



MATTER AND
THE UNIVERSE

Formal Theory

String Theory and Mathematical Physics

Elli Pomoni

Hamburg 6.12.2024



The String Theory group

A Small group

MATTER AND
THE UNIVERSE **MU**



Joerg
Teschner



Volker
Schomerus



1 Postdoc
2 PhDs



Craig
Lawrie



Elli
Pomoni



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1+2 Postdocs

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Craig
Lawrie



Till
Bargheer



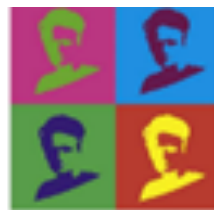
Elli
Pomoni



The String Theory group

A Small group, greatly expanded by third party funds

25% FTEs core funded
75% FTEs 3rd party funded



12 Postdocs
12 PhDs



SAGEX
Scattering Amplitudes:
from Geometry to Experiment



Funded by
the European Union



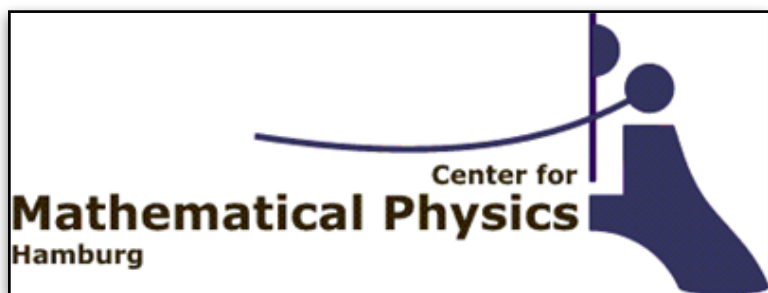
European Research Council
Established by the European Commission



HELMHOLTZ
Funding of first-time appointments

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Mathematics Inspired by
String & Quantum Field Theory
Research Training Group grant



Particles, Strings and
the early Universe
Collaborative Research Center grant

Higher Structures, Moduli
Spaces and Integrability
Collaborative Research Center grant

20 PIs and 25 FTEs



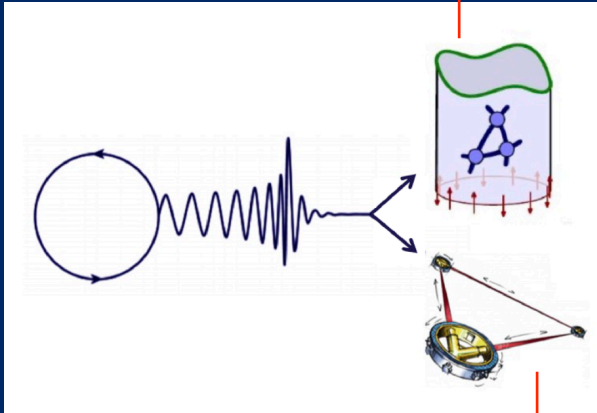
2005 2006 2008 2010 2012 2014 2016 2018 2022 2024



