INTEGRABILITY BEYOND NEAREST-NEIGHBOR INTERACTIONS

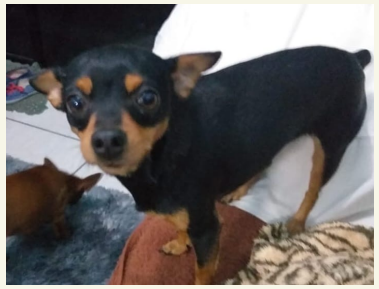
ANA RETORE

FELLOWS 2025

CAMPOS NOVOS

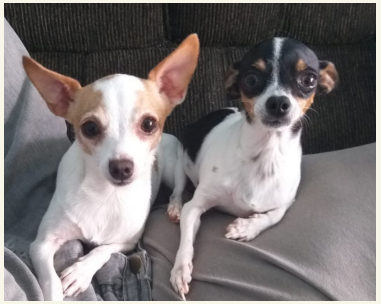
ANA LÚCIA RETORE

PRETA



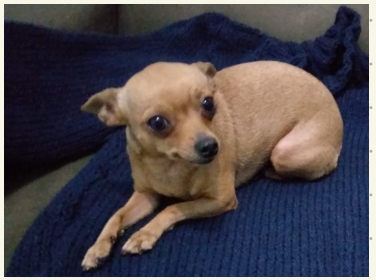
LILICA

BELA



LUNA

MEL



ANA LÚCIA RETORE

MIAMI

ONE-YEAR PhD internship

PhD student

SÃO PAULO

DUBLIN

ANA LÚCIA RETORE

FIRST POSTDOC POSITION

DUBLIN

HAMBURG

NOW

DURHAM

SECOND POSTDOC POSITION

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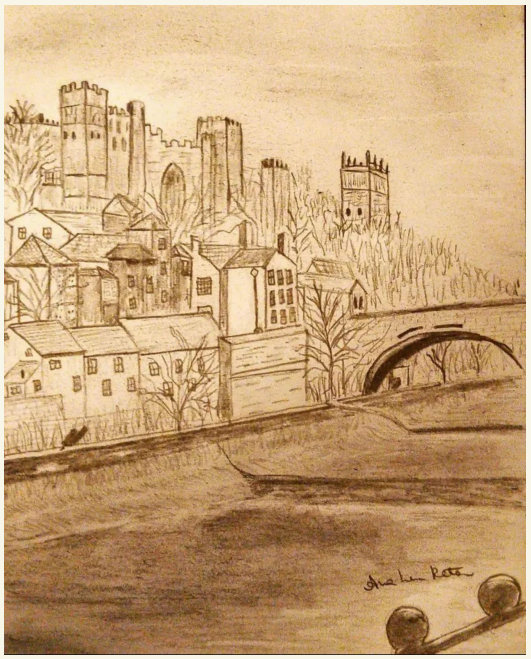
HOBBIES

Reading



Drawing

Video Games

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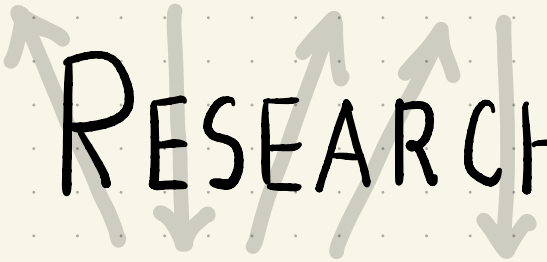
RESEARCH

