

A

Glossary

Writing about particle physics is full of acronyms and other puzzling terms, most of which are not easily deciphered even by experts in other areas of particle physics. For the benefit of the readers of this book, we define many of these terms here. Some acronyms are defined using other acronyms. In those cases, please find the definitions of those acronyms at the appropriate place in this list.

$0\nu\beta\beta$: Neutrinoless double-beta decay, a nuclear decay process in which two electrons and zero neutrinos are emitted.

$2\nu\beta\beta$: Double-beta decay, a nuclear decay process in which two electrons and two neutrinos are emitted.

2HDM : Two-Higgs-Doublet Model, a model with two Higgs fields, usually with natural flavor conservation in Higgs boson couplings.

AAAS : American Association for the Advancement of Science.

AC-LGAD : AC-coupled **LGAD**.

ACTA : Augmented Cherenkov Telescope Array, the next-generation atmospheric Cherenkov telescope project for gamma ray detection.

ADMX : Axion Dark Matter Experiment, an experiment at the University of Washington searching for axions using a large electromagnetic cavity in a static magnetic field.

ADMX-EFR : **ADMX**-Extended Frequency Range.

AdS : Anti-de Sitter space, a space-time background essential to many mathematical physics investigations.

AGILE : Astro-Rivelatore Gamma a Immagini Leggero, a space-based X-ray and gamma ray observatory.

AGN : Active Galactic Nucleus.

AI : Artificial Intelligence.

AIP : American Institute of Physics.

ALPHA : Axion Longitudinal Plasma Hodoscope.

ALCF : Argonne Leadership Computer Facility.

ALICE : A Large Ion Collider Experiment, an experiment at the **LHC** focusing on heavy ion collisions and the quark-gluon plasma.

ALP : Axion-Like Particle.

ALTIROC : **ATLAS** timing **ASIC**.

ALPS, ALPS-II : Any Light Particle Search, a series of experiments at **DESY** searching for **axions** and similar particles using laser light conversion in a strong magnetic field.

AMANDA : Antarctic Muon and Neutrino Detector Array, the first-generation neutrino telescope experiment in Antarctica.

AMF : Advanced Muon Facility, a proposed accelerator complex at **Fermilab** providing intense muon beams.

AMO : Atomic, Molecular, Optical

AMR : Adaptive Mesh Refinement.

AMS, AMS-02 : Alpha Magnetic Spectrometer, an antimatter detector located on the International Space Station.

ANITA : Antarctic Transient Antenna, a balloon experiment in Antarctica for detection of radio signals of ultra-high-energy neutrino events.

ANL : Argonne National Laboratory.

ANTARES : Astronomy with a Neutrino Telescope and Abyss environmental RESearch, a neutrino telescope experiment in the Mediterranean Sea.

APEX : A Prime EXperiment, an experiment at **JLab** searching for the production of dark photons using an intense electron beam.

API : Application Programming Interface.

APS : American Physical Society.

APS DPB : The American Physical Society Division of Physics of Beams.

APS DPF : The American Physical Society Division of Particles and Fields.

ARA : Askaryan Radio Array, a radiofrequency neutrino antenna experiment at the South Pole.

ARAPUCA : Argon R&D Advanced Program at UniCamp, a light-trapping device for **LArTPC** detectors.

ARGO : A proposed future argon-based **Dark Matter** detector.

ArgoNeuT : Argon Neutrino Teststand, a small liquid argon **TPC** experiment at **Fermilab**.

ARIADNE : Axion Resonant InterAction Detection Experiment.

ARIANNA : Antarctic Ross Ice-shelf ANtenna Neutrino Array, a radiofrequency neutrino antenna experiment in Antarctica.

ART : An Intensity Frontier software framework developed by the **Fermilab** Scientific Computing Division and used by **NOvA**, **mu2e**, **Muon $g - 2$** , **LArSoft**, **DarkSide**, **LArIAT**, and others.

A-Se : Amorphous Selenium.

ASIC : Application Specific Integrated Circuit, a silicon chip processor designed for a particular purpose.

ASTA : Advanced Superconducting Test Accelerator, an accelerator test facility at **Fermilab**.

Glossary

ATCA : Advanced Telecommunications Computing Architecture.

ATF : Accelerator Test Facility, a user facility at **BNL** providing high-brightness electron and photon beams.

ATF, ATF2 : Accelerator Test Facility, an accelerator test complex at **KEK** built to study beam dynamics issues for the **ILC**.

ATLAS : A Toroidal LHC ApparatuS, a large experiment at the **LHC** optimized for high transverse momentum particle production.

