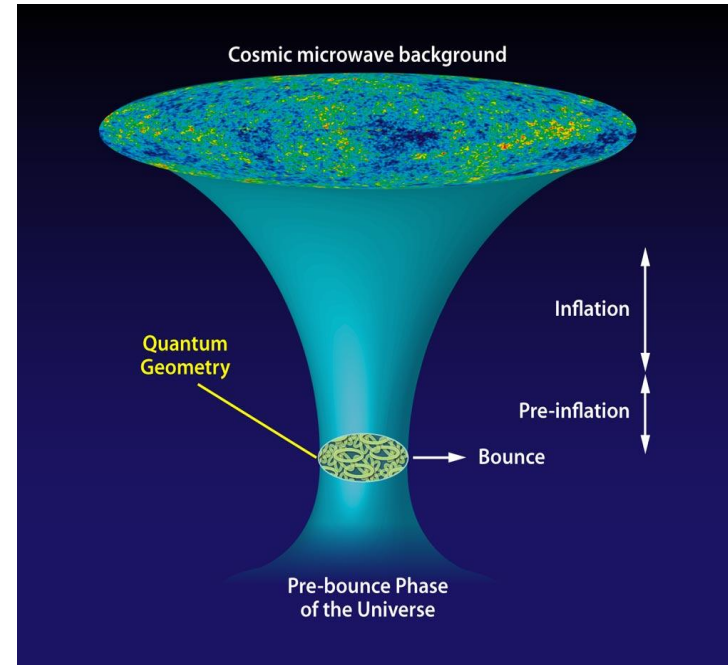
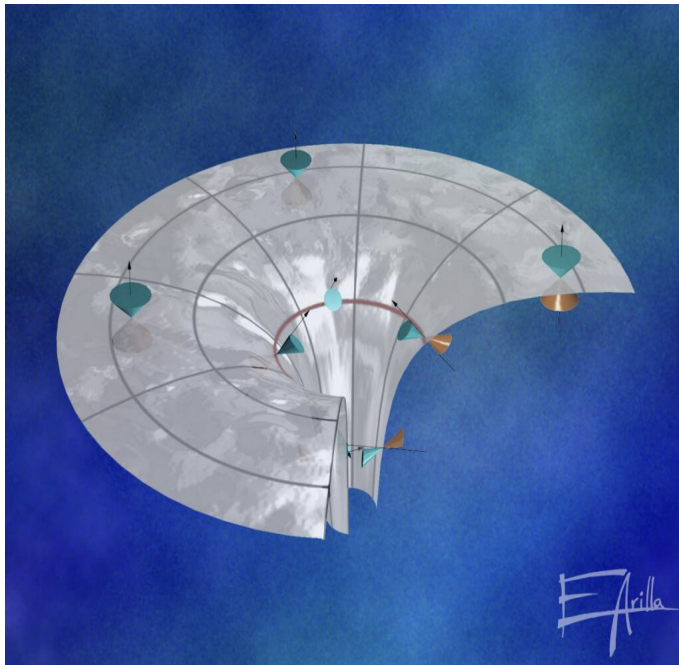


<https://sites.google.com/view/qfg-group>

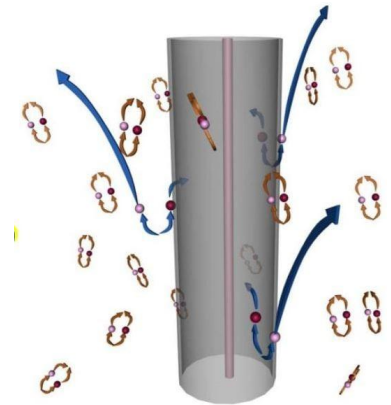


Research lines

Interplay between quantum phenomena and gravity

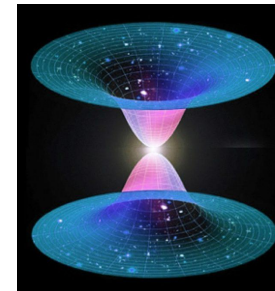
QFT in curved spacetimes: particle creation

