

Supplementary material to the manuscript

Edwards Localization

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We give the listings of the Wolfram Mathematica code used to generate Fig. 1 and 2.

Keywords: Polaron localization; Anderson localization; Edwards localization

I. THE CODE

We generated the data of Fig. 1 & 2 with the following Wolfram Mathematica [1] code:

```
(* **** Mathematica Wolfram Code for Fig. 1 & 2 ****)
(* wave function between the scattering centers *)
Psi[x_, k_, A_, phi_] := A*Sin[k*x + phi];
dPsi[x_, k_, A_, phi_] := A*k*Cos[k*x + phi];

(* normalization condition for the wave function *)
AAA[k_, phi_] :=
A /. Solve[Integrate[Psi[x, k, A, phi]^2, {x, 0, L}] == 1, A][[1]]

(* transfer matrices *)
RR[theta_] := {Cos[theta], -Sin[theta], {Sin[theta], Cos[theta]}];
TT[m_, g_, k_] := {{1, 2*m*g/k}, {0, 1}};

(* PARAMETERS *)
Clear[AA, phi, xx]
NN = 3; (* number of scattering sites NN=1,2,3,... *)
L = 1; (* segment length [0,L] *)
m = 1; (* mass of the particle *)

(* RECURRENCE RELATION FOR AMPLITUDES *)
Clear[AA];
Do[AA[i + 1] =
AA[i + 1] /.
Solve[dPsi[xx[i + 1], k, AA[i + 1], phi[i + 1]] ==
dPsi[xx[i + 1], k, AA[i], phi[i]] +
2*m*g*Psi[xx[i], k, AA[i], phi[i]], AA[i + 1]][[1]], {i, 0,
NN - 1}];

(* RECURRENCE RELATION FOR PHASES *)
Clear[phi];
Do[phi[i + 1] =
phi[i + 1] /.
Solve[Psi[xx[i + 1], k, AA[i + 1], phi[i + 1]] ==
Psi[xx[i + 1], k, AA[i], phi[i]], phi[i + 1]][[1]] /.
C[1] -> 0, {i, 0, NN - 1}];

(* NORMALIZATION OF EIGENSTATE (amplitude AA[0]) *)
Do[AA[i] = AAA[k, phi[i]], {i, 0, 0}];

(* MONTE CARLO *)
M = 100; (* MC Steps *)
g = 100; (* coupling constant between particle and scattering centers *)
tt = 1; (* time *)
SeedRandom[1];
PsiMC[x_] = 0;
PsiMCt[x_] = 0;
EMC = 0;
Do[{
(* RANDOM POSITIONS OF SCATTERING CENTERS *)
Clear[xxxx, xx];
Do[xxxx[i] = RandomReal[]*L, {i, 1, NN}];
xx[0] = 0;
```

```
Do[xx[i] = Sort[Array[xxxx, NN]][[i]], {i, 1, NN}];
Do[Print["r", i, " = ", xx[i]], {i, 1, NN}];
Print["-----"];
(* EIGENVALUE (search for the ground state with Newton-Raphson *) 
Clear[MM, k];
MM[0] = {{1, 0}, {0, 1}};
Do[MM[i + 1] =
Dot[Dot[RR[k]*({xx[i + 1] - xx[i]}), TT[m, g, k]], MM[0]], {i, 0,
NN - 1}];
Print["-----"];
FR = FindRoot[Tr[MM[NN]] == 1, {k, 0.01}];
k = k /. FR;

EE = k^2/2/m;
Print["(", j, ") = ", EE];
(* PBC DETERMINATION OF PHI[0] *)
RRR = FindRoot[
Psi[0, k, AA[0], phi[0]] == Psi[L, k, AA[NN], phi[NN]], {phi[0],
1}];
phi[0] = phi[0] /. RRR;
Print["-----"];
xx[NN + 1] = L;
PsiF[x_] =
Piecewise[
Table[{Psi[x, k, AA[i], phi[i]], xx[i] <= x < xx[i + 1]}, {i, 0,
NN}]];
PsiFt[x_] = Exp[-I*EE*tt]*PsiF[x];
PsiMC[x_] = PsiMC[x] + PsiF[x];
PsiMCt[x_] = PsiMCt[x] + PsiFt[x];
EMC = EMC + EE;
Print["EMC = ", EMC/j];
}, {j, 1, M}]
```

AUTHOR DECLARATIONS

Conflicts of interest

None declared.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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[1] Wolfram Mathematica <https://www.wolfram.com/mathematica/>.

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