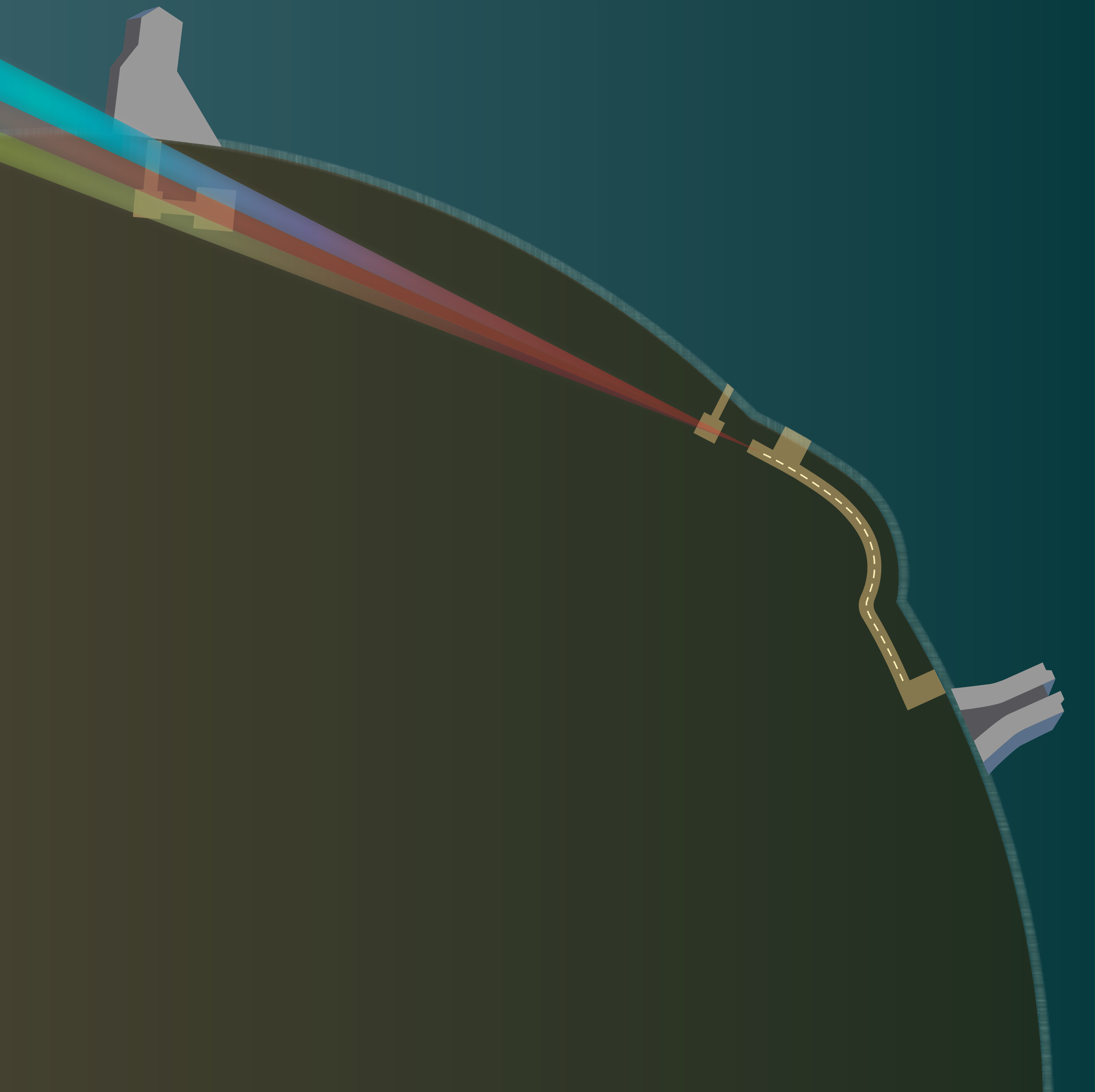
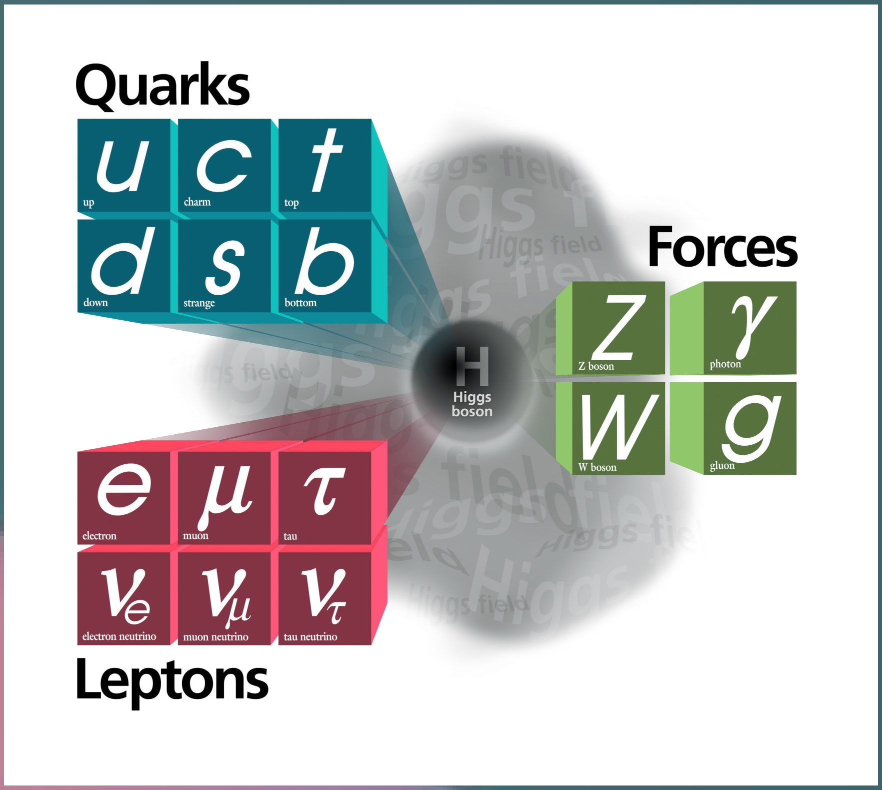
The Long-Baseline Neutrino Experiment

