Quasienergy resonance in a dynamic Wannier-Stark ladder

YUYA NEMOTO, Graduate School of Pure and Applied Sciences, University of Tsukuba,
KEN-ICHI HINO, NOBUYA MAESHIMA, Division of Materials Science, Faculty of
Pure and Applied Sciences, University of Tsukuba — A continuum effect of a
dynamic Wannier-Stark ladder driven by a cw laser is examined in terms of an ex-
cess density of states (EDOS), corresponding to the lifetime of a resonance state
[1]. It is mathematically shown that EDOS is governed by three different physi-
cal mechanisms, namely, the single-channel resonance mechanism, the multichannel
nonresonance mechanism, and the multichannel resonance mechanism. The last
mechanism becomes more important with increasing laser amplitude $F_{ac}$. The effect
of the interchannel interaction is maximized when the ratio of a Bloch frequency to
a laser frequency, represented as $\eta$, equals unity. In the actual calculations based
on the R-matrix Floquet theory, it is revealed that, in a large-$F_{ac}$ region, EDOS for
$\eta = 1$ shows a complicated spectral structure composed of a couple of newly growing
peaks, in contrast to EDOS for $\eta = 3$ which just shows a monotonic change of a
single spectral peak. It is speculated that the pronounced feature of the former spec-
tra is attributed to the Fano-like multichannel resonance mechanism, whereas the
feature of the latter case is attributed to the multichannel nonresonance mechanism.

Yuya Nemoto
Graduate School of Pure and Applied Sciences, University of Tsukuba

Date submitted: 15 Nov 2013
Electronic form version 1.4