Flux-quantizing the self-dual tensor field on M5-branes

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Extended Abstract.

The self-dual tensor field on M5-branes plays a famous and pivotal role in modern string theory, and yet the discussion of its subtle nature has mostly been confined to its local properties that are visible on a single coordinate chart.

In fact, the proper characterization of its global topological/solitonic degrees of freedom is quite subtle, not just due to its infamous self-duality in the decoupling limit (and, worse, its less widely appreciated non-linear self-duality in general), but also due to the fact that its Bianchi identity is twisted by the 4-flux density on the supergravity background, which *itself* of course is subject to the subtly non-linear Gauss law of 11D supergravity.

In recent years we have developed tools from algebraic topology and geometric homotopy theory to handle flux quantization in the presence of such nested, twisted and non-linear Bianchi identities (reviewed in [SS24a]) and have applied these to the flux quantization of the self-dual tensor field on M5-brane probes [GSS24b] compatible with that of their 11D supergravity backgrounds [GSS24a].

Among the interesting results is the rigorous demonstration [SS24b] of anyonic Chern-Simons quantum observables on M5 ⊥ MO9 intersections, confirming an old argument by [Susskind01] about embedding *topological* qbits into string/M-theory, a key issue in the holographic description of quantum materials.

References

[SS24a] H. Sati and U. Schreiber, *Flux quantization*, Encyclopedia of Mathematical Physics **4** (2025) 281-324 [doi:10.1016/B978-0-323-95703-8.00078-1] [arXiv:2402.18473]

[SS24b] H. Sati and U. Schreiber, *Abelian Anyons on Flux-Quantized M5-Branes*, preprint [arXiv:2408.11896].

[GSS24a] G. Giotopoulos, H. Sati, and U. Schreiber, *Flux Quantization on 11d Superspace*, JHEP **2024** (2024) 82 [doi:10.1007/JHEP07(2024)082] [arXiv:2403.16456]

[GSS24b] G. Giotopoulos, H. Sati, and U. Schreiber, *Flux-Quantization on M5-Branes*, JHEP **2024** 140 (2024) [doi:10.1007/JHEP10(2024)140], [arXiv:2406.11304]

[Susskind01] S. Hellerman and L. Susskind, *Realizing the Quantum Hall System in String Theory*, [arXiv:hep-th/0107200].