## ASPECTS OF SOME QUANTUM INTEGRABLE SYSTEMS WITH LONG-RANGED INTERACTIONS

A thesis submitted for the degree of DOCTOR OF PHILOSOPHY (Science)

in

Physics (Theoretical)

by PRATYAY BANERJEE

Department of Physics

UNIVERSITY OF CALCUTTA

2014

## Contents

1	Introduction	1		
2	$D_N$ type quantum Calogero model 2.1 Similarity transformation and its domain $\dots \dots \dots$	<b>25</b> 27 34		
3	<ul> <li>Level density distribution for 1D vertex models and related spin chains</li> <li>3.1 Level density for known HS like spin chains</li></ul>	<b>43</b> 45 49 59		
4	Polychronakos like spin chains associated with polarized spin reversal operators4.1Construction of the PSRO	<b>65</b> 67 74 86 92 96		
5	Conclusion	105		
Bi	Bibliography 1			

## List of Figures

3.1	Continuous curve represents the Gaussian distribution $G(E)$ and the his-	
	togram represents the normalized level density distribution for the dispersion relation (3.65) with coefficients $f_{0,1} = 1$ , $f_{0,2} = -1$ , $f_{1,1} = 1$ , drawn for the case $N = 40$ and $m = 2$ .	62
3.2	Continuous curve represents the error function $C(E)$ , while the circles represent cumulative level density distribution $F(E)$ for the dispersion relation (3.65) with coefficients $f_{0,1} = 1$ , $f_{0,2} = -1$ , $f_{1,1} = 1$ , drawn for	
	the case $N = 40$ and $m = 2$ .	63
4.1	Continuous curve represents the Gaussian distribution and circles repre- sent level density distribution for $N = 20$ and $m_1 = 3$ , $m_2 = 1$ .	102
4.2	Circles represent cumulative spacing distribution $P(s)$ , while continuous line is its analytic approximation $\tilde{P}(s)$ drawn for $N = 20$ and $m_1 =$	
	$3, m_2 = 1. \ldots $	103

## List of Tables

3.1	MSE for cumulative level density for the dispersion relation $(3.65)$ with	
	$m = 2. \ldots $	64
4.1	MSE for level density of $BC_N$ type PF chain with PSRO (4.34)	104