

New nanomaterial structures in the form of a double gyroid wire network: Mathematical modeling and applications

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We discuss a novel nano material structure of a double gyroid (DG) wire network. We start by introducing the geometrical structure of the DG and its fabrication as background. We then use methods of commutative and non-commutative geometry to model and describe this quantum wire network. The non-commutative geometry appears when turning on a magnetic field. In this setting the gyroid geometry is a 3d generalization of graphene. We classify the resulting algebras - the non-commutative geometry is closely related to non-commutative 3-tori as we discuss in detail.

We explain a conjecture relating the degeneracies in the commutative case with the special points in the non-commutative case. We show how the gyroid wire network compares to networks from other CMC surfaces. The gyroid network is the only one exhibiting Dirac points analogous to the ones in graphene. However, in contrast to graphene, the Dirac points in the gyroid networks appear to be topologically stable.

Biography

Birgit Wehefritz-Kaufmann has received her Ph.D. from Bonn University (Germany) in 1999. Currently, she is working at Purdue University as an Assistant Professor with a joint appointment in Mathematics and Physics. Visiting appointments include the Physics Department of Princeton University. She has authored numerous articles in prestigious journals. Her research is supported by a grant from the National Science Foundation.

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