# A review paper on fundamental physics at the ESS

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# General motivation

A lot of ideas/plans for fundamental physics at the ESS

No single source. Overview papers written for collider experiments.

Useful to see an overview of the possibilities, how they relate to the sensitivity of existing and other planned experiments and how they are leading in design/technology/method.

The fundamental physics beamline (ANNI) with experiments,  HIBEAM/NNBAR, UCN/VCN, ESSnusB, nuESS  etc etc.

Send a message to the ESS and the outside world that a competitive and innovative program can take place.

| | | |
|---|---|---|
| ANNI | Neutron decay, nEDM, fundamental symmetries | New physics (> TeV), strong CP problem, nucleon-nucleon interaction |
| UCN and VCN | Neutron lifetime, gravitational spectroscopy, nEDN | New Physics (> TeV), extra fundamental forces, strong CP problem |
| HIBEAM/NNBAR | Neutron conversions to antineutrons and sterile neutrons | New physics (> TeV), baryogenesis, neutrino mass, dark matter |
| nuESS | Elastic neutrino-nucleus scattering | Standard Model tests |
| ESSnuSB | Leptonic CP violation | New physics, baryogenesis |

Incomplete!!

# Common format

For each activity

Status

When it could take place

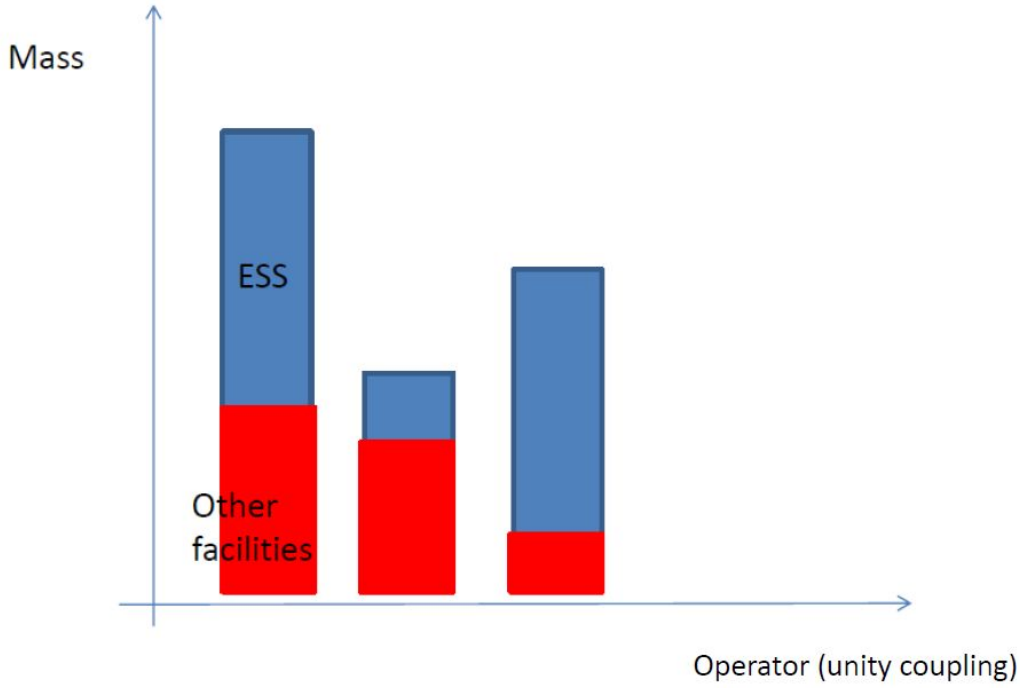
How does it compare with existing and other planned facilities.

Where do we lead in the expected sensitivity/figure of merit ?

Where are we unique ?

Where is the instrumentation/apparatus development leading ?

Common EFT analysis for all activities ?



# A Review Paper on Fundamental physics at the European Spallation Source


## Abstract

Presently under construction, the European Spallation Source (ESS) will be the world's most powerful pulsed neutron source. This proposed paper will study the capability of the ESS to develop a unique program of experimental particle physics at the intensity and precision frontiers. Experiments at the ESS can address central open questions in modern physics such as the mechanism of baryogenesis, the strong CP problem, extra fundamental interactions and the nature of dark matter. The experiments have sensitivity to particles and processes beyond the Standard Model at mass scales beyond that available at colliders. This proposed paper explores the potential of the ESS within the context of the present and planned worldwide program of particle physics activities.

# Publication

Early discussion with editor from Review of Modern Physics.
They are interested. We need to send a short document on the format/content of the paper to take this further.

# Discussion