

# Accepted Manuscript

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Yu. Kondratiev, S. Molchanov, B. Vainberg

PII: S0022-1236(17)30151-9  
DOI: <http://dx.doi.org/10.1016/j.jfa.2017.04.006>  
Reference: YJFAN 7781

To appear in: *Journal of Functional Analysis*

Received date: 17 March 2016  
Accepted date: 11 April 2017

Please cite this article in press as: Yu. Kondratiev et al., Spectral analysis of non-local Schrödinger operators, *J. Funct. Anal.* (2017), <http://dx.doi.org/10.1016/j.jfa.2017.04.006>

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# Spectral analysis of non-local Schrödinger operators.

Yu. Kondratiev <sup>\*</sup>, S. Molchanov <sup>†</sup>, B. Vainberg <sup>‡</sup>

## Abstract

We study spectral properties of convolution operators  $\mathcal{L}$  and their perturbations  $H = \mathcal{L} + v(x)$  by compactly supported potentials. Results are applied to determine the front propagation of a population density governed by operator  $H$  with a compactly supported initial density provided that  $H$  has positive eigenvalues. If there is no positive spectrum, then the stabilization of the population density is proved.

**Key words:** random walk, spectrum, front propagation, population, stabilization.

**MSC classification:** 47A10, 60J85, 47D06

## 1 Introduction

In this paper we study the spectral properties of the Hamiltonian  $H$  in  $L^2(\mathbb{R}^d)$  given by

$$H = \mathcal{L} + v(x), \quad \mathcal{L}\psi(x) = \chi \int_{y \in \mathbb{R}^d} (\psi(x+y) - \psi(x))a(y)dy, \quad x \in \mathbb{R}^d, \quad (1)$$

where

$$a(y) = a(-y), \quad a \geq 0, \quad \int_{\mathbb{R}^d} a(y)dy = 1, \quad (2)$$

and  $v(x) \geq 0$  is continuous and compactly supported.

The operator  $\mathcal{L}$  is the generator of a symmetric random walk on  $\mathbb{R}^d$  with the intensity of jumps equal to  $\chi > 0$ . Function  $a(y)$  is the density of transition from  $x$  to  $x+y$  at the moment of the jump. Operators  $H$  of the form (1) appear in many applications, such as models of population dynamics that include the KPP type processes (where the offspring start at the location of the parent particle [9], [4], [5], [6]) and contact processes

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<sup>\*</sup>Fakultat für Mathematik, Universität Bielefeld, 33615 Bielefeld, Germany, kondrat@math.uni-bielefeld.de. The work was partially supported by the DFG through SFB 701, Bielefeld University.

<sup>†</sup>Dept of Mathematics and Statistics, UNC at Charlotte, NC 28223 and National Research Univ., Higher School of Economics, Russian Federation, smolchan@uncc.edu. The work was partially supported by the NSF grant DMS-1410547 and by the DFG through SFB 701, Bielefeld University.

<sup>‡</sup>Dept of Mathematics and Statistics, UNC at Charlotte, NC 28223, brvainbe@uncc.edu. The work was partially supported by the NSF grant DMS-1410547; corresponding author.

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