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BPS solitons in a Maxwell baby Skyrme model with a nontrival dielectric function

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In this presentation, we describe the construction of gauged BPS baby skyrmions inherent to a model in which the dynamics of the gauge field is controlled by the usual Maxwell term now multiplied by a nontrivial dielectric function. We introduce the theoretical context in which this investigation is inserted and present the lagrange density which defines the so-called Maxwell baby Skyrme model. We write the corresponding Gauss law for time-independent configurations and fix a particular gauge choice which leads to BPS skyrmions with no electric field and electric charge. By focusing our attention on structrures with radial symmetry, we point out that the expression for the total energy of the effective theory must be enlarged in order to support the existence of BPS solutions. We then proceed with the minimization of the enlarged energy via the implementation of the BPS prescription, from which we get not only the lower bound for the energy itself, but also the first-order equations whose solutions saturate the aforecited bound. In the sequence, we fix an specific form for the superpotential which is known to give rise to well-behaved BPS skyrmions in the simplest Maxwell baby Skyrme scenario (i.e. in the absence of the dielectric function). Moreover, in order to generate solutions with internal structures, we also choose a particular mathematical form for the dielectric function which contains a positive real parameter α. From this point on, we focus our attention on the effects caused by α on the profiles of the corresponding BPS configurations, from which we fix the values of the additional parameters of the model. We solve the effective first-order equations for different values of α and depict the numerical BPS solutions. As a result, we get that α controls the magnetic field's shape, which eventually differs from its standard profile in a dramatic way. In particular, it is possible to define five different scenarios according to the magnetic profile the values of α engender. Similar dependence can also be identified in the solution to the magnetic energy density, which stands for the portion of the energy distribution which is proportional to the magnetic field. Finally, we summarize the main results and enumerate our perspectives regarding future investigations based on the developments discussed in this presentation.

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