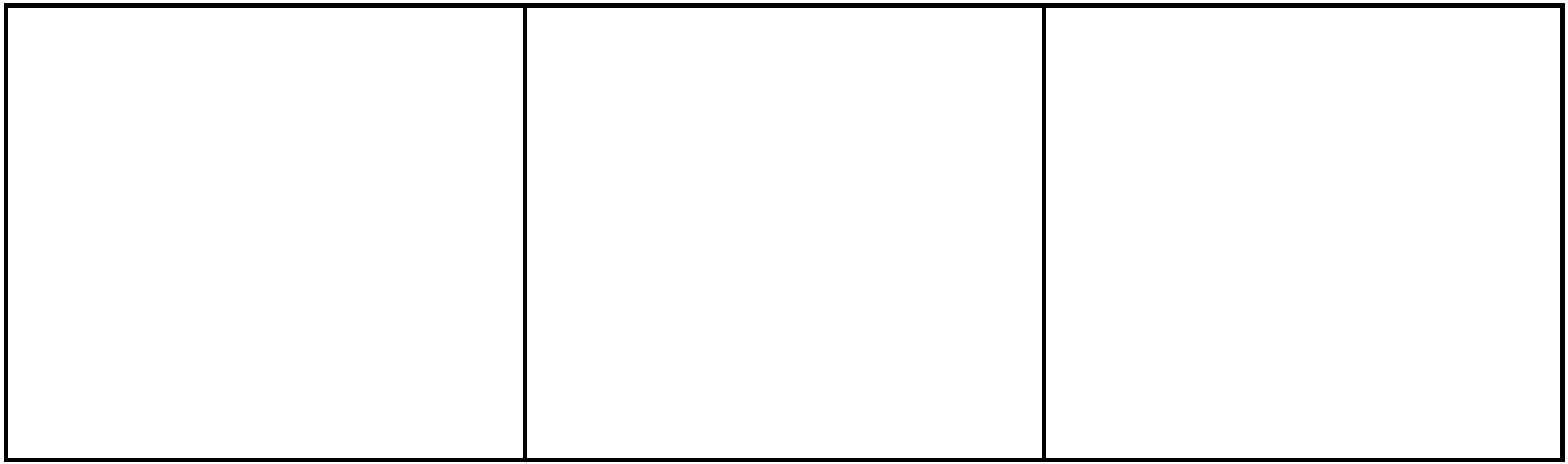
Real Scalar Phase Transitions: Bubble Nucleation, Nonperturbatively

with Oliver Gould & David Weir



Anna Kormu (she/her)

Third EuCAPT Annual Symposium

1.6.2023

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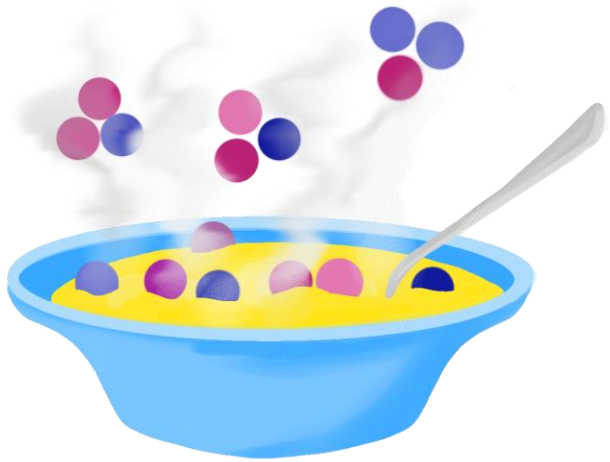
Universe at 100GeV 		

