Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

Mobility transition between ballistic and diffusive transport in PT-symmetric lattices TONI EICHELKRAUT, RENÉ HEILMANN, STEFFEN WEIMANN, SIMON STÜTZER, Institute of Applied Physics, Friedrich-Schiller-Universität Jena, DEMETRIOS CHRISTODOULIDES, CREOL, University of Central Florida, ALEXANDER SZAMEIT, Institute of Applied Physics, Friedrich-Schiller-Universität Jena — In this work, we show theoretically and experimentally that in non-hermitian time-independent systems ballistic and diffusive transport coexist, but on different time scales. Our study is based on a parity-time-symmetric (PT) optical waveguide array exhibiting an alternating loss profile with homogeneous coupling between neighboring guides. The key of this study is that the coupling is equal between all waveguides, leading to "broken" PT-symmetry and, hence, a complex band structure. Exciting a single waveguide of such a structure, initially all modes are excited and the evolution of the wavepacket is ballistic. The imaginary part of the band structure leads to a contraction of the wavepacket's spectrum around the mode whose eigenvalue possesses the smallest imaginary part. Due to this effect, for large propagation distances the variance of the wavepacket shows the diffusive spreading. We emphasize that these dynamics cannot be achieved within any Hermitian system. In order to probe the theoretical predictions experimentally, laser-written waveguide arrays inside fused silica were analysed. Losses were implemented by sinusoidally bending every second waveguide transverse to lattice plane. The experimental results show excellent agreement with the theoretical predictions.

Toni Eichelkraut
Institute of Applied Physics, Friedrich-Schiller-Universität Jena

Date submitted: 31 Jan 2014 Electronic form version 1.4