ATR : Advanced Test Reactor, a research reactor at the Idaho National Laboratory.

Auger : Pierre Auger Observatory, experiment in Argentina that detects ultra-high-energy cosmic rays through both fluorescence and surface water Cherekov detectors.

Argonne Wavefield Accelerator, a beam facility at **ANL**.

Axion : A hypothetical, very light particle, with couplings to quarks that reverse under **P** transformations. Such particles could make up the **Dark Matter** of the Universe.

BaBar : An experiment at **SLAC**, using e^+e^- annihilation at approximately 10 GeV to study rare heavy quark and lepton decays.

Baikal : A neutrino telescope in Lake Baikal in Siberia.

Baksan : An underground laboratory in the Caucasus mountains in Russia.

BAO : Baryon Acoustic Oscillations.

Baseline : In neutrino physics, the distance between the neutrino production point, near an accelerator, and the neutrino detector.

BBN : Big Bang Nucleosynthesis.

BELLA : Berkeley Lab Laser Accelerator, a facility at **LBNL** for the development of laser-driven accelerators.

Belle : An experiment at **KEK**, using e^+e^- annihilation at approximately 10 GeV to study rare heavy quark and lepton decays.

Belle-II : An experiment at **KEK**, using e^+e^- annihilation at approximately 10 GeV to study rare heavy quark and lepton decays with 50-100 times the data set produced by **BaBar** and **Belle**.

BEPCII : Beijing Electron-Positron Collider II, an e^+e^- collider at **IHEP** with center of mass energy range of 2–4.63 GeV.

BESIII : An experiment at **IHEP**, using e^+e^- annihilation at approximately 3–4 GeV to study charm quark and tau lepton physics.

BEST : Baksan Experiment on Sterile Transitions, a proposed radioactive source experiment in Russia with a gallium detector.

BINP : Budker Institute for Nuclear Physics, a high-energy physics laboratory in Novosibirsk, Russia.

BMW : Budapest-Marseille-Wuppertal Collaboration carrying out lattice **QCD** calculations.

BNB : Booster Neutrino Beam, a neutrino beamline at **Fermilab** using the Booster.

BNL : Brookhaven National Laboratory.

Borexino : A solar neutrino experiment at **Gran Sasso**.

Boson : A type of elementary particle whose intrinsic spin is an integer (0, 1, 2, ...) multiple of \hbar . Such particles can make up a macroscopic force field such as the electromagnetic field.

BOSS : Baryon Oscillation Spectroscopic Survey, a galaxy survey aiming to measure baryon acoustic oscillations.

BR : Branching Ratio, the probability that an unstable particle decays to a particular final state.

BREAD : Broadband Reflector Experiment for Axion Detection.

BRN : Basic Research Needs, a process and set of workshops within the US **DOE** to obtain community input on priority technical goals and opportunities.

BSM : Beyond the Standard Model, a reference to new physics associated with an extension of the **SM**.

C : Charge conjugation, the interchange of particles and antiparticles.

CALICE : CALorimeter for Linear Collider Experiment, an experimental collaboration aimed at improving the technology of hadron calorimeters, especially with the **PFA** method.

Canfranc Underground Laboratory : An underground scientific facility in a former railway tunnel in the Spanish Pyrenees under Monte Tobazo in Canfranc, Spain.

Capability : In computing, a measure of high-speed, highly parallel computing that might require a large fraction of a supercomputer.

Capacity : In computing, a measure of computing in which many moderately parallel jobs are run alongside one another.

CAPTAIN : Cryogenic Apparatus for Precision Tests of Argon INteractions, a liquid argon R&D detector.

CASPER : Cosmic Axion Spin Precession Experiment.

CAST : CERN Axion Solar Telescope, an experiment at **CERN** searching for **axions** radiated from the Sun.

CC : Charged Current weak interactions.

CCD : Charge Coupled Device, a class of pixel silicon detectors.

CDF : Collider Detector at Fermilab, a large experiment at the **Fermilab** Tevatron optimized for high transverse momentum particle production.

CDM : Cold Dark Matter, a class of **Dark Matter** models in which the dark matter particles move at nonrelativistic speeds.

CDR : Conceptual Design Report.

Ce-LAND : A ^{144}Ce source to be placed in **KamLAND** to study the reactor neutrino anomaly.

Glossary

CE ν NS : Coherent Elastic Neutrino-Nucleus Scattering, an **NC** neutrino process and also a proposed experiment to be sited at the **BNB**.

CE&O : Communication, Education, and Outreach, a topic of one of the “frontiers” in this study.

