

Nonlinear surface impurity in a semi-infinite two-dimensional square lattice:

Green function approach

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We examine the formation of localized states on a generalized nonlinear impurity located at or near the surface of a semi-infinite two-dimensional (2D) square lattice. Using the formalism of lattice Green functions, we obtain in closed form the number of bound states as well as their energies and probability profiles, for different nonlinearity parameter values and nonlinearity exponents, at different distances from the surface. We specialize in two cases: an impurity close to an "edge" and an impurity close to a "corner." We find that, unlike the case of a 1D semi-infinite lattice, in 2D, the presence of the surface helps in the formation of a localized state. © 2006 The American Physical Society.