

Nonlinear surface impurity in a semi-infinite lattice

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We examine the formation of bound states on a generalized nonlinear impurity located at or near the beginning (surface) of a linear, tight-binding semi-infinite 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. It is shown that close to the surface, the amount of nonlinearity needed to create a bound state or to effect dynamical self-trapping, increases (decreases) depending on whether the exponent is smaller (larger) than, approximately, 2. ©2005 The American Physical Society.