

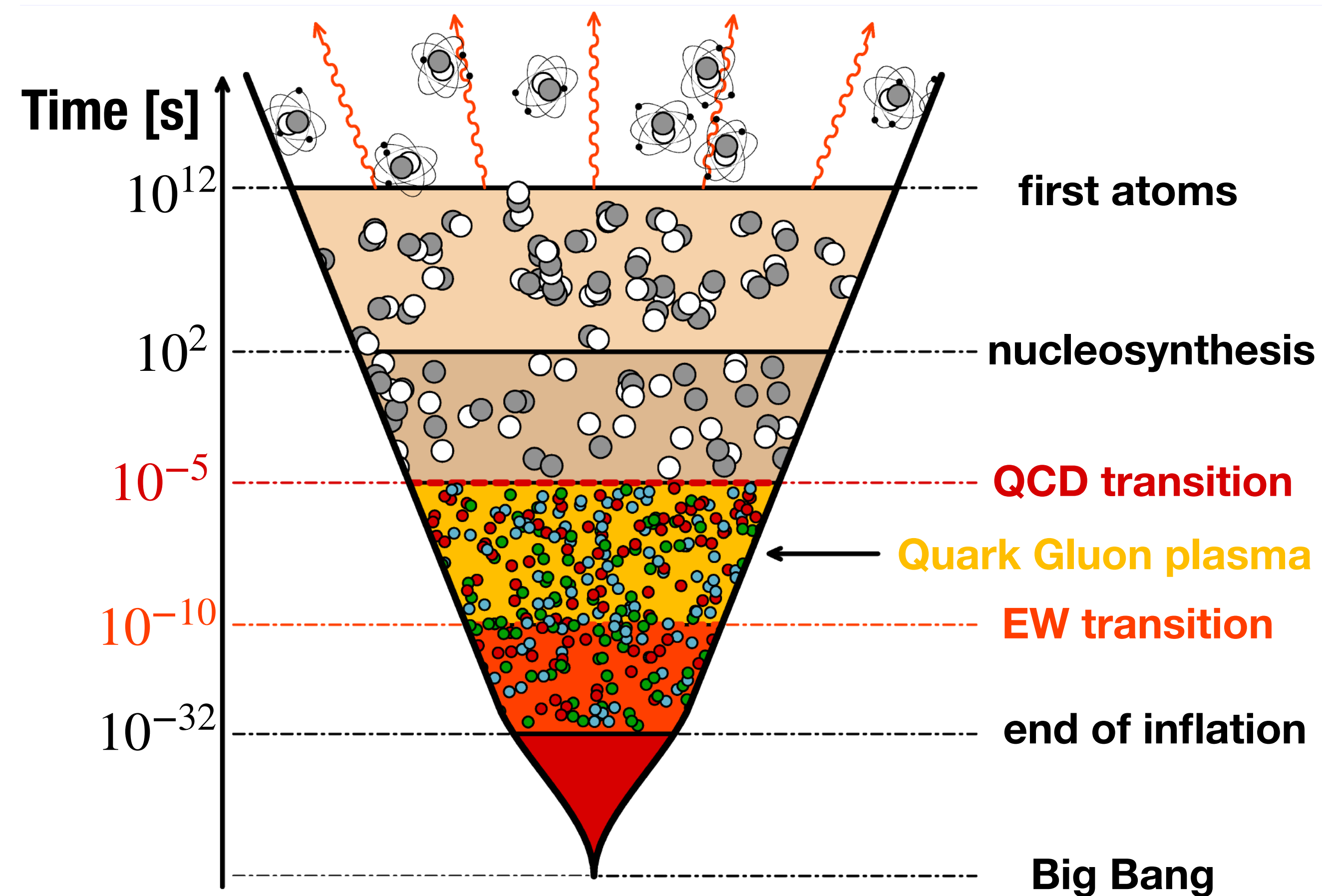
ExtremeQFTs

*Quantum field theories
under extreme conditions:
precision calculations for
colliders and cosmology*

