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# Defects in non-Abelian Gauge Theory

General Fellini Meeting in Ferrara

May 2022

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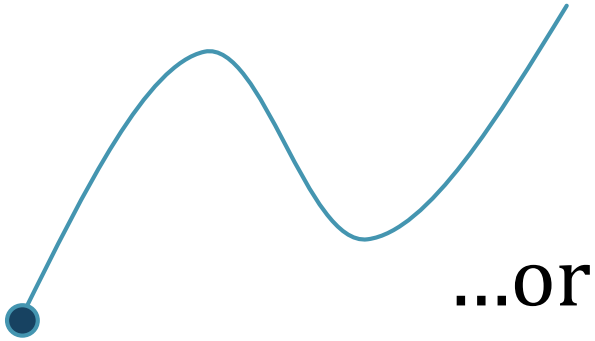
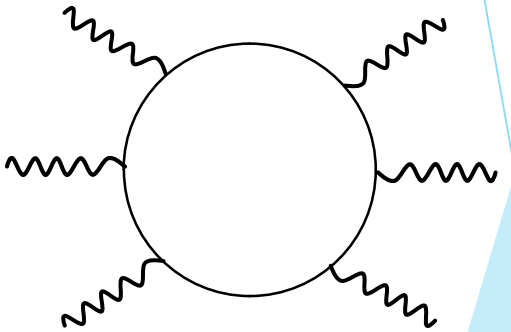
QFT is not all about particles and their worldlines….

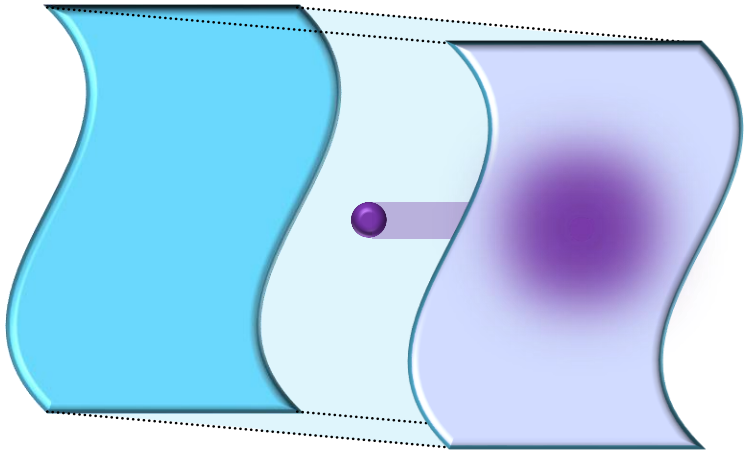


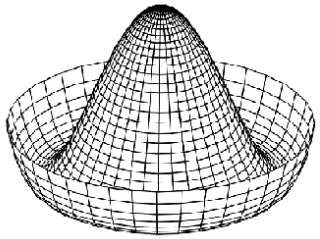
…or even interactions…



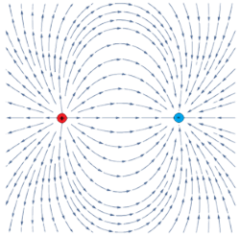
extended objects (“defects”) play an important role!

they are responsible
for measuring charge…



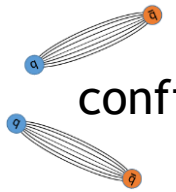


Higgs



Coulomb

…detecting subtle phases…



confining

…and capturing quantum entanglement

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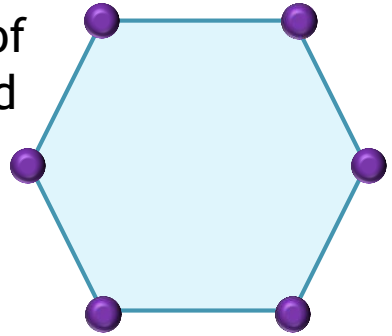
# defects are embedded lower dimensional problems…

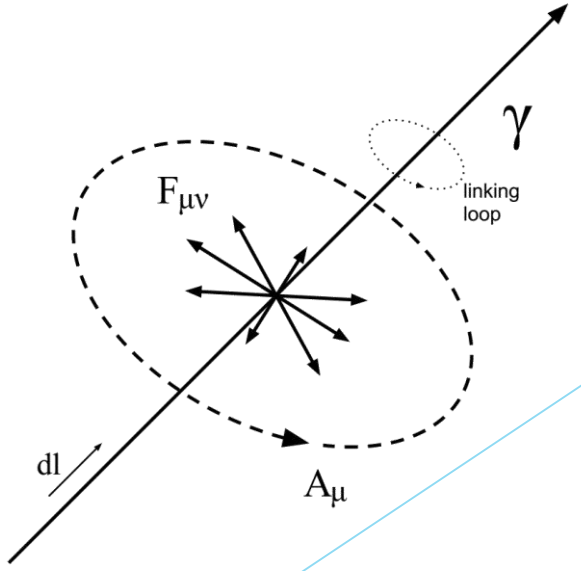
$$\mathrm{tr}_{\mathfrak{R}} \mathcal{P}\, e^{i \oint_C A_\mu \, dx^\mu}$$