Exploring Fundamental Symmetries of the Universe

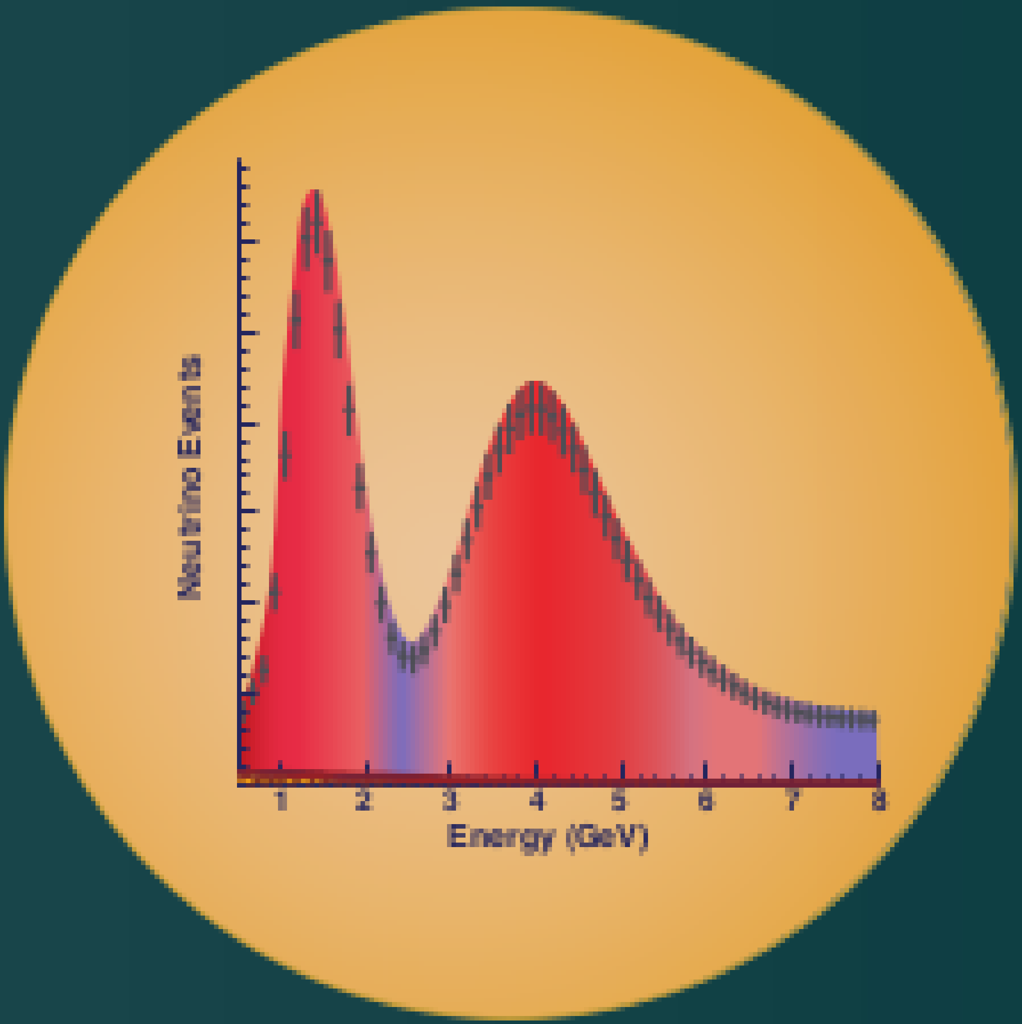




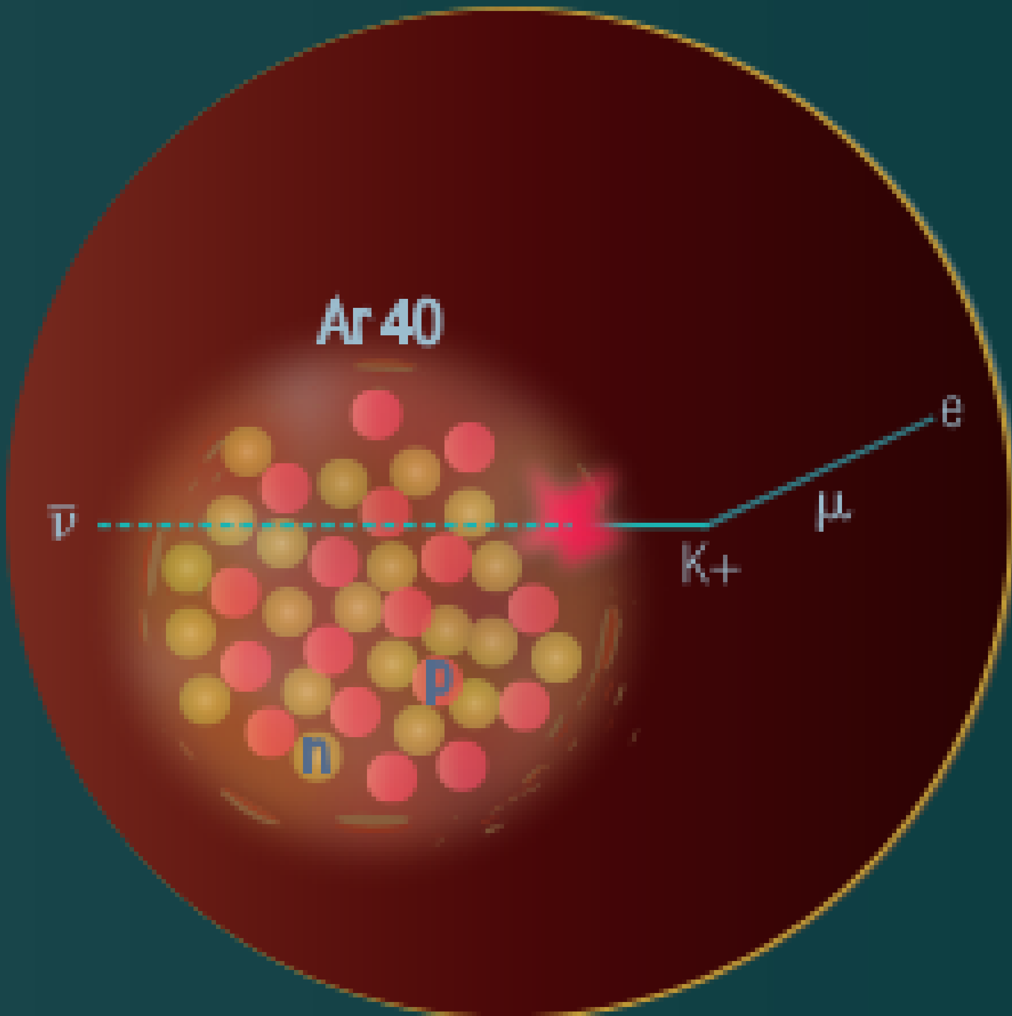
In the Standard Model, the simple Higgs mechanism, which has now been confirmed by the observation of the Higgs boson, is responsible for both quark and lepton masses, mixing and charge-parity (CP) violation (the mechanism responsible for matter/anti-matter asymmetries). However, the small size of neutrino masses and their relatively large mixing bears little resemblance to quark masses and mixing, suggesting that different physics — and possibly different mass scales — in the two sectors may be present

