Ding, Weiyue; **Jost, Jürgen**; **Li, Jiayu**; **Wang, Guofang**
An analysis of the two-vortex case in the Chern-Simons Higgs model. (English) Zbl 0928.58021
Calc. Var. Partial Differ. Equ. 7, No. 1, 87-97 (1998).

The authors construct in 2+1 dimensional Minkowski space the Chern-Simons-Higgs model described by the Lagrangian density

$$\mathcal{L}(A) = D_\alpha \Phi \overline{D}_\alpha \Phi + \tfrac{k}{4}\varepsilon^{\alpha\beta\gamma} F_{\alpha\beta} A_\gamma - k^{-2}|\Phi|^2(1-|\Phi|^2)^2$$

corresponding to a complex scalar field Φ coupled to a gauge field A ($F_{\alpha\beta} = \partial_\alpha A_\beta - \partial_\beta A_\alpha$, $D_\alpha \Phi = \partial_\alpha \Phi - iA_\alpha \Phi$). They investigate the stationary configurations of periodic vortices: these are solutions on some lattice in $\mathbb{R}^2$ which are gauge equivalent on the boundary of a fundamental domain Ω. The flux through Ω is quantized: $\int_\Omega F_{12} dx = 2\pi N$, N being the vortex number.

The existence results hold for arbitrary N. Some finer variational results and asymptotic results for coupling $k \to 0$ are known only for $N = 1$. The authors present a variational existence proof of vortex solutions for $N = 2$ and analyze their asymptotic behaviour for $k \to 0$. For $N > 2$, except in special cases, the situation is unclear.

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MSC:

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