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**BORIS MITYAGIN**, The Ohio State University

*Convergence of spectral decompositions of Hill operators with trigonometric polynomial potentials*

We consider the Hill operator

$$Ly = -y + v(x)y, \quad 0 \leq x \leq \pi,$$

subject to periodic or antiperiodic boundary conditions, with potentials  $v$  which are trigonometric polynomials with nonzero coefficients, of the form

$$\begin{aligned} (i) & \quad a e^{-2ix} + b e^{2ix}; \\ (ii) & \quad a e^{-2ix} + B e^{4ix}; \\ (iii) & \quad a e^{-2ix} + A e^{-4ix} + b e^{2ix} + B e^{4ix}. \end{aligned}$$

Then the system of eigenfunctions and (at most finitely many) associated functions is complete but it is not a basis in  $L^2([0, \pi], C)$  if  $|a| \neq |b|$  in the case (i), if  $|A| \neq |B|$  and neither  $-b^2/4B$  nor  $-a^2/4A$  is an integer square in the case (iii), and it is never a basis in the case (ii) subject to periodic boundary conditions.

This is a joint work with Plamen Djakov; see arxiv 0911.3218.