The Long-Baseline Neutrino Experiment (LBNE) will provide a unique, world-leading program for the exploration of key questions at the forefront of particle physics and astrophysics. LBNE has been conceived around three central components:

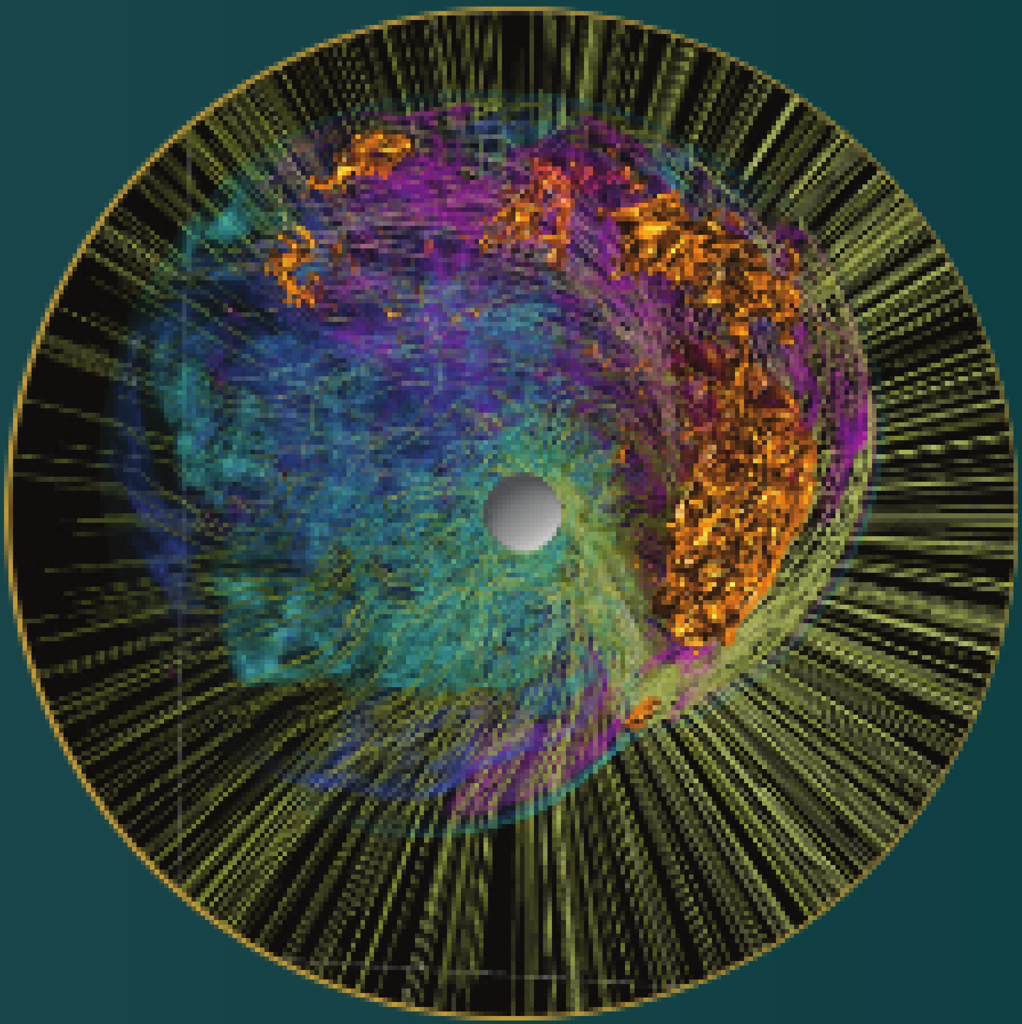
1. an intense, wide-band neutrino beam
2. a fine-grained *near* neutrino detector just downstream of the neutrino source
3. a massive liquid argon time-projection chamber (LArTPC) deployed as a *far* neutrino detector deep underground, 1,300 km downstream; this distance between the neutrino source and far detector — the *baseline* — is measured along the line of travel through the Earth