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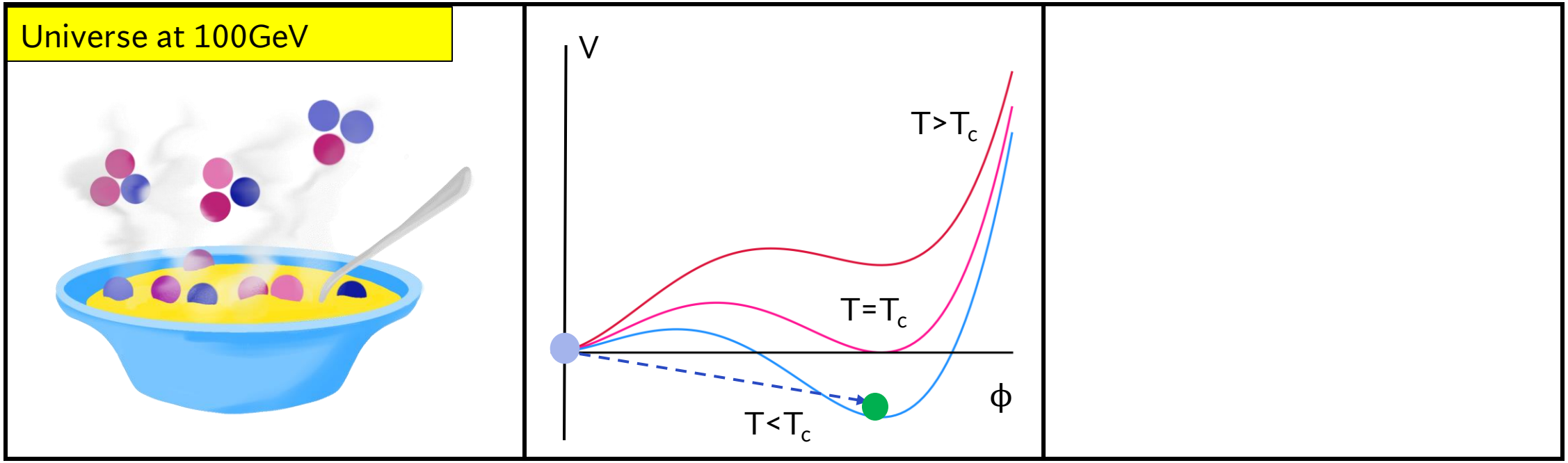

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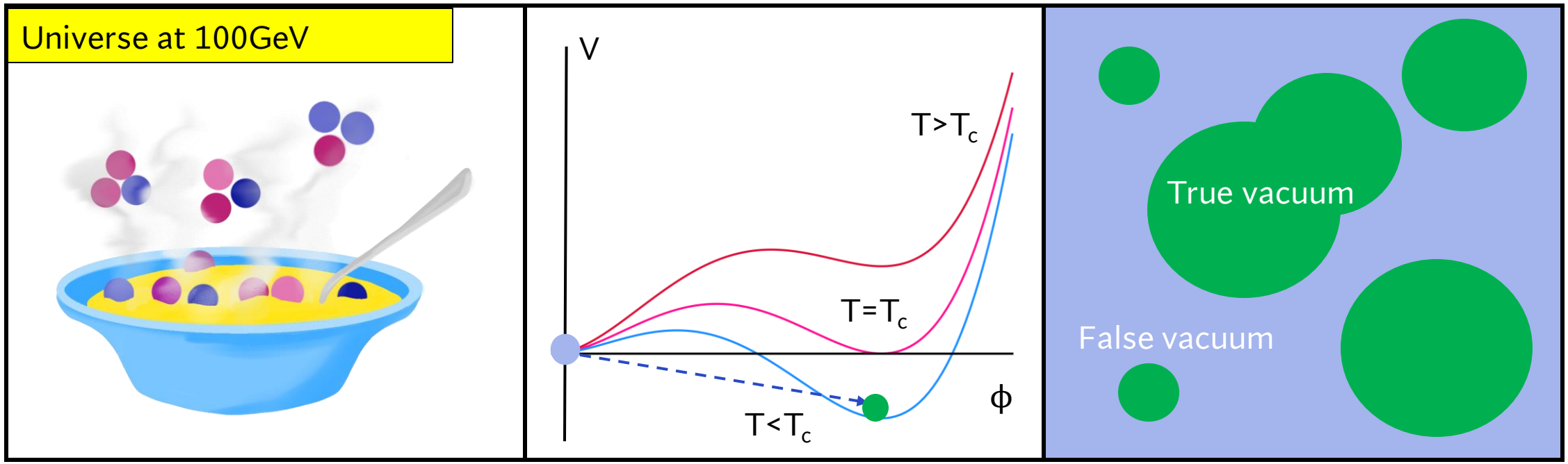