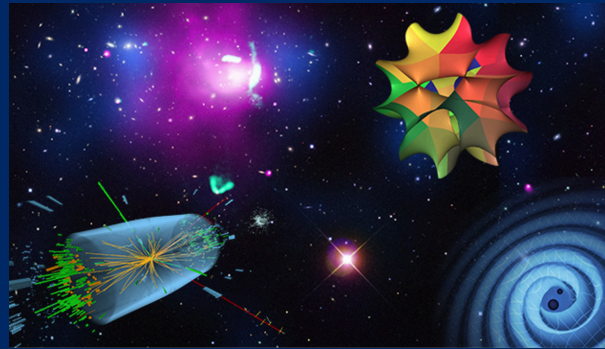
Mission

Rethinking Quantum Field Theory

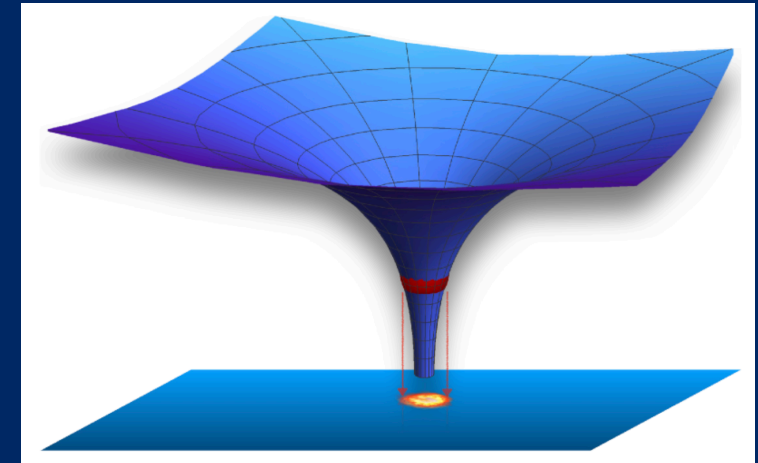
Strongly coupling
Quantum regime



Precision measurements



Unraveling Quantum gravity



Quantum Black Holes

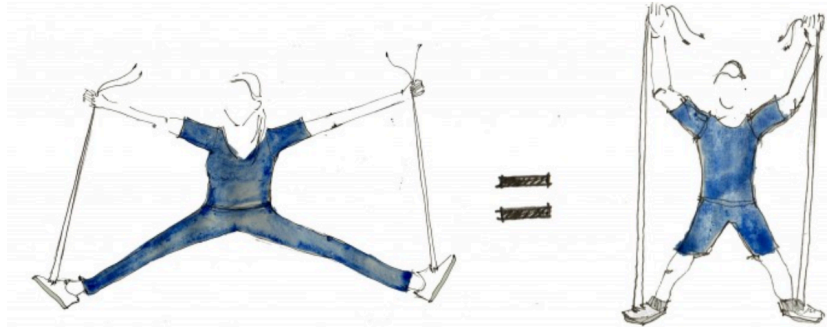
Inspire new mathematics

A highlight

Finite Temperature

Rethinking Quantum Field Theory

Thermal bootstrap



Using only **symmetries** and
general principles
solve for the dynamics

Quantum critical systems

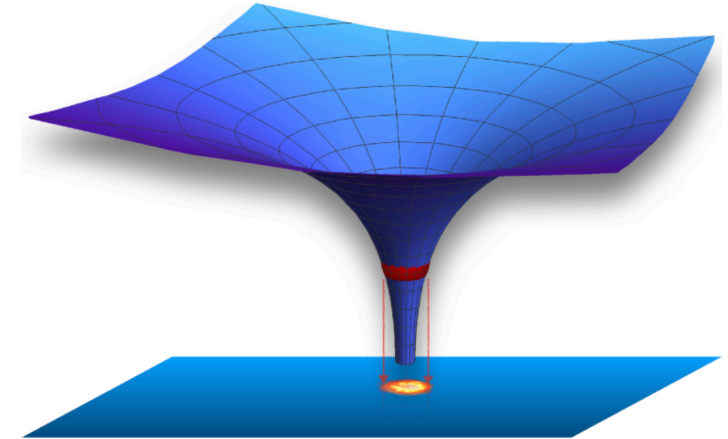
Computability at
Strongly coupling
Quantum regime &
Finite Temperature

New Mathematics

New Group theory objects

Unraveling Quantum gravity

Quantum Black Holes



Holography translates
thermal data into
Black Hole physics

Critical $O(N)$ models at finite temperature

[2411.00978 J.Barrat, E. Marchetto, A.Miscioscia, E.Pomoni]

Second-order phase
transitions in
quantum magnets &
liquid-gas phases.