CEPC : Circular Electron Positron Collider, a large circular e^+e^- collider proposed to be hosted by China.

CERN : Conseil Européen pour la Recherche Nucleaire, the major European high energy physics laboratory, located in Geneva.

CESR : Cornell Electron Storage Ring, an e^+e^- colliding beam accelerator at Cornell University that operated in the energy range 3.5-12 GeV from 1979 to 2008. The accelerator is still in operation as a synchrotron light source (**CHESS**) and as an accelerator physics testbed.

CesrTA : CESR Test Accelerator, a configuration of **CESR** to study the design of electron damping rings, in particular, for **ILC**.

CFD : Constant Fraction Discrimination.

Chameleon : A new particle that has properties that depend on its environment.

CHIPS : Cherenkov detectors In mine Pits, a proposed experiment to use the **Fermilab** beams and massive Cherenkov detectors in flooded mine pits.

CHOOZ : A first-generation reactor neutrino experiment located in Chooz, France.

CKM : Cabibbo-Kobayashi-Maskawa matrix, the matrix relating the weak interaction and mass eigenstates of quarks.

CL : (Statistical) Confidence Level.

CLEAN : Cryogenic Low Energy Astrophysics with Noble gases, a cryogenic noble liquid experiment for **Dark Matter** and solar neutrinos.

CLEO : A general-purpose particle detector at **CESR** that studied heavy quark decays and spectroscopy.

CLFV : Charged Lepton Flavor Violation.

CLIC : Compact Linear Collider, a concept for an e^+e^- linear collider, with center of mass energies up to 3 TeV, based on two-beam acceleration.

CM : Center of Mass, the system for viewing a particle collision or decay in which the overall system is at rest.

CMB : Cosmic Microwave Background, the approximately isotropic microwave radiation in the universe created in the original formation of atoms from electrons and ionized protons.

CMB-S4 : Stage-IV **CMB** experiment.

CMD-3 : An experiment at **BINP** measuring the cross section for $e^+e^- \rightarrow$ hadrons.

CMOS : Complementary Metal-Oxide Semiconductor, a class of semiconductor devices.

CMS : Compact Muon Spectrometer, a large experiment at the **LHC** optimized for high transverse momentum particle production.

CoGeNT : COherent GERmanium Neutrino Technology, a germanium detector for **Dark Matter** and other signals requiring low background.

COHERENT : An experiment to measure $CE\nu NS$ at the **SNS**.

COMET : An experiment at **J-PARC** searching for muon to electron conversion in the field of a heavy nucleus.

COUPP : Chicagoland Observatory for Underground Particle Physics, a **Dark Matter** detector using a bubble chamber, now located in the Sudbury Mine in Sudbury, Ontario.

CP : The combination of a **C** and a **P** transformation, converting particles to antiparticles, plus mirror (left-right) reflection. This is a very accurate, but not perfect, approximate symmetry of nature.

CPAD : Coordinating Panel for Advanced Detectors, an advisory panel on detector technology created by the **APS DPF**.

CPT : The combination of a **C**, and a **P**, and a **T** transformation, converting particles to antiparticles, plus mirror (left-right) reflection, plus reversal of the direction of time. Local quantum field theory predicts this to be a perfect symmetry of nature.

CPU : Central Processing Unit of a computer.

CRADA : Cooperative Research and Development Agreement, an agreement between a government laboratory and a private company to pursue R&D on a technology or project.

CSI : Coherent Scattering Investigations at the **SNS**, a proposed **CENNS** search experiment for the **SNS**.

CTA : Cherenkov Telescope Array, a planned large-area array of telescopes for high energy gamma rays.

CTF3 : CLIC Test Facility 3, the most recent in a series of test accelerators for **CLIC** at **CERN**.

CUDA : Compute Unified Device Architecture, which defines a parallel computing architecture for **NVIDIA GPUs**.

CUORE : Cryogenic Underground Observatory for Rare Events, an experiment searching for neutrinoless double beta decay, located at **Gran Sasso**, Italy.

DØ : D-zero, a large experiment at the **Fermilab** Tevatron optimized for high transverse momentum particle production.

DAEδALUS : Decay At rest Experiment for δ_{CP} studies at the Laboratory for Underground Science, a neutrino oscillation experiment based on beams created by cyclotrons.

DAFNE : Double Annular Φ Factory for Nice Experiments, an e^+e^- collider at **LNF**.

DAMA : DArk MAtter experiment, a scintillator-based dark matter search experiment at **Gran Sasso**.

DAMIC : DArk Matter In CCD experiment, an experiment at **Fermilab** searching for light **Dark Matter** particles.

DANSS : