Magnetism and topology in self-assembled 3D gyroid nanostructures

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Gyroids are renowned in the fields of metamaterials and photonics for their connectivity and chirality, and are now beginning to draw their due attention in the field of magnetism. I will describe our work on the fabrication of magnetic gyroids with node-node distances close to the magnetostatic exchange length, and our work on imaging their magnetic states via electron holography [1]. Our attempt to provide a framework to understand the magnetization dynamics of a small number of gyroid unit cells [2], and how their interactions may generate and influence spin waves [3] is described. Finally, I will touch upon the long-range ordering of gyroids over tens to hundreds of unit cells, including ways to control the morphology by directed self-assembly [4]. I will explain how ptychographic X-ray computed tomography (PXCT) was employed for large-scale observations of gyroids and the related single-diamond network at sub-unit-cell resolution, and how this technique enabled us to reveal the existence of topological defects which arise during self-assembly [5].

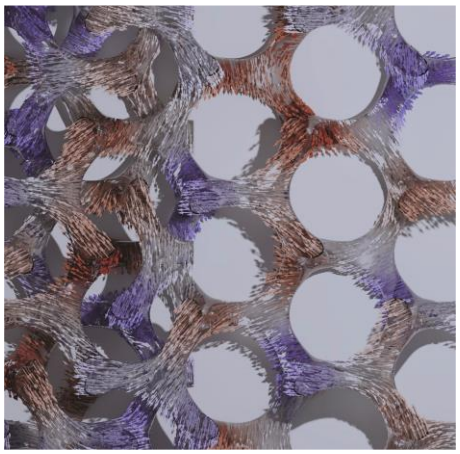

Figure 1 Representation of the intricate configuration of the magnetization in nanoscale magnetic gyroids

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