PID2024-161668NB-100

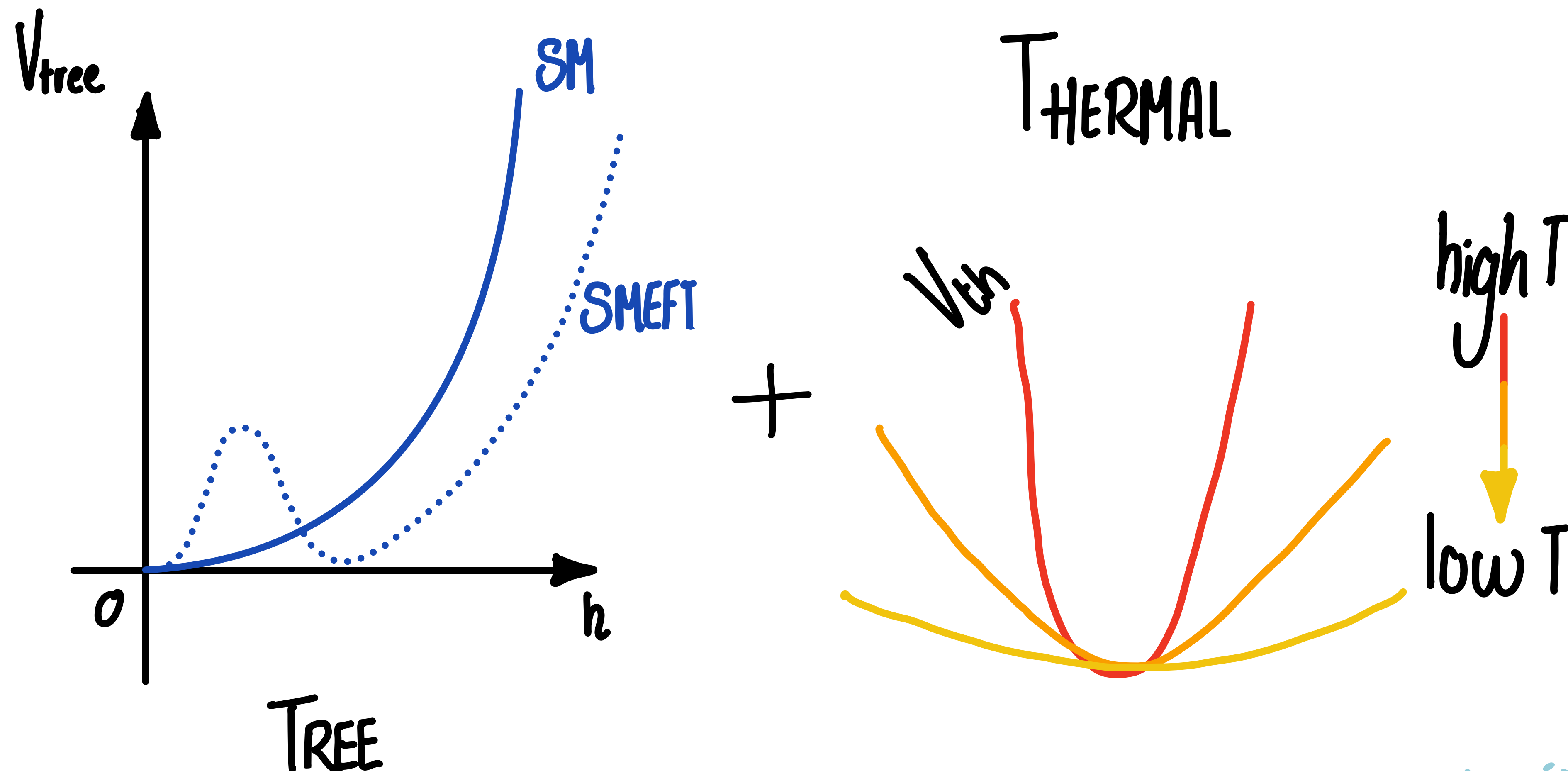
External review of FTAE

Granada, 24th April, 2026



