Recent mathematical progress on Triply Periodic Minimal Surfaces, and how physics inspired them

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New Triply Periodic Minimal Surfaces (TPMSs) of genus 3 have been recently discovered. Some were explicitly constructed, others implicitly. I will review the mathematical techniques, in particular those involved in the existence proof of the deformations of the Gyroid. The new techniques will lead to even more new TPMSs of genus 3, which we are numerically aware of and determined to work on in the near future. Interestingly, all these mathematical results were heavily inspired by soft-matter physics. So I will also tell the stories of this interdisciplinary collaborations.

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[1] Chen, Hao. Exp. Math. 28 (2019), no. 4, 404–419.
[2] Chen, Hao; Traizet, Martin. SIAM J. Math. Anal. 53 (2021), no. 1, 855–887.
[3] Chen, Hao; Weber, Matthias. Trans. Amer. Math. Soc. 374 (2021), no. 3, 2057–2078.
[4] Chen, Hao; Weber, Matthias. Trans. Amer. Math. Soc. 374 (2021), no. 4, 2785–2803.
[5] Chen, Hao. Indiana Univ. Math. J. 70 (2021), no. 4, 1543–1576.
[6] Chen, Hao; Freese, Daniel. Proc. A. 478 (2022), no. 2267, Paper No. 20220431, 18 pp.