Atiyah-Manton Approach to Skyrmion Matter

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Abstract

We propose how to approach, and report on the first results in our effort for, describing nuclear matter starting from the solitonic picture of baryons which is supposed to represent QCD for large number of colors. For this purpose, the instanton-skyrmion connection of Atiyah and Manton is exploited to describe skyrmion matter. We first modify 't Hooft's multi-instanton solution so as to suitably incorporate proper dynamical variables into the skyrmion matter and then by taking these variables as variational parameters, we show that they cover a configuration space sufficient to adequately describe the ground state properties of nuclear matter starting from the skyrmion picture. Our results turn out to be comparable to those so far found in different numerical calculations, with our solution reaching stability at high density for a crystal structure and obtaining a comparable value for the energy per baryon at the minimum, thus setting the stage for the next step.