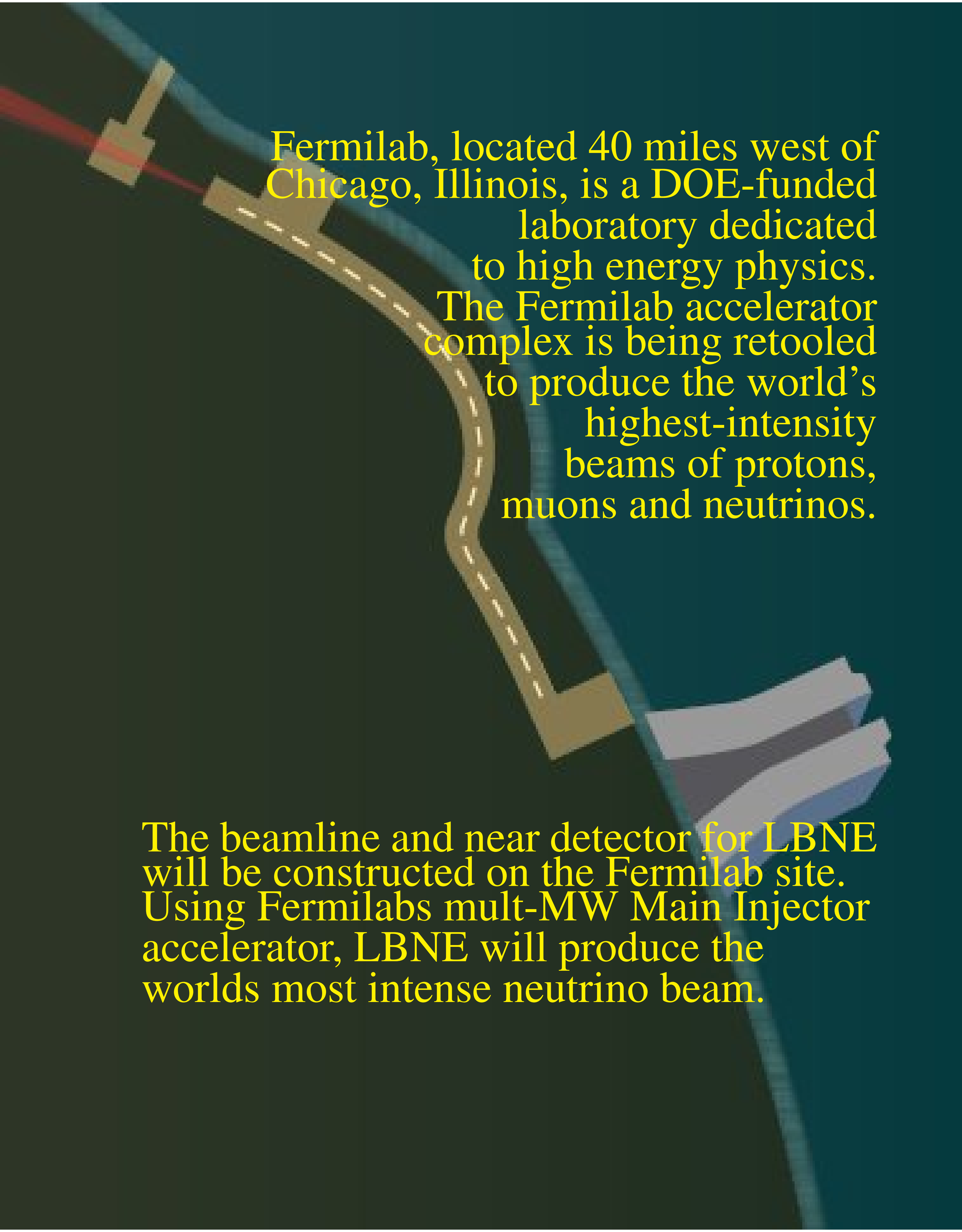
Through precise studies of neutrino flavor oscillations enabled by an intense, optimized beam and advanced detectors, LBNE aims to shed light on the mystery of matter/antimatter asymmetry in the Universe.



With the world's largest cryogenic particle detector deep underground, LBNE will probe the stability of matter and its relation to the Grand Unification of forces.