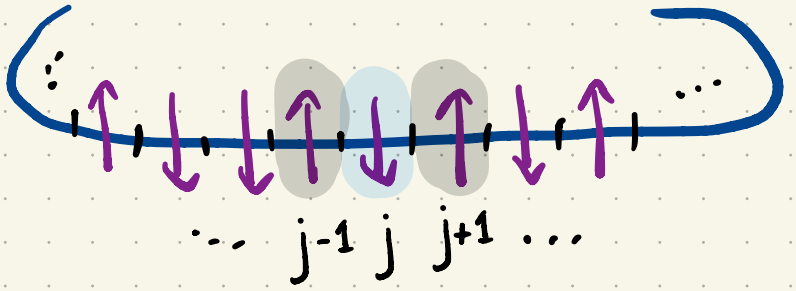


SPIN CHAIN

Discrete 1d quantum system, whose Hamiltonian acts on L copies of a Hilbert space

$$\mathbb{H} : \underbrace{\mathbb{C}^2 \otimes \dots \otimes \mathbb{C}^2}_{L} \mapsto \mathbb{C}^2 \otimes \dots \otimes \mathbb{C}^2$$

$$\mathbb{H} = \sum_{j=1}^{L} h(j)$$



INTEGRABLE

The presence of many hidden SYMMETRIES

INTEGRABLE MODELS

$Q_1 = e^{iP}$

$Q_2 = H$

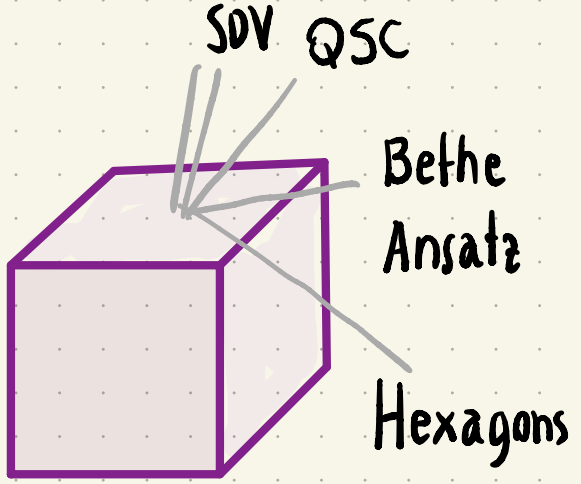
Q_3

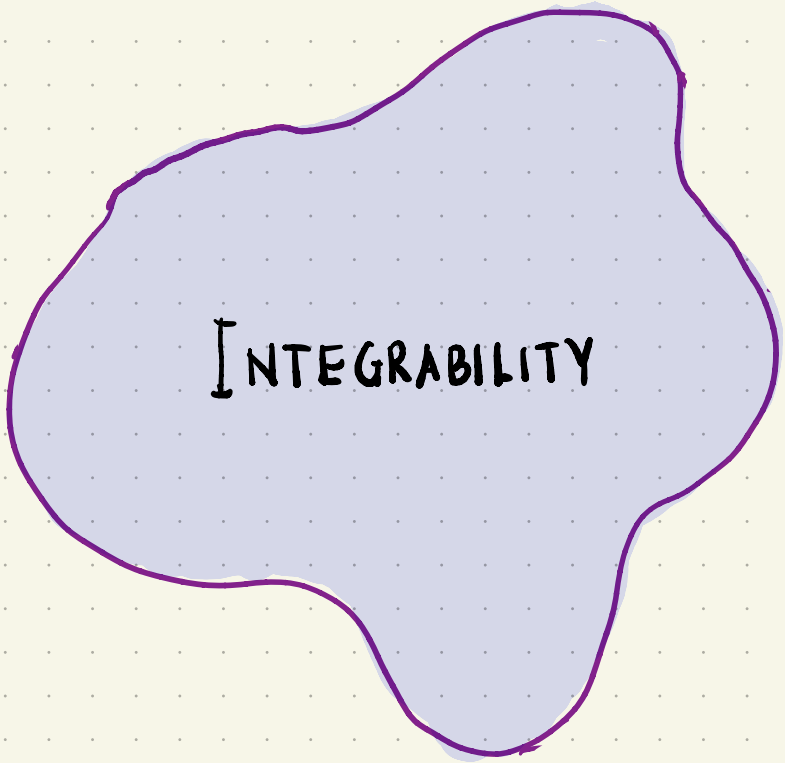
and MANY MORE

$[Q_n, Q_m] = 0$

$m, n = 1, 2, \ldots$

R-MATRIX $\Rightarrow$ CHARGES $\Rightarrow$





* MAGNETISM

Heisenberg spin chain

Potts model,

* SUPERCONDUCTIVITY

1d. Hubbard model

* STATISTICAL MECHANICS

GENERALISED GIBBS-ENSEMBLE

* NON-ISOLATED SYSTEMS LINDBLADIANS

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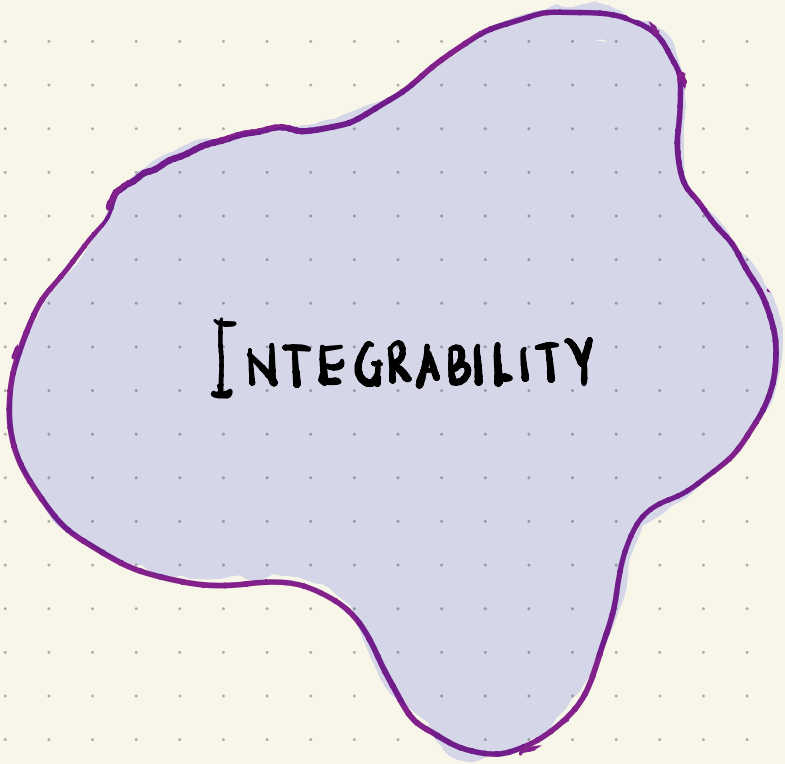

- QUANTUM COMPUTING.
- STOCHASTIC SYSTEMS
- GAUGE THEORIES
- MATHEMATICS (QUANTUM GROUPS
  YANGIANS
  TEMPERLEY-LIEB)

WHEN PRESENT IS A VERY USEFUL TOOL -->

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* We can rarely solve problems exactly;

* Perturbation theory works very well at weak coupling

* At strong coupling Perturbation theory stops working

* INTEGRABLE MODELS

  can be solved even for

  medium and strong coupling.

Q_1. IS THIS AN INTEGRABLE HAMILTONIAN ?

Q_2. CAN WE GO BEYOND MODELS WITH A LOT OF SYMMETRY ?

(including $R(u,v) \neq R(u-v)$)

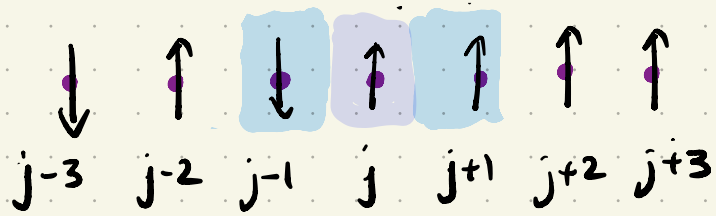
with de Leeuw, Paletta, Prybytok, Ryan

Q_3. CAN WE GO BEYOND NEAREST-NEIGHBOUR INTERACTIONS

such as

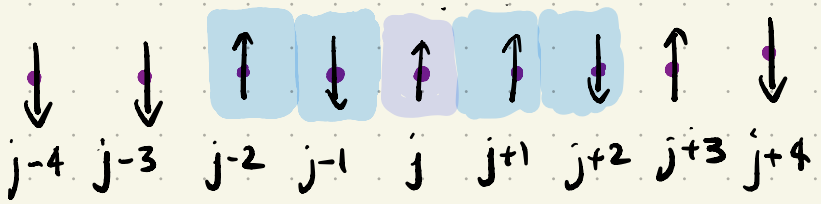
$$H \sim \sum_{j=1} h_{jj+1} + g\, h_{jj+1j+2}$$