Tauberian theorem:
asymptotic for heavy
spectrum

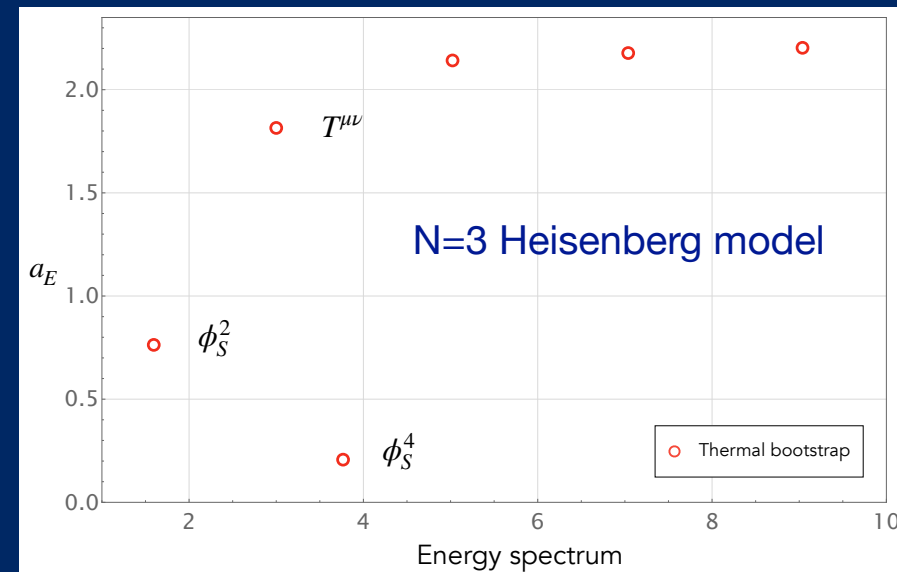
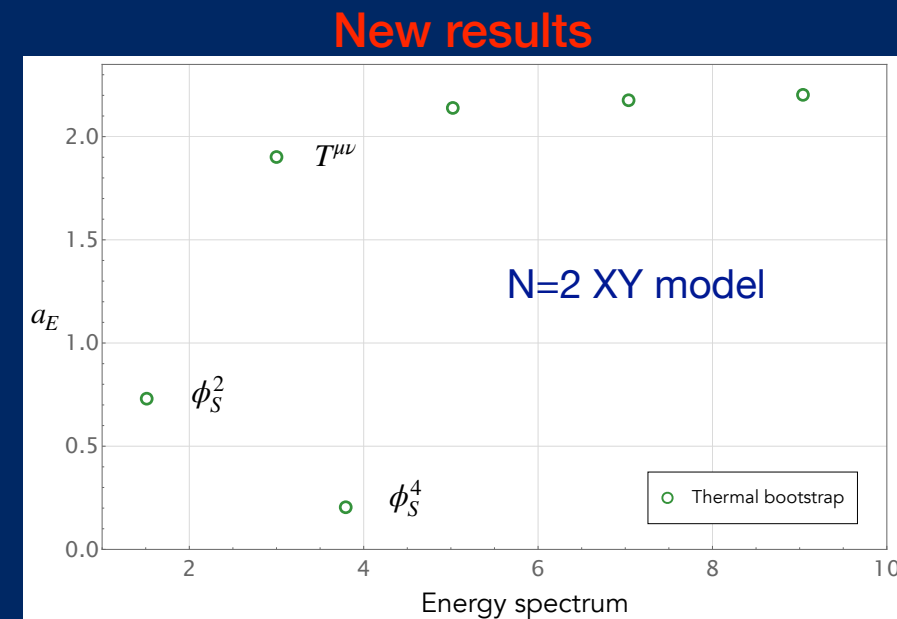
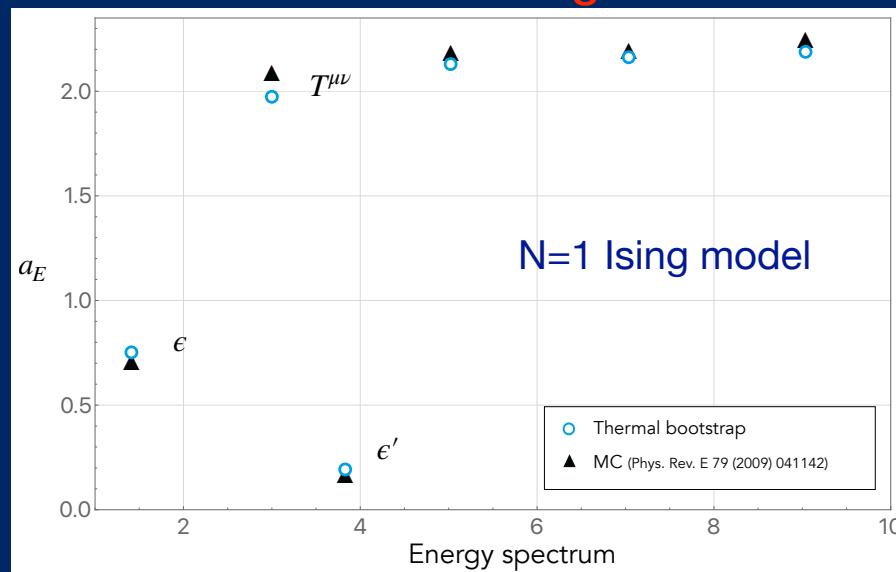
a_E : thermal vevs

The phase transitions
happen at finite
temperature!

