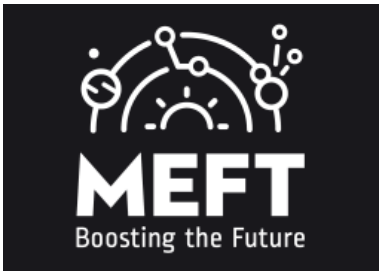


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# Multi-Parton Systems in a QCD medium

*Wednesday 28 January 2026 11:15 (15 minutes)*

Quantum Chromodynamics (QCD) is the theory of the strong interaction, responsible for binding quarks and gluons inside hadrons. In ultra-relativistic heavy-ion collisions, such as those at the LHC, these constituents are liberated to form a hot, dense phase of deconfined matter —the Quark-Gluon Plasma (QGP). Jets, collimated sprays of hadrons produced by hard scattered partons, interact with the QGP, a phenomenon known as jet quenching. A key open question is how these in-medium interactions unfold in space and time, and how they modify the internal structure of parton showers.

Among the variables proposed to describe this evolution, formation time plays a central role. It provides a dynamical scale for when partons effectively decouple from their parent emitter —a concept that becomes even richer in a medium where multiple emissions and interference effects coexist.

This thesis will analytically study double soft-gluon emission in a QCD medium, focusing on the interference pattern between subsequent emissions. The aim is to identify under which conditions the radiation pattern factorises and when quantum coherence prevents a simple interpretation in terms of independent emissions. This work will contribute a crucial building block to the development of space-time-resolved parton showers, and it will lay the theoretical groundwork for future studies of in-medium QCD jets.

## Field of Research/Work

Particles and Fields

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