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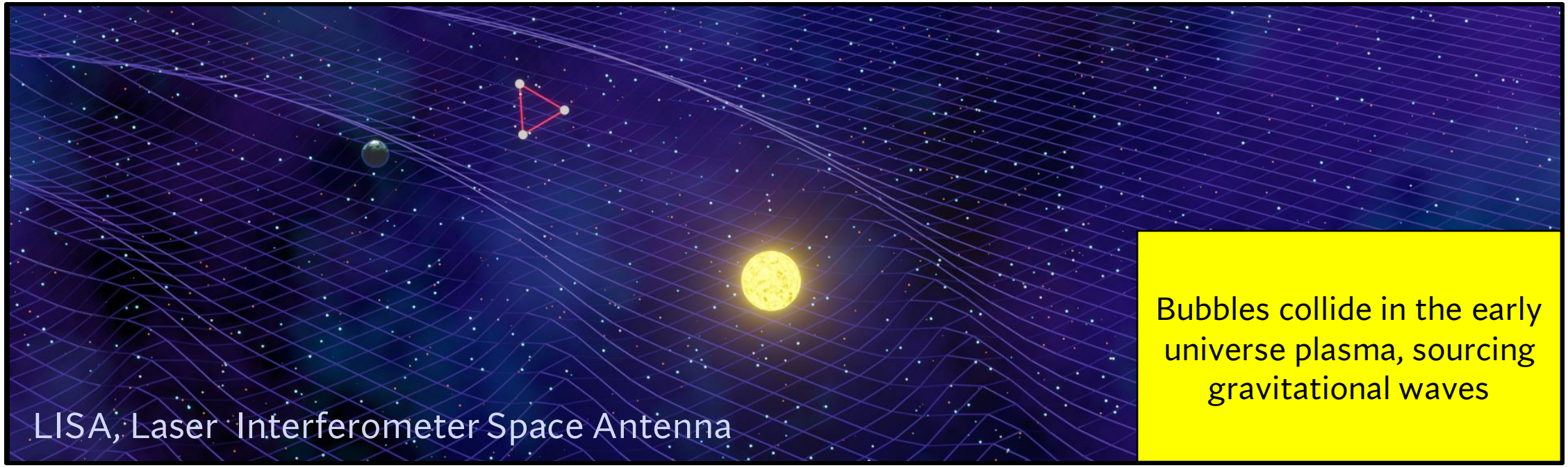
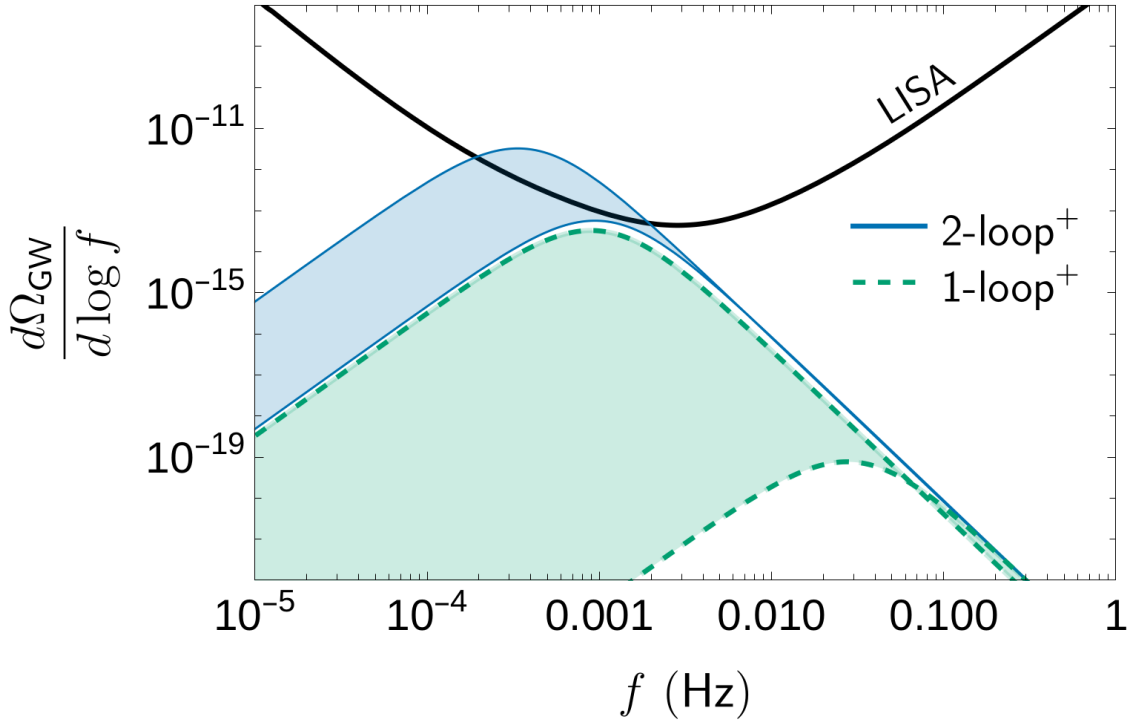