Big picture of ExtremeQFTs project: EW physics at 10^{15} K

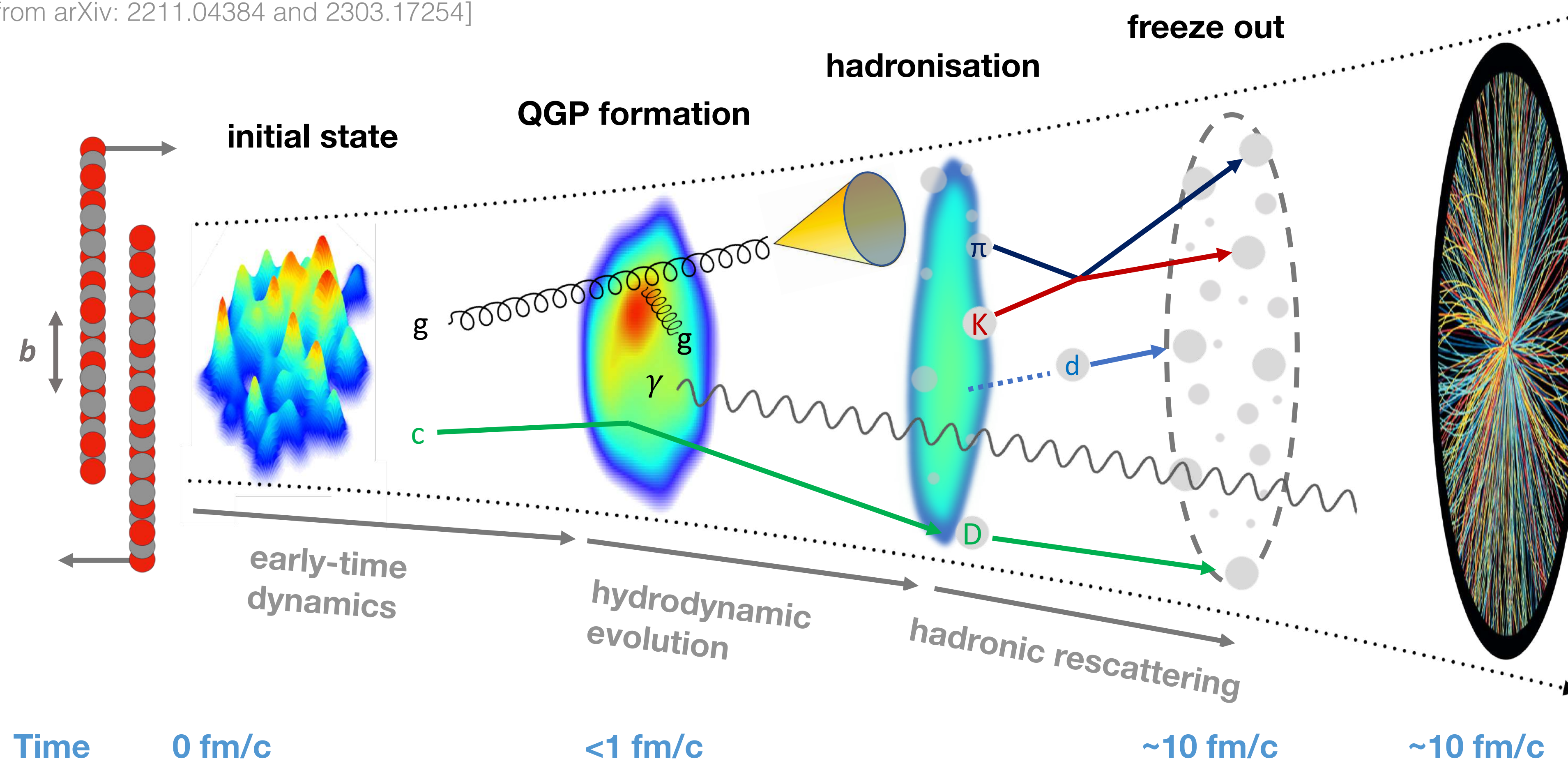
[Adapted from Mia West's talk @HEFT2025]