Monte Carlo is the only
other existing alternative.
Results exist only for the
simplest Ising model.

MC: computational heavy

Check the method against MC



Critical $O(N)$ models at finite temperature

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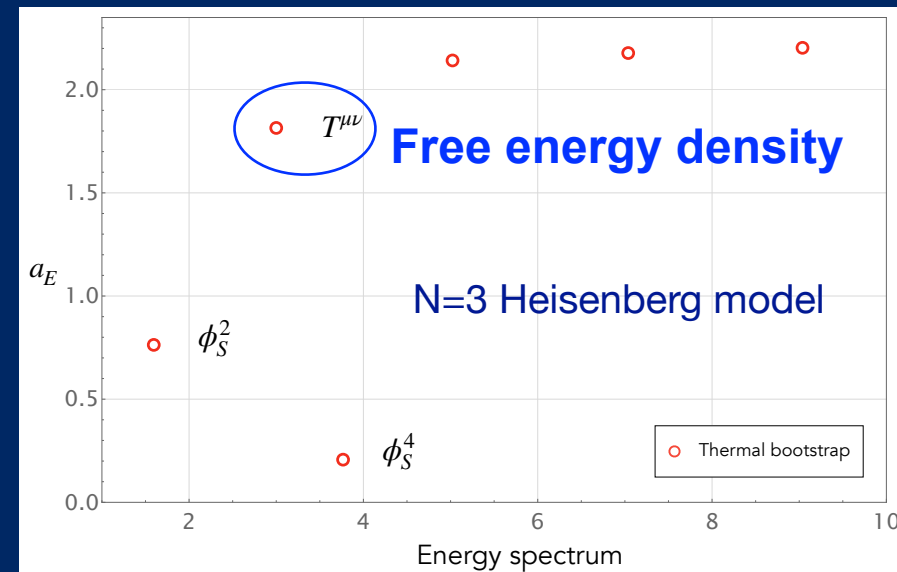
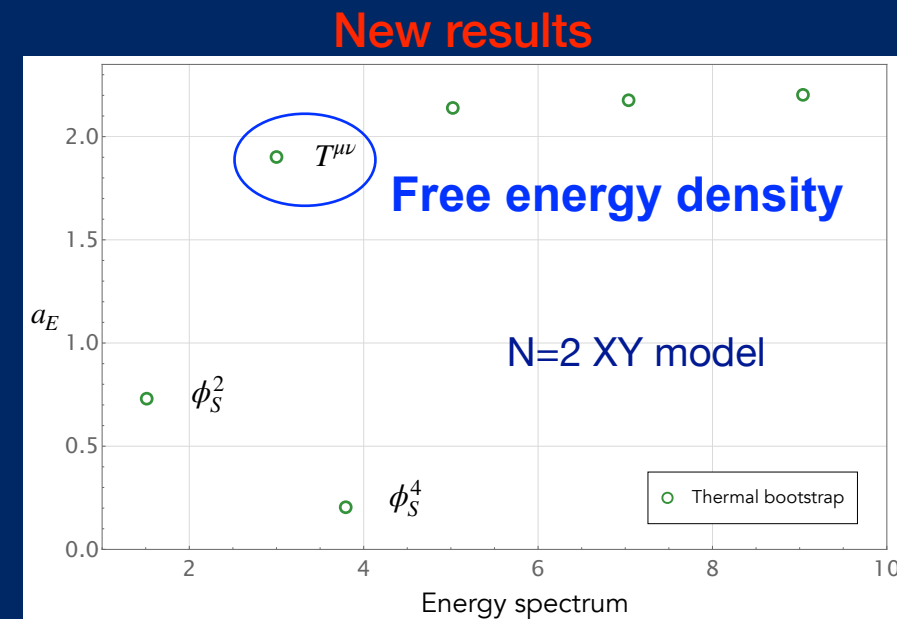
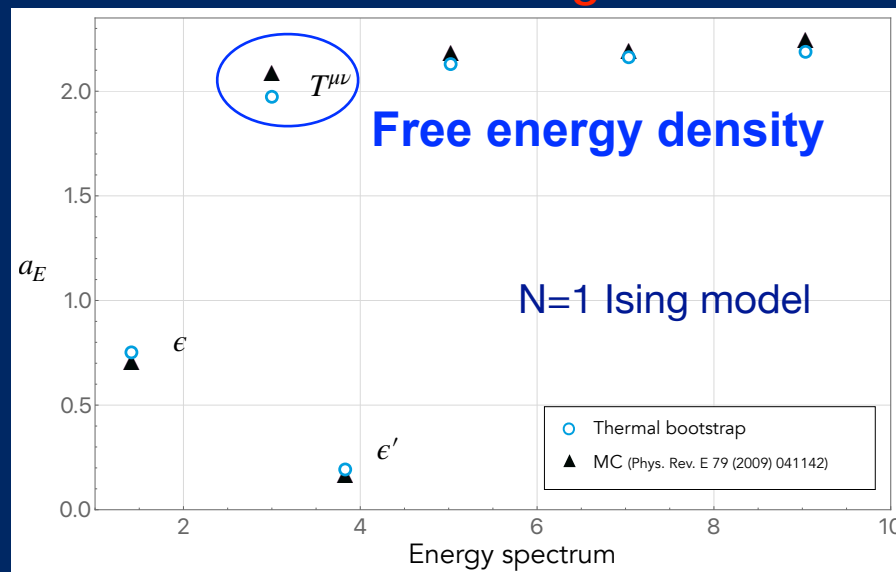
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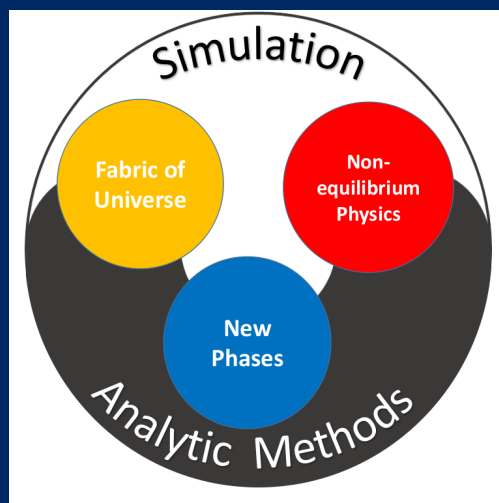
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Critical $O(N)$ models at finite temperature

