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Constructing Near-BPS Skyrmions with Constant Baryon Densities

The Skyrme Model seems unable to reproduce the small binding energy in nuclei although it provides a relatively good picture of the nucleons. This suggests that Skyrme-like models that nearly saturate the Bogomol'nyi bound may be more appropriate since their mass is roughly proportional to the baryon number. In an attempt to remedy this situation, we propose a near-BPS Skyrme Model. It consists of terms up to order six in derivatives of the pion fields, including the nonlinear and Skyrme terms which are assumed to be relatively small. Our special choice of mass term leads to well-behaved analytical BPS-type solutions with approximately constant baryon density configurations, as opposed to the usual shell-like configurations found in most extensions of the Skyrme Model. Fitting the four model parameters, we find a remarkable agreement for the binding energy per nucleon B/A with respect to experimental data. These results support the idea that nuclei could be near-BPS Skyrmions.

Author: MARLEAU, Luc (Université Laval)

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