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Sergiy Koshkin* (koshkins@uhd.edu), University of Houston-Downtown, CMS Department, 1 Main Street, #S705, Houston, TX 77002. *Gauge theory of Faddeev-Skyrme functionals.*

We study geometric variational problems for a class of nonlinear sigma-models in quantum field theory. Mathematically, one needs to minimize an energy functional on homotopy classes of maps from closed 3-manifolds into compact homogeneous spaces G/H . The minimizers are known as Hopfions and exhibit localized knot-like structure. Our main results include proving existence of Hopfions as finite energy Sobolev maps in each (generalized) homotopy class when the target space is a symmetric space. For more general spaces we obtain a weaker result on existence of minimizers in each 2-homotopy class. Our approach is based on representing maps into G/H by equivalence classes of flat connections. The equivalence is given by gauge symmetry on pullbacks of $G \rightarrow G/H$ bundles. We work out a gauge calculus for connections under this symmetry, and use it to eliminate non-compactness from the minimization problem by fixing the gauge. (Received August 31, 2009)