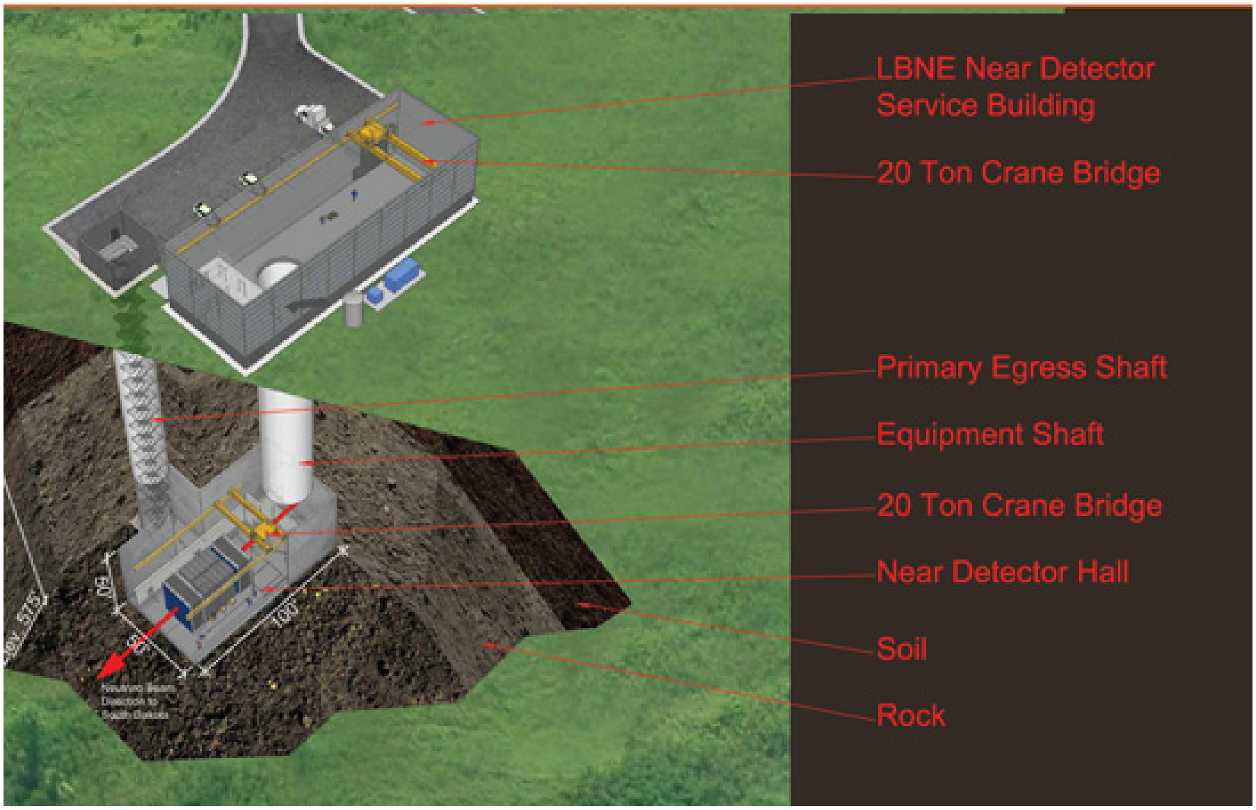
LBNE's observation of thousands of neutrinos from a core-collapse supernova in the Milky Way would allow us to peer inside a newly-formed neutron star, and potentially witness the birth of a black hole.



Fermilab, located 40 miles west of Chicago, Illinois, is a DOE-funded laboratory dedicated to high energy physics. The