BPS Domain Walls in Massive Hyper-Kähler Sigma Models

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There exists a long history for searching topological defects such as domain walls. Lots of their properties in particular localization of massless or light fields on them have been investigated. Recent interest in the brane-world scenario has brought us an idea to realize our world as the effective field theory of light localized fields on the brane. Supersymmetry (SUSY) is combined with this idea by considering the BPS solitons in SUSY field theories. They typically break the half of the original SUSY spontaneously. BPS domain walls are investigated in detail in \( D = 4, \mathcal{N} = 1 \) SUSY theories (with four supercharges), on which effective field theories have two unbroken supercharges. However in order to realize \( D = 4, \mathcal{N} = 1 \) SUSY theory on the world-volume, we need a higher-dimensional theory with eight supercharges. In these theories scalar multiplets are hypermultiplets. They must parameterize curved hyper-Kähler (HK) manifolds with a scalar potentials admitting at least two discrete degenerate vacua. These models are called the massive HK nonlinear sigma models (NLSM).

In this talk, the HK quotient method to construct HK manifolds is shown to be generalized to the massive models and the BPS domain wall in the simplest case of the Eguchi-Hanson target space was given. Keeping essential properties of eight supercharges, we discussed a simpler and familiar case of \( D = 4, \mathcal{N} = 2 \) SUSY theories. Also we use the \( \mathcal{N} = 1 \) superspace formalism. A fully off-shell \( \mathcal{N} = 2 \) superspace (the Harmonic superspace) formalism is discussed in the original paper [1].

References


\(^1\)Talk based on [1, 2].

\(^2\)Speaker