Real Scalar Phase Transitions: Bubble Nucleation, Nonperturbatively

- Determining the nucleation rate is analytically difficult → perturbation theory
- Perturbation theory suffers from the so-called infrared problem



Gould, Tenkanen arXiv:2104.04399

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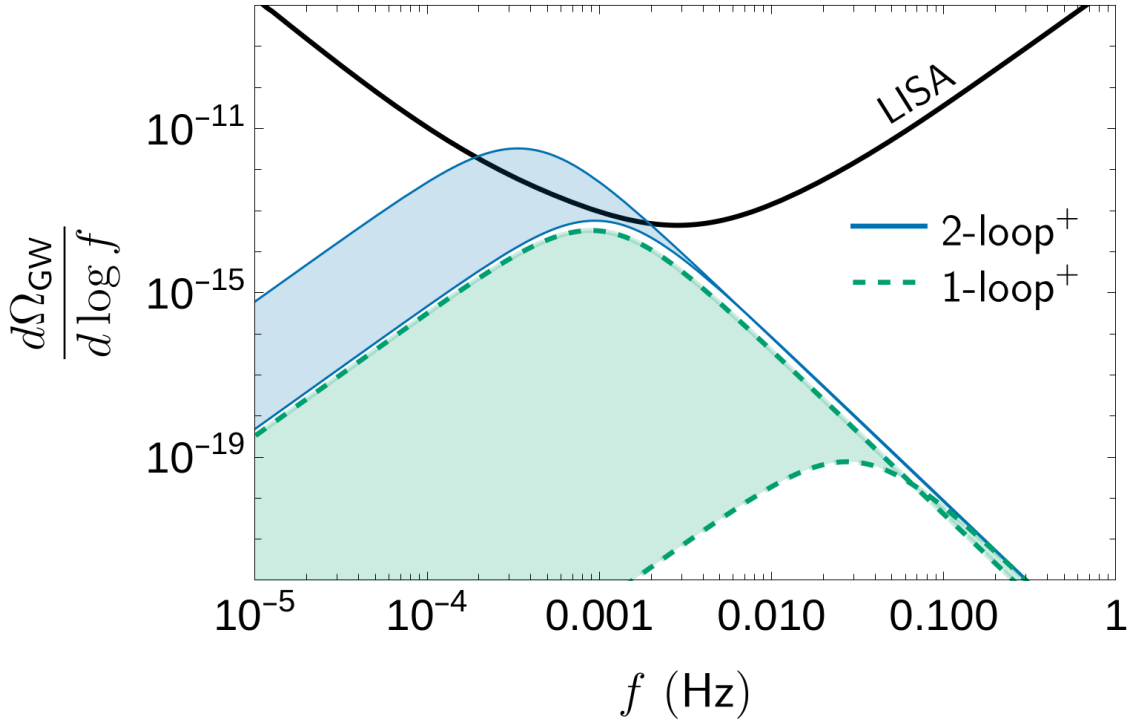

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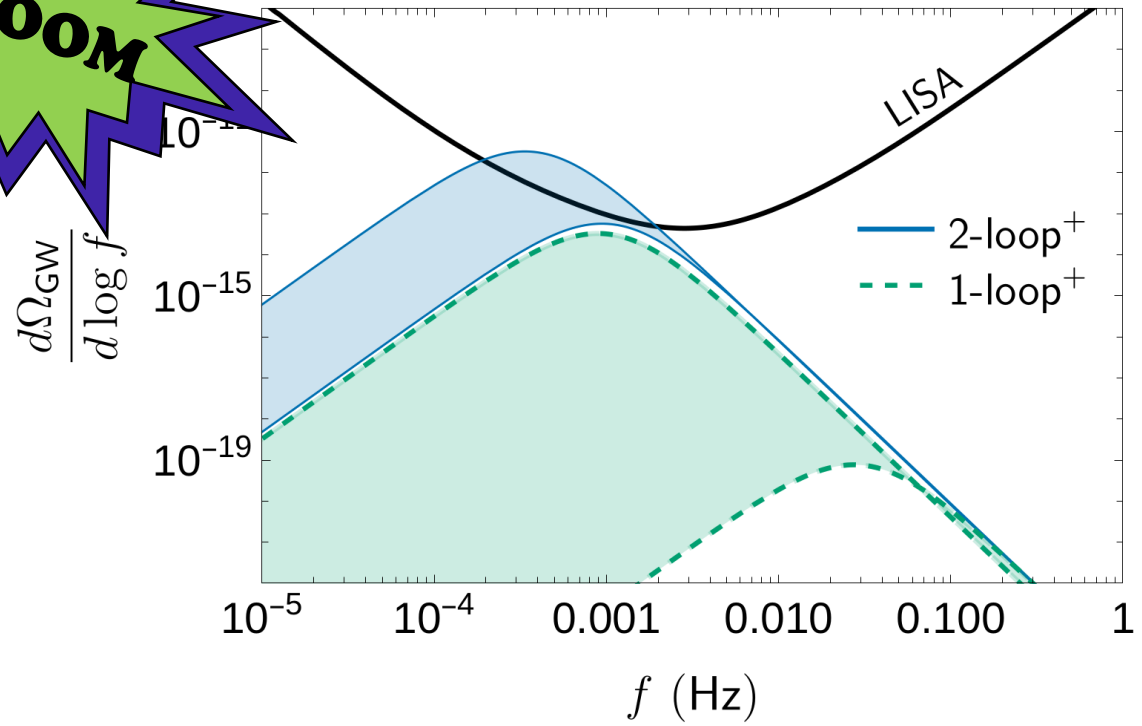

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Real Scalar Phase Transitions: Bubble Nucleation, Nonperturbatively

Introduces uncertainty! How accurate are our cosmological predictions?

