IGFAE INSTITUTO GALEGO DE FÍSICA DE ALTAS ENERXÍAS

EXCELENCIA MARÍA DE MAEZTU

String Theory and Related Fields

IGFAE Retreat 2026

USC UNIVERSIDADE DE SANTIAGO DE COMPOSTELA

MINISTERIO DE CIENCIA, INNOVACIÓN Y UNIVERSIDADES

AGENCIA ESTATAL DE INVESTIGACIÓN

Rede CIGUS
Centros de investigación do Sistema Universitario de Galicia

Cofinanciado por la Unión Europea

Fondos Europeos

Xacobeo 2027

Group members

Seniors

Alfonso V. Ramallo

Jose L. Miramontes

Javier Mas

José Edelstein

Juniors

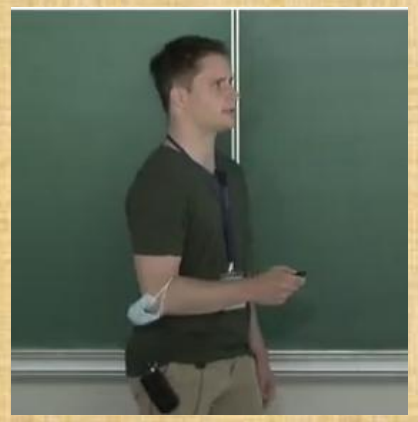
Riccardo Borsato
RyC 2022

Luca Buoninfante
Global Talent

Anxo F. Biasi
JL “la Caixa”
Quasi-RyC

Group members

Postdocs



Tim Meier
Since Nov 2024

Martí Berenguer
New postdoc in Korea

Marcelo Oyarzo
Since Mar 2026

Bradley Cownden
Since Jan 2026

Kostas Rigatos
Departed

PhD students

Juan Santos

Miguel García

Felipe Agurto

Research Topics

- AdS/CFT duality
- Integrability and gauge theories
- Quantum field approaches to gravity
- Nonlinear evolution equations
- Neural networks and black holes beyond general relativity

