

Theory Plans Till 2025

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Physics within the Standard Model

- QCD: jets, finite temperature and density, phase diagram, quark-gluon plasma
- High-energy cosmic rays
- Inflation and gravitational waves

Physics beyond the Standard Model

- Supersymmetry searches with machine learning
- Extended Higgs sectors
- Dark matter beyond the WIMP paradigm: self-interactions, light particles, axions, sterile neutrinos
- Early Universe: phase transitions, baryogenesis
- Cosmological and astrophysical new physics probes: BBN, CMB, 21-cm observations, structure formation, tensions between observations
- GAMBIT, DarkSUSY

Topics and Synergies with Experiments

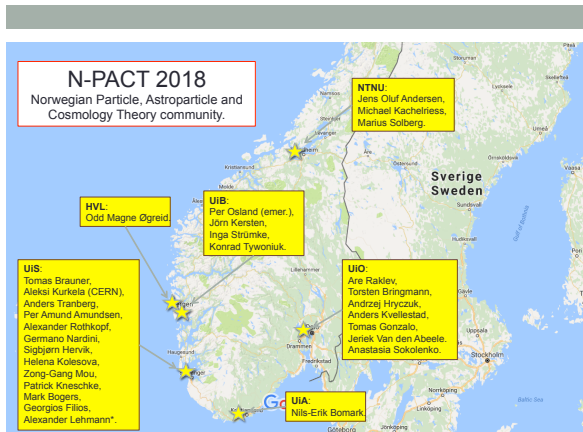
Physics within the Standard Model

- QCD: jets, finite temperature and density, phase diagram, quark-gluon plasma \rightsquigarrow ALICE
- High-energy cosmic rays \rightsquigarrow CTA
- Inflation and gravitational waves \rightsquigarrow LISA

Physics beyond the Standard Model

- Supersymmetry searches with machine learning \rightsquigarrow ATLAS
- Extended Higgs sectors \rightsquigarrow ATLAS
- Dark matter beyond the WIMP paradigm: self-interactions, light particles, axions, sterile neutrinos
- Early Universe: phase transitions, baryogenesis
- Cosmological and astrophysical new physics probes: BBN, CMB, 21-cm observations, structure formation, tensions between observations \rightsquigarrow CTA?
- GAMBIT, DarkSUSY \rightsquigarrow ATLAS, CTA, and others

Networking



- Stimulate interactions
- Gain visibility in RCN and EU \rightsquigarrow grants?

Strategic Thoughts

- Theory infrastructure: theorists (incl. PhD students, postdocs!)
- Upgrade required to reach critical mass for top-level community
- Strong national groups more efficient than individuals spread over Europe
- Also Norwegian strategy update needed?

2013 strategy paragraph about theory (under “other activities”)

Theory is a strong driver of particle physics and provides essential input to experiments, witness the major role played by theory in the recent discovery of the Higgs boson, from the foundations of the SM to detailed calculations guiding the experimental searches. Europe should support a diverse, vibrant theoretical physics programme, ranging from abstract to applied topics, in close collaboration with experiments and extending to neighbouring fields such as astroparticle physics and cosmology. Such support should extend also to high-performance computing and software development.

- Particle, astroparticle, cosmology theory coalescing
- Enhance visibility of theory as important and independent science driver