1st order EW phase-transition imprints GW spectrum & collider data

Big picture of ExtremeQFTs project: QCD at 10^{12} K

[Adapted from arXiv: 2211.04384 and 2303.17254]



Properties of hot QCD medium are encoded in jet properties

Global objectives of ExtremeQFTs project

GO1: Description of QCD jets in hot plasmas at leading order and beyond

GO2: Precise computation of PT and GW parameters



Specific objectives complementary to Miki's ERC

- Search for skyrmions at finite temperature
- Non-equilibrium features, e.g. bubble wall velocity

GO3: Complementary studies at collider and cosmological experiments

ExtremeQFTs project: research team

GO1: Description of QCD jets in hot plasmas at leading order and beyond

Alba Soto Ontoso



GO2: Precise computation of PT and GW parameters

Mikael Chala



GO3: Complementary studies at collider and cosmological experiments

Abdelhak Djouadi



ExtremeQFTs project: research team

GO1: Description of QCD jets in hot plasmas at leading order and beyond

Alba Soto Ontoso



GO2: Precise computation of PT and GW parameters

Samuel Abreu (Staff at CERN-TH)

- Starting in August 2026
- Amplitudes and multiloop calculations
- Precision collider physics

GO3: Complementary collider and experimental experiments

Mark Djouadi



ExtremeQFTs project: research team

GO1: Description of QCD jets in hot plasmas at leading order and beyond

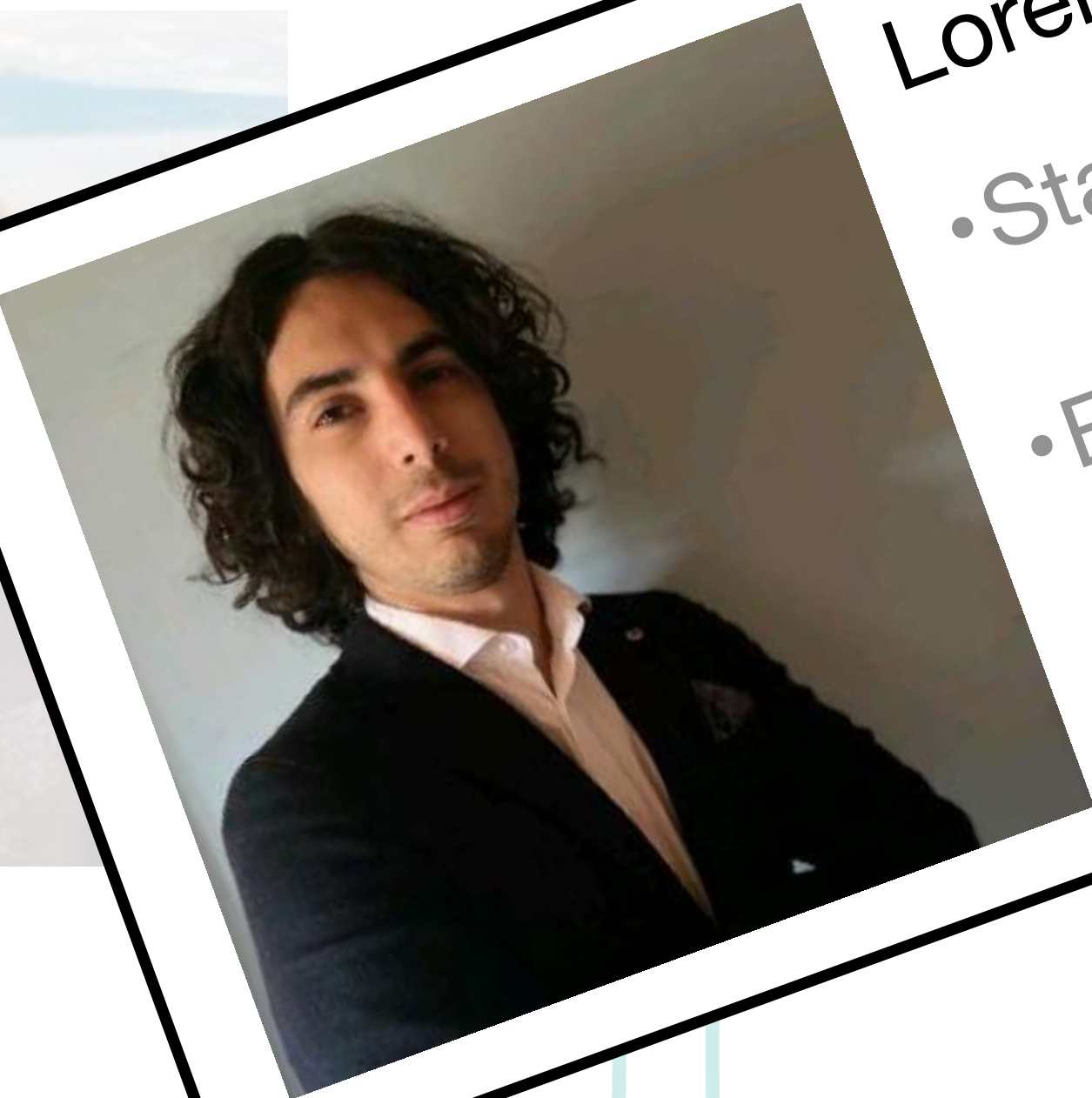
Alba Soto Ontoso



GO2: Precise computation of PT and GW parameters

Lorenzo Mai (U Genoa, Marzani's group)

- Starting in Fall 2026
- Electroweak higher-order computations
- Heavy-flavour and resummation



GO3: Complementary collider and theoretical experiments

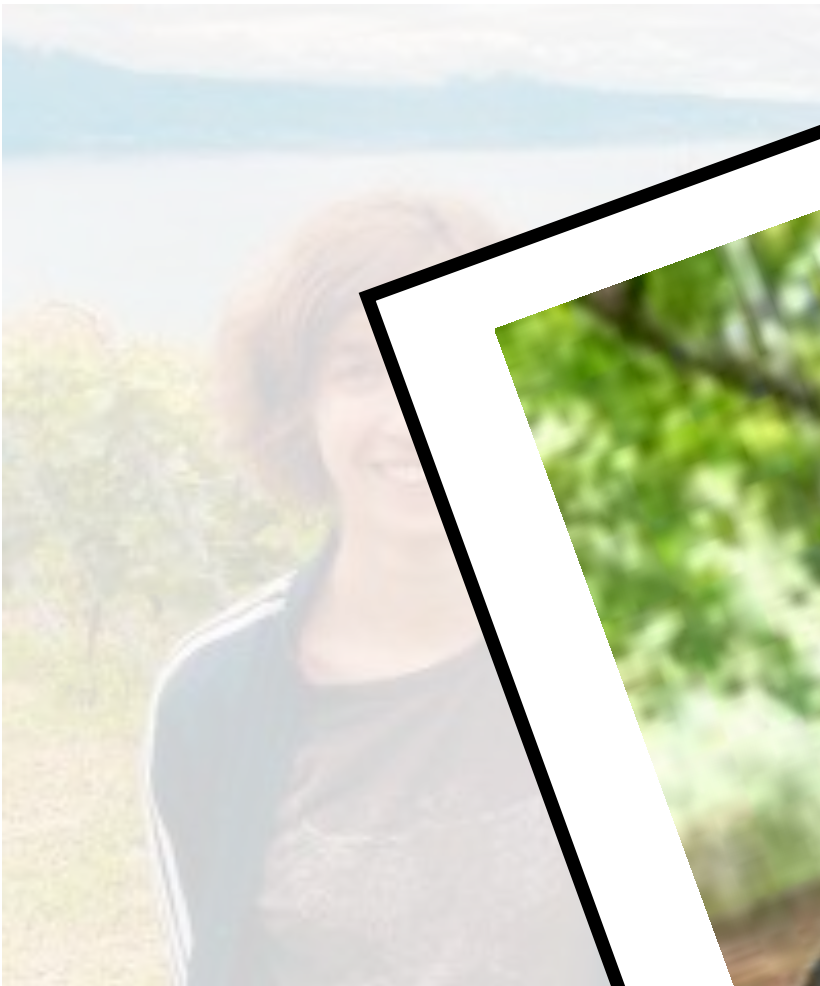
Mark Djouadi



ExtremeQFTs project: research team

GO1: Description of QCD jets in hot plasmas at leading order and beyond

Alba Soto Ontoso



GO2: Precise computation of PT and GW parameters

Victor López-Pardo (IGFAE)

- PhD with Armesto and Ferreiro
- Starting in early 2027
- Quarkonia and open quantum systems



GO3: Complementary collider and experimental experiments

Mark Djouadi



ExtremeQFTs project: FTAE members in work team

Diogo Costa



Luis Gil



Afonso Guerreiro (fall 2026)



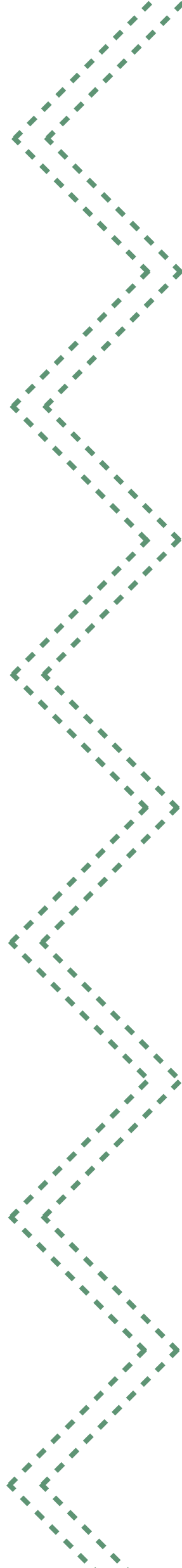
Zhe Ren



Fuensanta Vilches



Marco Leitão (early 2027)



Progress so far

GO1: Description of QCD jets in hot plasmas at leading order and beyond

- L Apolinario, **D Costa**, **A Soto-Ontoso**, *Bottom-up approach to describe groomed jet data in heavy-ion collisions*, arXiv: 2601.13310
- J Silva, **A Soto-Ontoso**, *Collinear spin correlations of final-state radiation in dense QCD matter*, arXiv: 2511.17737
- M van Beekveld, **A Soto-Ontoso**, et al., *A new suite of Lund observables to resolve jets*, arXiv: 2511.16723

GO2: Precise computation of PT and GW parameters

- JC Criado, **M Chala**, **L Gil**, *Thermoskyrmions*, arXiv: 2601.18873

GO3: Complementary studies at collider and cosmological experiments

- G Arcadi, **A Djouadi**, *Interpreting the current Higgs excesses at the LHC in the 2HD+a framework* arXiv: 2512.08807

What's next?

GO1: Description of QCD jets in hot plasmas at leading order and beyond

GO2: Precise computation of PT and GW parameters

GO3: Complementary studies at collider and cosmological experiments

⇒ **Explore synergies between techniques used in hot QCD and hot EW**

⇒ **%-level SM baseline for BSM studies**

⇒ **Development of MC tools for SMEFT studies**