AdS/CFT duality




A **classical** Gravity system ⟷ A **strongly coupled** Quantum system

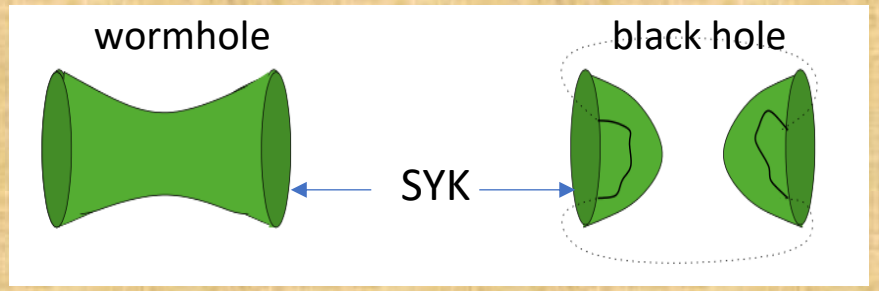
A **classical** Gravity system

Falling into a **black hole**, or traversing a **wormhole**

←

Strongly coupled Quantum system

The dynamics of **SYK** quantum mechanics



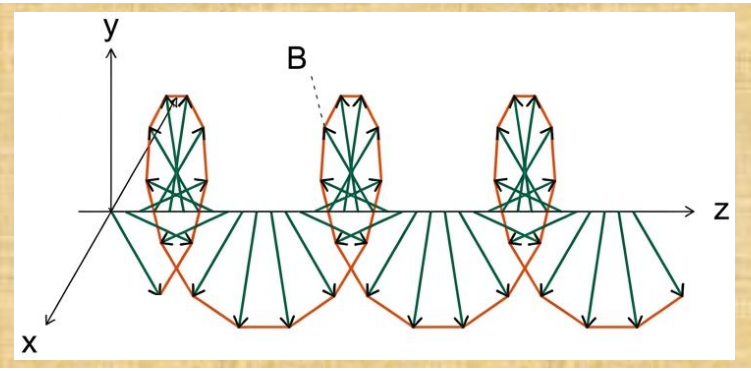
A **classical** Gravity system

AdS_5 with helical flavor branes

→

Strongly coupled Quantum system

Chiral symmetry breaking in presence of a helical magnetic field



JHEP

Hot wormholes and chaos dynamics in a two-coupled SYK model

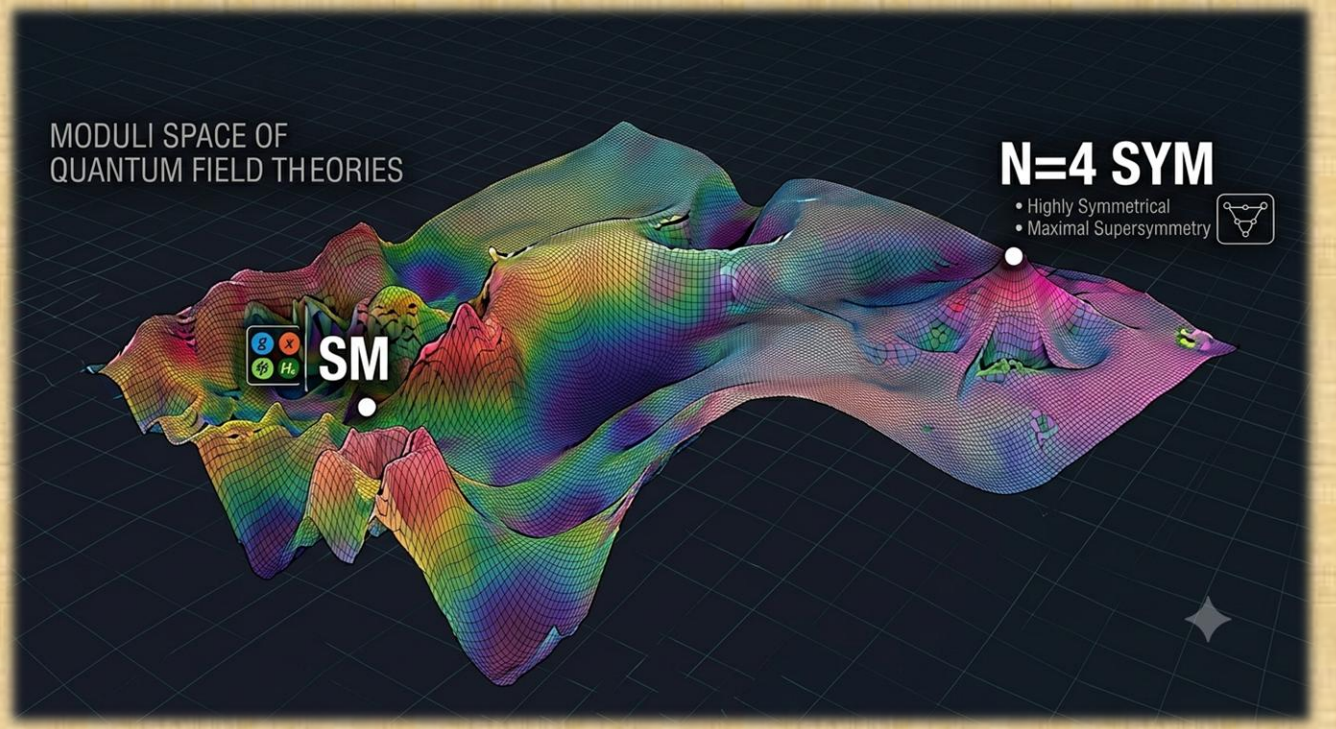
Martí Berenguer, Javier Mas, Juan Santos-Suárez and Alfonso V. Ramallo

JHEP

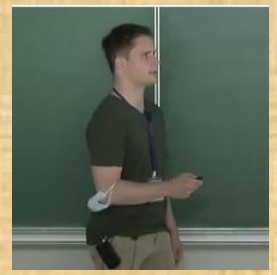
Chiral symmetry breaking and restoration by helical magnetic fields in AdS/CFT

Martí Berenguer,[a] Javier Mas,[a] Masataka Matsumoto,[b] Keiju Murata[c] and Alfonso V. Ramallo[a]

Integrability and Gauge Theories








JHEP

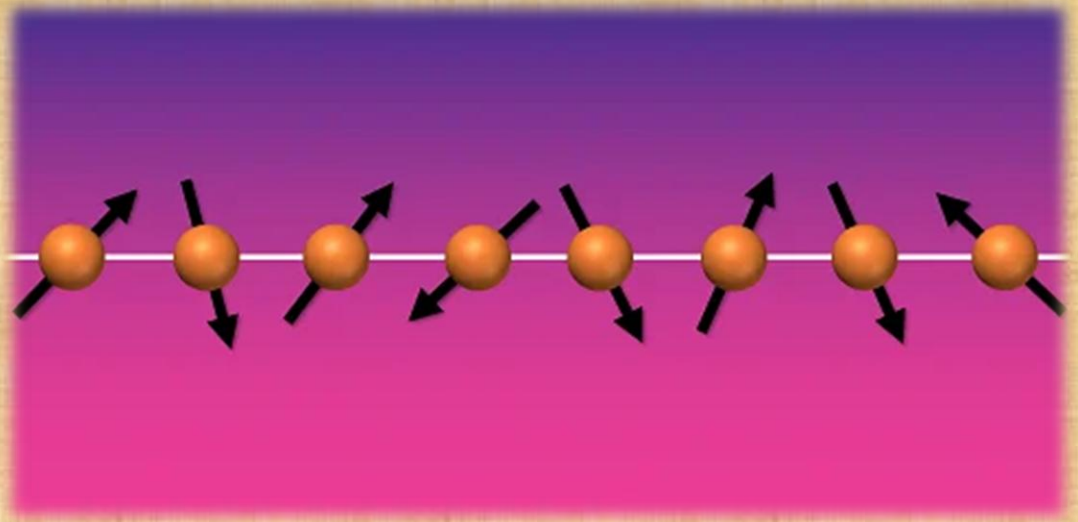
Jordanian deformation of the non-compact and $\mathfrak{sl}_2$-invariant $XXX_{-1/2}$ spin-chain

Riccardo Borsato and Miguel García Fernández

JHEP

Non-commutative deformations of gauge theories via Drinfel'd twists of the scale symmetry

Riccardo Borsato [a] and Tim Meier [a]



Quantum field approaches to gravity

Luca's talk

Nonlinear evolution equations

Phenomena common to many models of physics

Turbulence

Many physical systems develop dynamics at scales much smaller than the ones initially present in the system.

Addressed in fluids and incoherent regimes

Coherent forms of turbulence

Energy Cascades and Condensation via Coherent Dynamics in Hamiltonian Systems

Anxo Biasi[1], Patrick Gérard[2]

Commun. Math. Phys. (2025) 406:264

What happens in general relativity when energy concentrates at small scales?

Neural networks and black holes beyond GR



Discovery of rotating black hole solutions

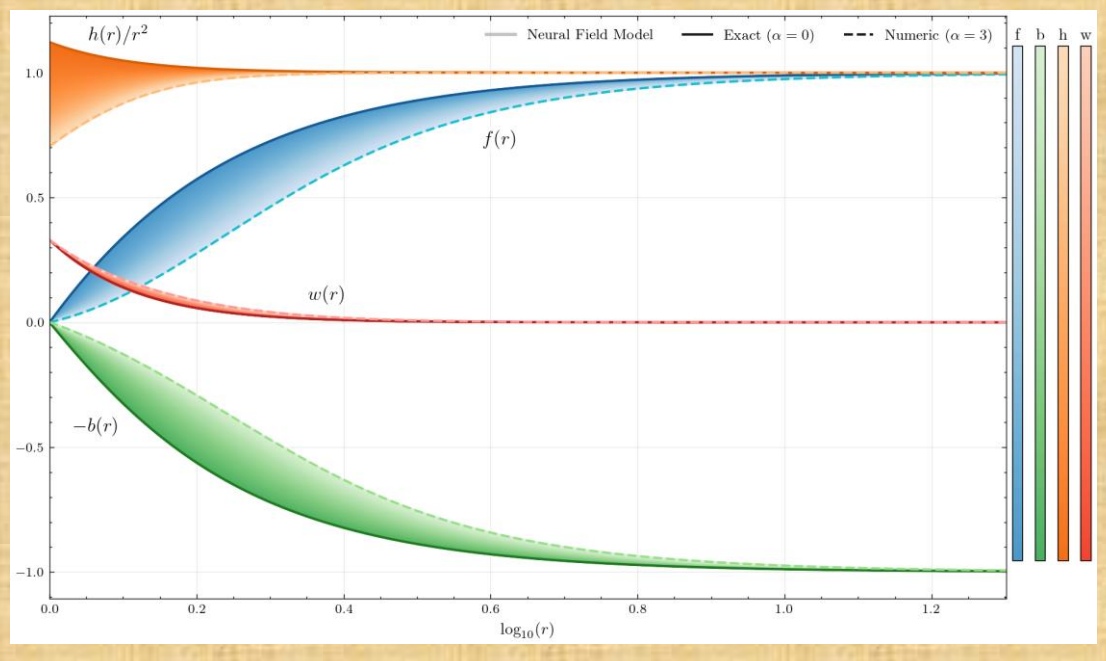
Traditional numerical methods: high precision - initial seed

Neural Networks: low precision - no initial seed

NEW: Discovery-refinement scheme

high precision - no initial seed

$$\frac{\|f_{\text{numeric}}(x) - f_{\text{exact}}(x)\|_{L^2}}{\|f_{\text{exact}}(x)\|_{L^2}} \sim \mathcal{O}(10^{-160})$$



IGNITE

International presence

Conference in Santiago

Iberian Strings 2026

<u>Research stays:</u> MIT, Caltech, Trinity College Dublin and Harvard (next fall).

<u>Seminars:</u> Princeton, NYU, ETH Zurich, etc.

Quantum Computing Education Initiative (The End)

Javier Mas

José Edelstein

Alberto Insua

Irais Bautista

Quantum Computing Masterclasses

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Thanks!

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