Fermilab accelerator complex is being retooled to produce the world's highest-intensity beams of protons, muons and neutrinos.

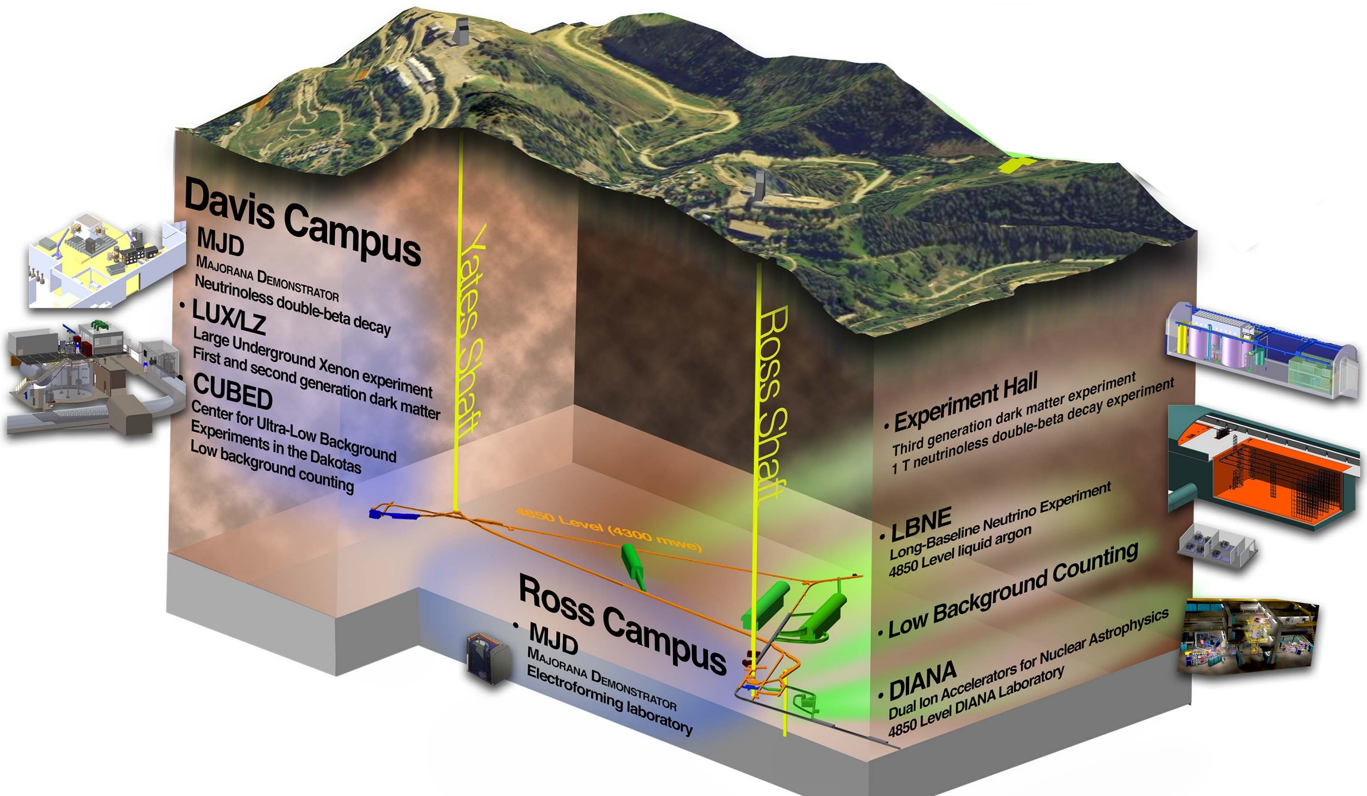
The beamline and near detector for LBNE will be constructed on the Fermilab site. Using Fermilabs mult-MW Main Injector accelerator, LBNE will produce the worlds most intense neutrino beam.

