and Upstill,
http://www.phy.bristol.ac.uk/people/berry_mv/the_papers/BERRY089.pdf
- 16) *Topological Solitons in Magnetohydrodynamics*. A. M. Kamchatnov,
http://www.jetp.ac.ru/cgi-bin/dn/e_055_01_0069.pdf
- 17) *Linking numbers and nucleosomes*. Francis Crick
<https://www.pnas.org/content/pnas/73/8/2639.full.pdf>