- Hawking radiation in black holes
- Cosmology: primordial fluctuations
- Schwinger effect



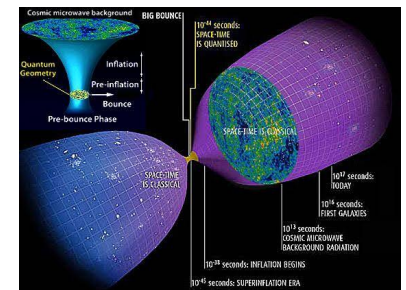
Semiclassical gravity: effects from the RSET

- Black hole alternatives: black stars



Quantum gravity

- Non perturbative canonical quantization (LQG & LQC)
- Quantum gravity footprints in the CMB
- Problem of time



UCM researchers in this group

Permanent professors



Luis J. Garay



Jose A. Ruiz Cembranos



Mercedes Martín-Benito

Postdoc



Lucía Menéndez-Pidal

(although no member of Iparcos)

UCM researchers in this group

Permanent professors



Luis J. Garay



Jose A. Ruiz Cembranos



Mercedes Martín-Benito

Postdoc



Lucía Menéndez-Pidal

To join us in the near future



Daniele Oriti

PhD students at UCM

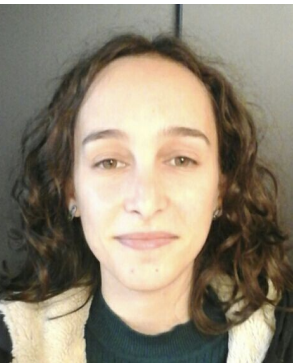
Finished in 2023



Valentin Boyanov

Thesis: *Vacuum polarization and regular gravitational collapse*

Postdoc at CENTRA, Univ. Lisboa (since 05/2023)



Rita Neves

Thesis: *Observational imprints from loop quantum cosmology*

Postdoc at Sheffield University (since 11/2023)

Ongoing



Álvaro Álvarez Domínguez

Quantization of charged fields in electromagnetic backgrounds

Defense expected in 2025



Álvaro Parra López

Cosmological production of dark matter in the universe and in the laboratory

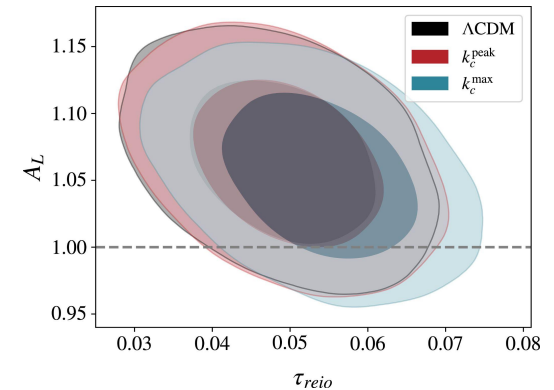
Defense expected in 2024

9 MSc students supervised since 2022

Scientific results in the last 2 years

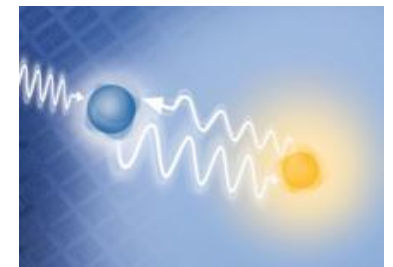
Observational consequences from LQC

- Solid evidence that “hybrid LQC” (a formalism to deal with inhomogeneities in LQC) is a suitable framework to model the early Universe, with a well defined pre-inflationary dynamics, and with predictions in agreement with observations.



QFT in nontrivial backgrounds

- Progress in our understanding of particle creation phenomena in QFT, such as in the context of the Schwinger effect: generalized quantum Vlasov equation.
- Operational meaning to the concept of particle.
- Measurement theory for QFT based on the coupling to detectors.



Weyl transverse gravity

- Relation between the quantizations of GR and WTDiff at the canonical and covariant levels.
- Exhaustive analysis of their equivalence from multiple aspects.

Dissemination

Publications

14 papers in peer reviewed journals (JCAP, JHEP, PRD, CQG, etc) and 4 preprints.

