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Skyrmion-induced bound states on the surface of 3D Topological Insulators DIMITRIOS ANDRIKOPOULOS[1], BART SOREE[2], Katholieke Univ Leuven — In this work, we study the interaction between the surface state of a 3D Topological Insulator and a skyrmion magnetic texture. The skyrmion texture couples to the spin of the surface state electron with strength Δ_S. Vortex and hedgehog skyrmion and anti-skyrmion structures are considered and their interaction is compared. Due to the vortex structure, the interaction of the in-plane components can be neglected and a step function is used to describe the skyrmion magnetization profile. In the hedgehog case, it is shown that the in-plane components cannot be disregarded and thus a realistic description for the skyrmion is required. Working in the micromagnetic framework, we derive a macrospin description for the skyrmion using the variational principle and then numerically solve for the bound states. It is shown that the existense and properties of these states as a function of skyrmion size, strongly depend on the skyrmion type. Both vortex and hedgehog skyrmions or anti-skyrmions can induce bound states with energies $|E| < \Delta_S$. For the hedgehog skyrmion case however, bound state appearance depends on the chirality. Finally, the probability densities in these states are computed and it is demonstrated that the electrons are localized throughout the skyrmion region.

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