

# Band Gap Formation, Fundamental Solitons and Vortices in 2D Nonlinear Lattices

M. J. Ablowitz<sup>a</sup>, N. Antar<sup>b</sup>, İ. Bakırtaş<sup>b</sup> and B. Ilan<sup>c</sup>

<sup>a</sup>Department of Applied Mathematics, University of Colorado, Colorado 80309-0526,

<sup>b</sup>Department of Mathematics, Istanbul Technical University, Maslak 34469, Turkey,

<sup>c</sup>School of Natural Sciences, University of Colorado at Merced, Merced, CA 95344

Tel: +90 0212 285 33 25, email: antarn@itu.edu.tr

## Abstract:

In this talk, we present the band gap formation and the existence of localized nonlinear modes of the underlying nonlinear Schrödinger equation (NLS) with two dimensional irregular lattices, possessing dislocations, defects and quasicrystal structures. We next investigate vortex solitons on quasicrystal lattices. We use a spectral fixed-point numerical scheme to obtain the nonlinear localized modes and vortex solitons. By using direct computational simulations, stability properties of fundamental and vortex solitons are investigated.

## References:

1. N.K. Efremidis et al., Phys. Rev. Lett. 91, 213906 (2003).
2. D. Neshev, Y.S.Kivshar, H. Martin, and Z. Chen, Opt. Lett., 29,486 (2004).
3. E.Schonbrun and R.Piestun, Opt. Eng., 45,028001 (2006)
4. M. J. Ablowitz and Z. H. Musslimani, Opt. Lett., 30,2140 (2005)
5. M. J. Ablowitz, B. Ilan, E. Schorbrun, and R. Piestun, Theo. and Math. Phys., 151 (3) (2007)
6. H. Sakaguchi and B. Malomed, Phys. Review E, 74, 026601 (2006)