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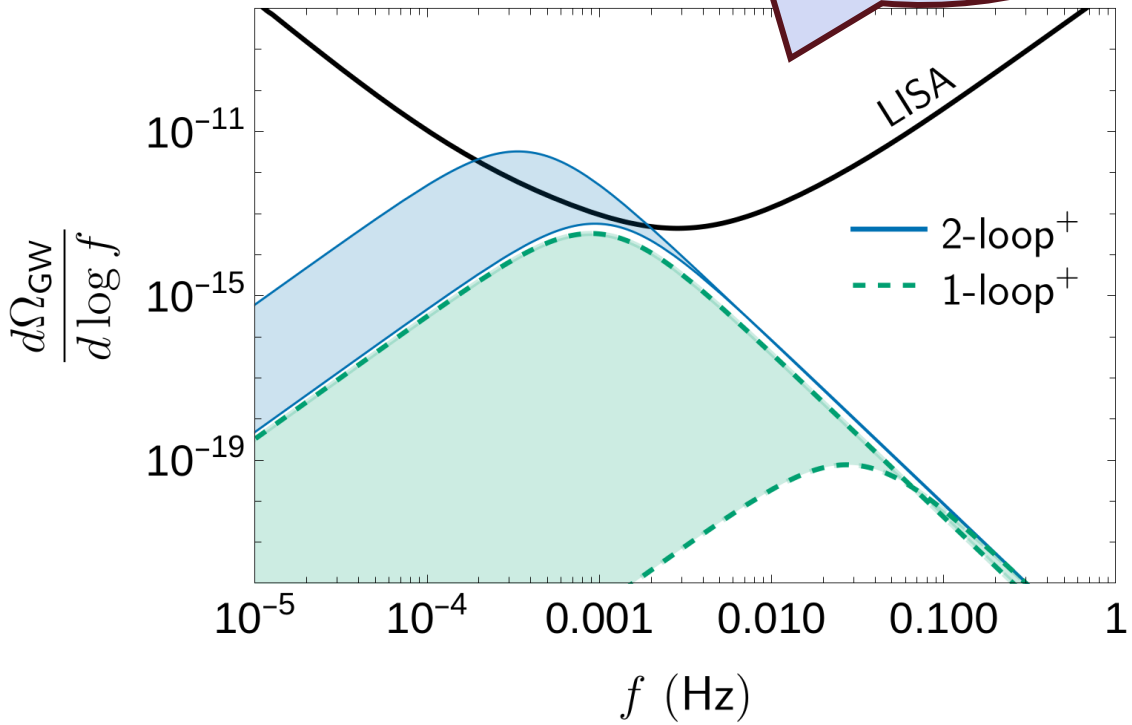

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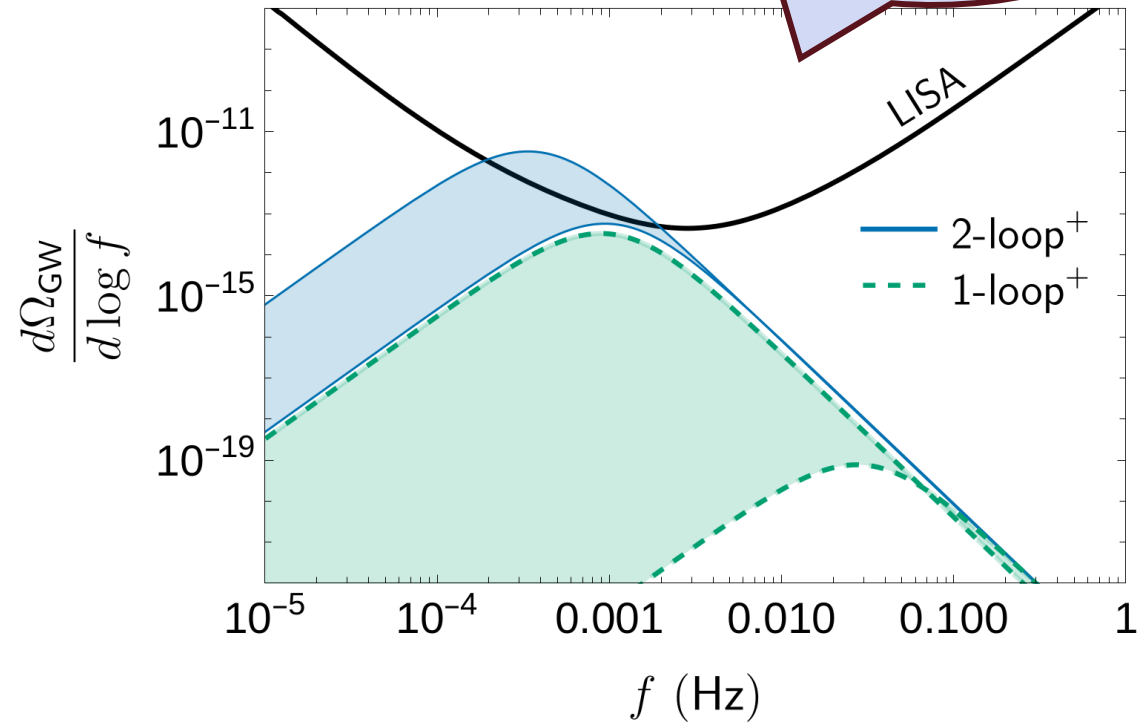
- Simulations to the rescue! (hep-lat/0103036, hep-ph/0009132)

