

# Clifford Tori and the singularly perturbed Cahn-Hilliard equation

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## Abstract

In the talk we will discuss some entire solutions  $u_\varepsilon$  to the Cahn-Hilliard equation

$$-\varepsilon^2 \Delta(-\varepsilon^2 \Delta u + W'(u)) + W''(u)(-\varepsilon^2 \Delta u + W'(u)) = 0,$$

where  $W(u) = \frac{1}{4}(1 - u^2)^2$ , under the volume constraint

$$\int_{\mathbb{R}^3} (1 - u_\varepsilon) dx = 4\sqrt{2}\pi^2,$$

whose nodal set approaches the Clifford Torus, that is the Torus with radii of ratio  $1/\sqrt{2}$  embedded in  $\mathbb{R}^3$ , as  $\varepsilon \rightarrow 0$ . What is crucial is that the Clifford Torus is a Willmore surface and it is non-degenerate, up to conformal transformations. The proof is based on the Lyapunov-Schmidt reduction and on careful geometric expansions of the laplacian.

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