RANGE 2



RANGE 3

$$g$$



$$+ O(g^2)$$

AND STILL COMPUTE THE R-MATRIX ?

with M. de Leeuw

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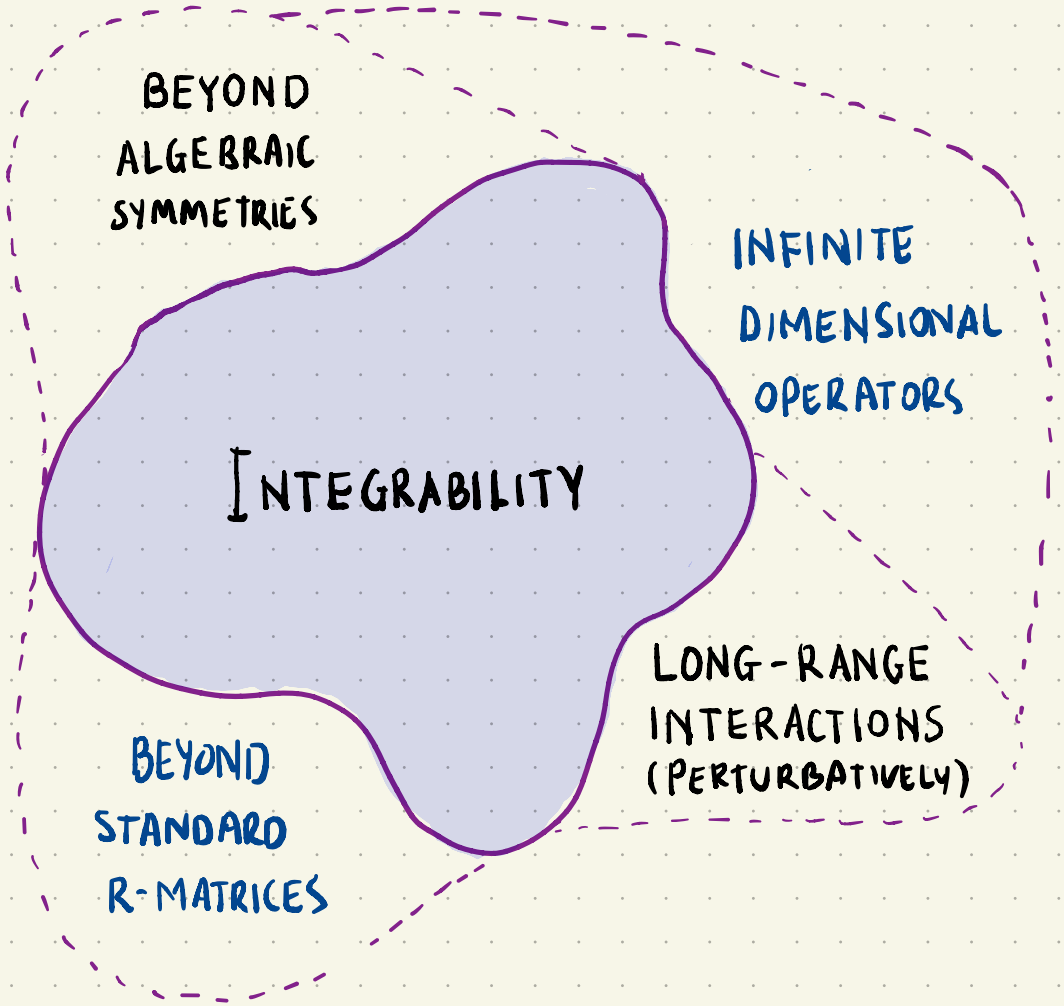
TO DO:



BOUNDARIES ?