Blue squares: Proposed LBNE service buildings; one would be close to the intersection of Kirk Road and Giese Road; Green oval: Footprint of the proposed, 52-foot-high hill

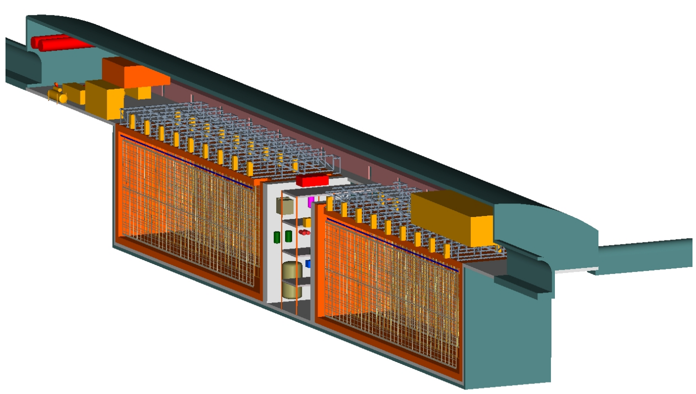


A high-resolution near detector located approximately 500 m downstream of the LBNE neutrino production target is a key component of the LBNE scientific program. The near neutrino detector will enable LBNE to achieve its primary scientific goals - in particular discovery-level sensitivity to CP violaiton - as well as exploit the potential of high-intensity neutrino beams as probes of new physics.

The Sanford Underground Research Facility is a laboratory located on the site of the former Homestake gold mine in Lead, SD that is dedicated to underground science. Nuclear chemist Ray Davis solar neutrino experiment located a mile underground in the former mine ran from 1967 to 1993 and uncovered the first evidence for neutrino oscillations. Ray Davis earned a share of the 2002 Nobel Prize for physics for his discovery.



The LBNE far detector will be located at the 4,850-ft level of the Sanford Underground Research Facility. LBNE is envisioned as the next-generation, multi-decade neutrino experiment at this site seeking groundbreaking discoveries.



LBNE's 34-kt LArTPC will be the worlds largest cryogenic particle physics detector.