Wison loop: the prototypical defect, deceptively simple to write

a network of 0d + 1d + 2d defects



## Symmetry defects are simple (topological) examples



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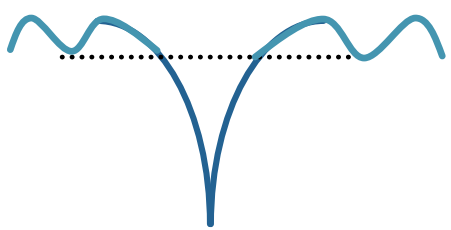
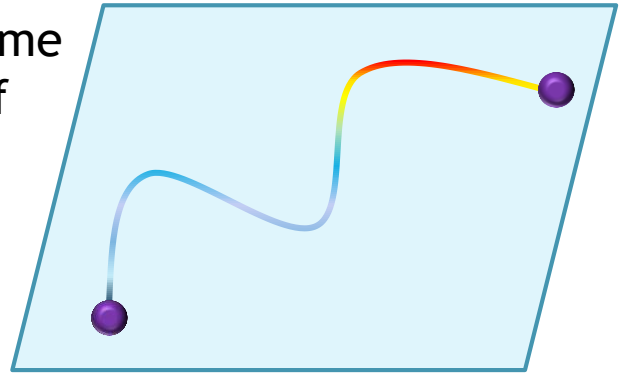
# Key questions:

1. How do we classify extended defects in Lagrangian QFTs? (the answer for local defects/operators is known).



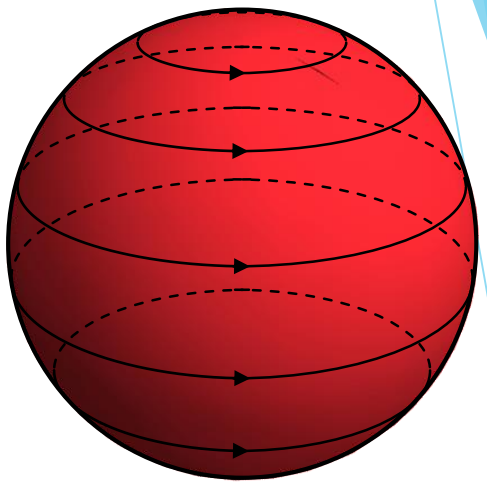
singularities in dynamical fields

Worldvolume degrees of freedom

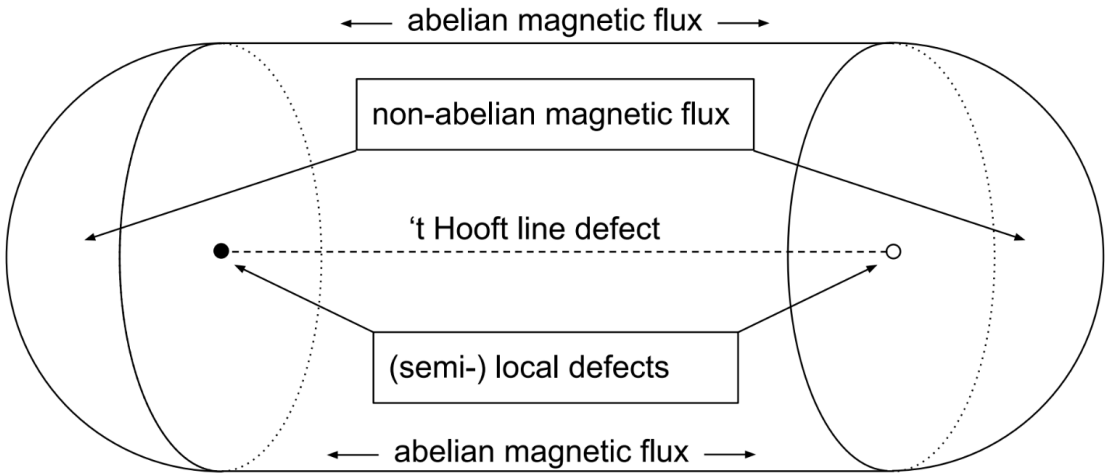


2. How do we use the spectrum of defects to analyze the physics, beyond the constraints of symmetry?

supersymmetry provides protection without oversimplification…



…it is an ideal laboratory to test exotic ideas



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# I have recently been working on

- local 4d defect operators as probes of confinement
  supersymmetry……✔
  duality…… ?
  physics……😢

- ray operators in 3d and general boundary conditions for worldvolume theories: collaboration with Guerrini and support from my secondment advisor Kapustin.

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# Other activities since the last meeting

- entropy of charged black holes and localization

  with M. Hosseini and A. Zaffaroni (JHEP 2022)

- protected local operators in three dimensions

  with L. Guerrini and S. Pentai (JHEP 2022)

- bound states of Wilson and vortex loops

  with L. Griguolo and L. Guerrini (JHEP 2021)

- co-advising a graduating PhD student 🤞

- moving to a faculty job in the UK