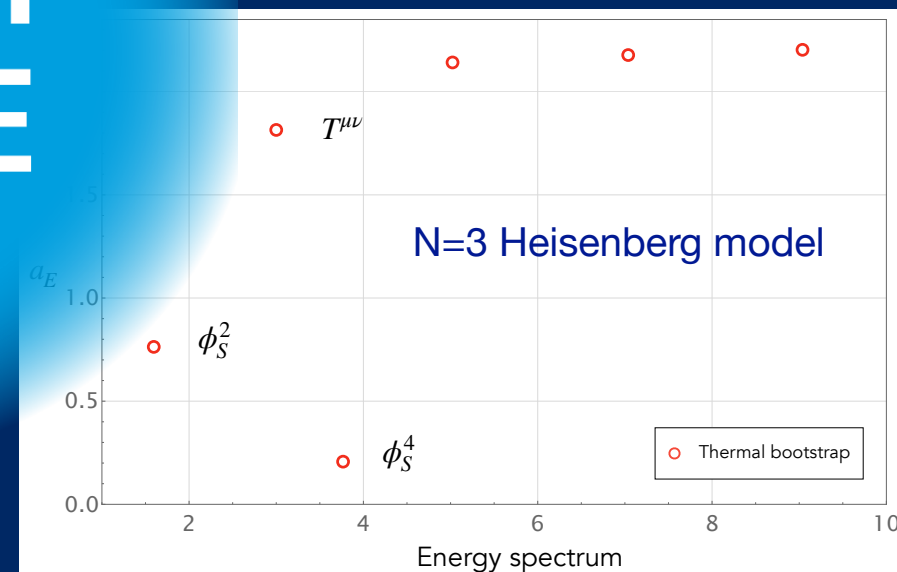
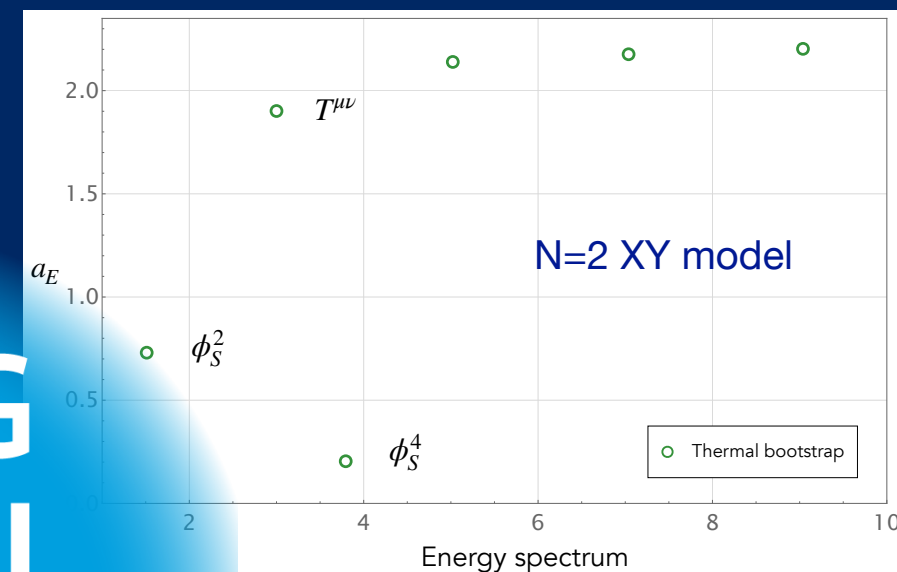
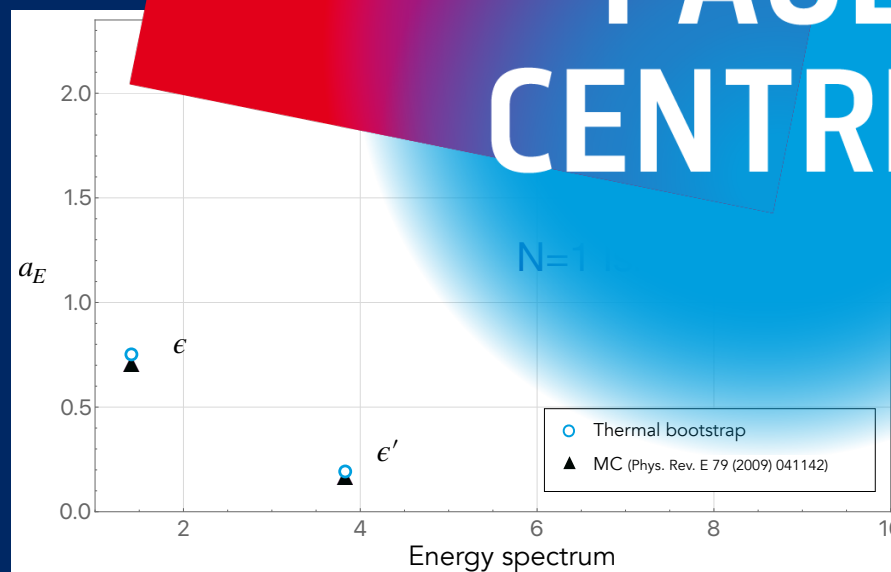
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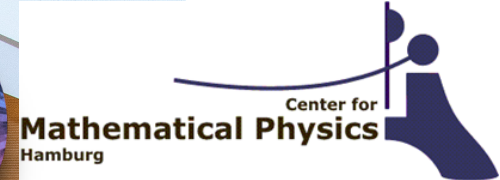
WPC white paper

WOLFGANG
PAULI
CENTRE



WOLFGANG PAULI CENTRE

Interdisciplinary
centre
for theoretical
physics



Interplay
with
mathematics

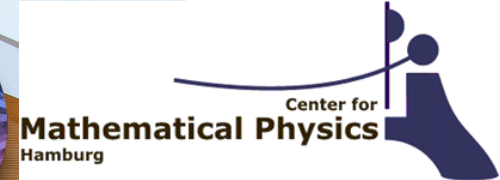


Small initial core funding, huge impact

- Collaboration with Mathematics (Collaborative Research Center)
- Within MU (Quantum Universe Excellence Cluster)
- Wolfgang Pauli Centre (collaboration across topics MML)

WOLFGANG PAULI CENTRE

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physics



Interplay
with
mathematics



WPC provides potential to repeat the success story with Mathematical Physics.
For that need sufficient core support (see WPC white paper).

Thank you

Contact

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