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Berry phase-like effect near DOS singularity in continuum models coupled with discrete states SAVANNAH GARMON, DVIRA SEGAL, University of Toronto, INGRID ROTTER, Max Planck Institute for the Physics of Complex Systems — Threshold effects in a continuum model (cut-off frequency in a waveguide or the band edge in tight-binding chains) may significantly modify the single-particle discrete eigenvalue spectrum resulting from coupled discrete states. Focusing on tight-binding chains as an example we reveal a Berry phase-like effect as the system parameters are adiabatically varied about certain exceptional points (non-analytic points in the eigenvalue spectrum) that are related to the threshold (van Hove) singularity in the density of states. We show that this effect is related to the form of the eigenvalue expansion in the vicinity of the band edge. In particular, for a semi-infinite model with a side-coupled impurity the eigenvalues in this vicinity may be expanded in powers of the coupling g , rather than the more usual g^2 . In another example, in the case of an infinite tight-binding chain with a side-coupled impurity (or a two-level atom traveling in an infinite waveguide) the DOS singularity results in a $g^{4/3}$ amplification of the decay width of the resonant state [1, 2].

[1] Phys. Rev. B **73**, 115340 (2006).

[2] Phys. Rev. Lett **94**, 043601 (2005).

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