Conferences

More than 20 talks at different international conferences, e.g

- Luis J. Garay. *Black semiclassical stars*. Invited talk at RQI-North online 2022.
- Mercedes Martín-Benito. *Cosmological perturbations in Loop Quantum Cosmology*. Plenary talk at Loop's 22, ENS-Lyon, France.
- Mercedes Martín-Benito. *Contrasting Loop Quantum Cosmology with observations*. Keynote talk at EREP 2023, UPV-Bilbao, Spain.

Closest collaborations

- MICIN coordinated project with nodes at IAA, IEM, IFT:
PID2020-118159GB-C44
- Carlos Barceló at IAA-CSIC, Raúl Carballo-Rubio at CP3-Origins/USD, Javier Olmedo at UGR: co-supervision of multiple PhD students.



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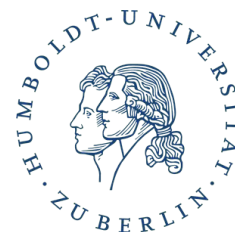
- Group of Eduardo Martín-Martínez at University of Waterloo



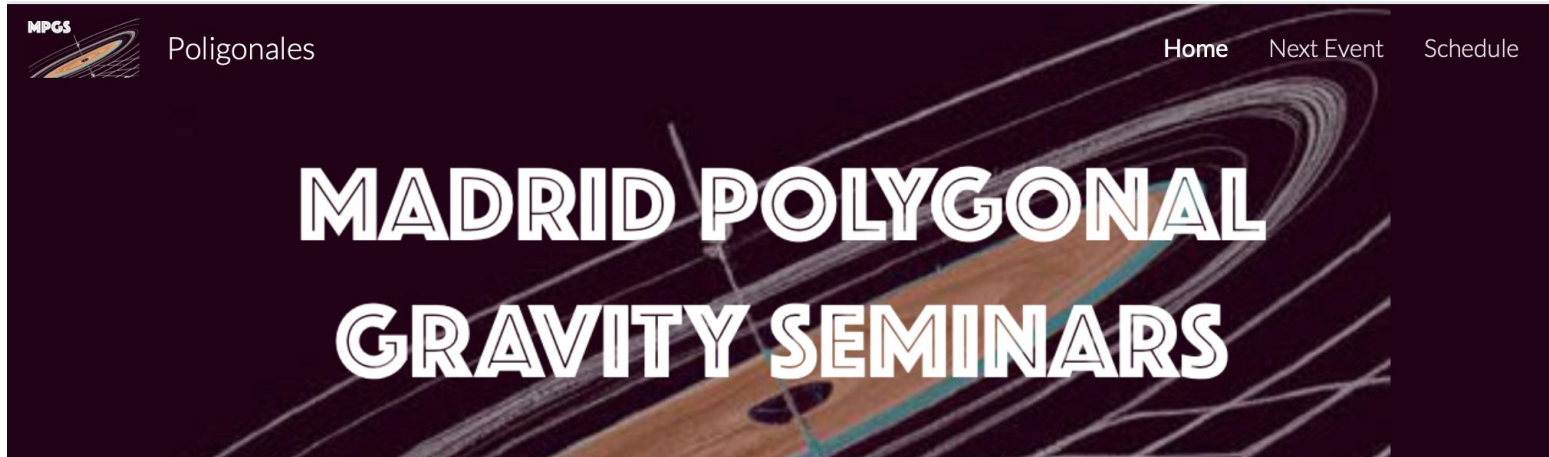
**UNIVERSITY OF
WATERLOO**



- Ana Alonso-Serrano at Humboldt Univ. and Albert Einstein Institute.



<https://sites.google.com/view/polygrav>



The Madrid Polygonal Gravity Seminars brings to Madrid recognized international experts in the field of gravity.

It is a seminar series put together by people from four different institutions in Madrid: IEM-CSIC, IFT-UAM/CSIC, Carlos III University, and Complutense University, with research interests that lie mostly in the interface between gravity and quantum theory.

The seminar is monthly and rotates between the involved institutions, hosting two talks in each event.



THANKS