APPLICATIONS ?

GENERALISE THE METHODS TO FIND SOLUTIONS?

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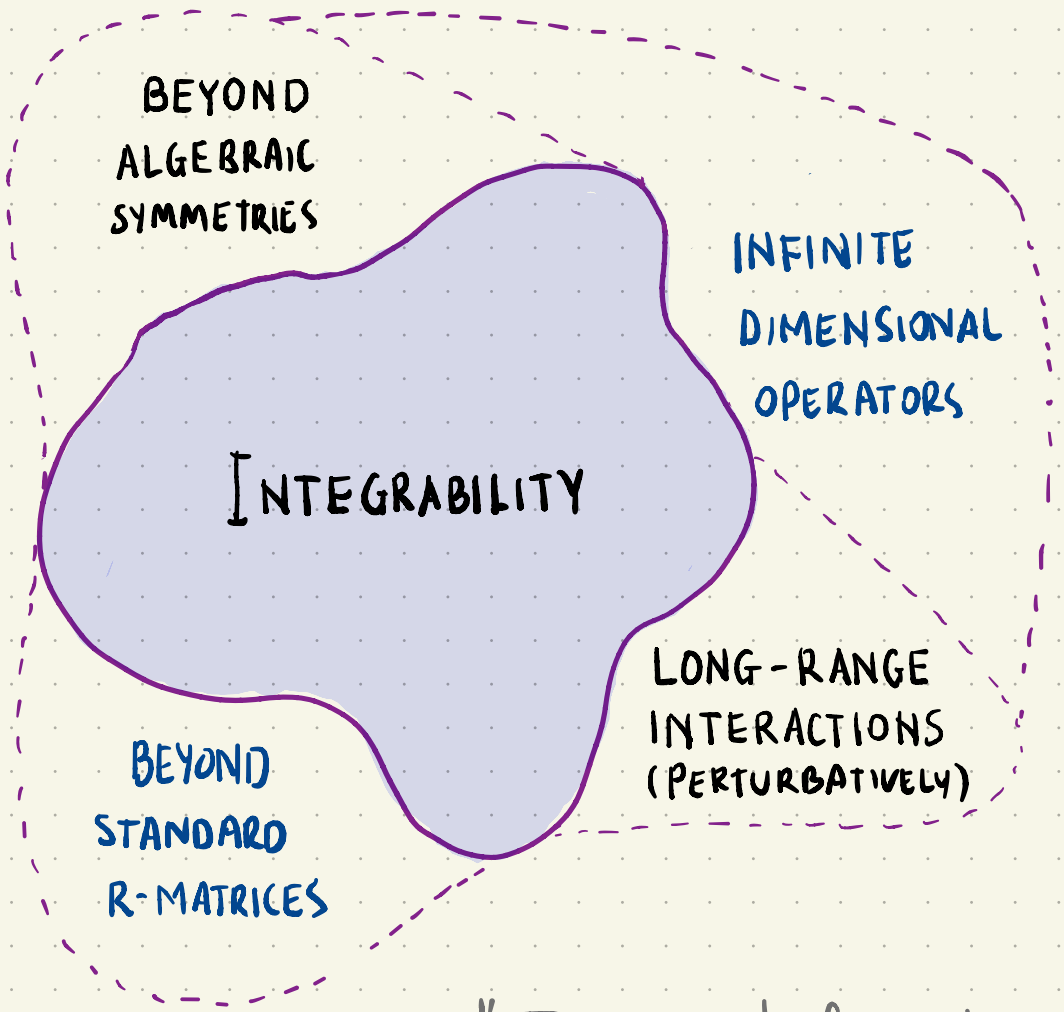
To do:



BOUNDARIES ?

APPLICATIONS ?

GENERALISE THE METHODS TO FIND SOLUTIONS ?

THANK YOU!

"Journey before destination."
(from the Stormlight Archives)

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