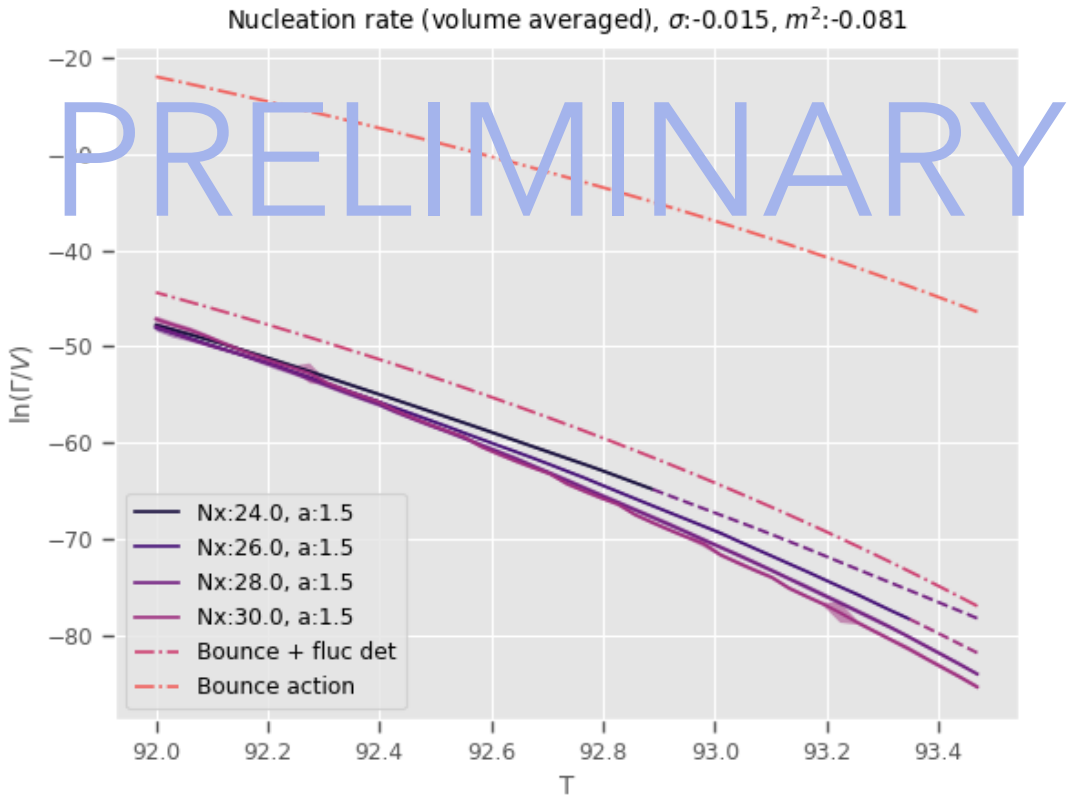


Gould, Tenkanen arXiv:2104.04399

Real Scalar Phase Transitions: Bubble Nucleation, Nonperturbatively

Gould, arXiv:2101.05528

- Toy model that has key features of BSM models
- Dimensional reduction 4D cont → 3D cont → 3D lattice (arXiv:hep-ph/9508379)
- MCMC + real time simulations



Real Scalar Phase Transitions: Bubble Nucleation, Nonperturbatively

- Allows us to calibrate the uncertainty in phase transition parameters when obtained from perturbative results
- Accurate computations of the nucleation rate are crucial for calculating e.g. the GW power spectrum

One-bubble takeaway

There can be large uncertainties in nucleation rates calculated from the bounce action