

# Guido Mazzuca

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## Education

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<b>SISSA - Scuola Internazionale Superiore di Studi Avanzati</b> , Mathematics	Trieste, Italy Jan 2017 – Jan 2021
<b>University of Milan</b> , Mathematics	Milan, Italy Jan 2012 – Jan 2017

## Experience

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<b>Tulane University</b> , Postdoctoral Researcher	New Orleans, LA Jan 2023 – present 3 years 1 month
<b>KTH Royal Institute of Technology</b> , Stockholm, Sweden, Postdoctoral Researcher	Stockholm, Sweden Jan 2021 – Jan 2023 2 years 1 month

## Volunteer

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<b>BATS and GIST</b> , Organizer Organizer for BATS and GIST math outreach programs.	New Orleans, LA Jan 2023 – present
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## Publications

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### **Adiabatic invariants for the FPUT and Toda chain in the thermodynamic limit.**

We study the periodic Fermi-Pasta-Ulam-Tsingou system as a perturbation of the periodic Toda lattice equations. Exploiting this idea, we show that the Toda integral of motions are adiabatic invariants for the Fermi-Pasta-Ulam-Tsingou system in the thermodynamic limit. This result holds in probability with respect to the Gibbs measure of the system.

Guido Mazzuca, Tamara Grava, Alberto Maspero, Antonio Ponno

[doi.org/10.1007/s00220-020-03866-2](https://doi.org/10.1007/s00220-020-03866-2)

### **Generalized Gibbs ensemble of the Ablowitz-Ladik lattice, circular beta-ensemble and double confluent Heun equation**

In this paper, we prove a polynomial Central Limit Theorem for several integrable models, and for the  $\beta$  ensembles at high-temperature with polynomial potential. Furthermore, we are able to relate the mean values, the variances and the correlations of the moments of these integrable systems with one of the  $\beta$  ensembles. Moreover, we show that for several integrable models, the local functions' space-correlations decay exponentially fast.

Guido Mazzuca, Ronan Mémín

[doi.org/10.1007/s00023-024-01435-0](https://doi.org/10.1007/s00023-024-01435-0)

## Generalized Gibbs ensemble of the Ablowitz-Ladik lattice, circular beta-ensemble and double confluent Heun equation

We consider the discrete defocusing nonlinear Schrödinger equation in its integrable version, which is called defocusing Ablowitz-Ladik lattice. We consider initial data sample according to the Generalized Gibbs ensemble for this lattice with periodic boundary conditions with period  $N$ . In this setting, the Lax matrix of the Ablowitz-Ladik lattice is a random CMV-periodic matrix, and it is related to the Killip-Nenciu circular  $\beta$ -ensemble at high-temperature. Furthermore, we obtain the generalized free energy of the Ablowitz-Ladik lattice and the density of states of the random Lax matrix by establishing a mapping to the one-dimensional log-gas. For the Gibbs measure related to the Hamiltonian of the Ablowitz-Ladik flow, we obtain the density of states via a particular solution of the double-confluent Heun equation.

Guido Mazzuca, Tamara Grava

[doi.org/10.1007/s00220-023-04642-8](https://doi.org/10.1007/s00220-023-04642-8)

## Skills

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**Mathematics**

**Programming**

## Languages

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**Italian**

Native speaker

**English**

Fluent

**Spanish**

Basic knowledge

## Interests

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**Mathematics**

## Projects

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**Mathematical Fundation of Soliton Gas theory and Generalized Hydrodynamics**

Jan 2017 – present

Study of the mathematical aspects of Soliton Gas theory and Generalized Hydrodynamics (GHD) for integrable PDEs.

- Soliton Gas
- Generalized Hydrodynamics

## References

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**Professor Tamara Grava**

**Professor Alberto Maspero**

**Professor Ken McLaughlin**

**Professor Herbert Spohn**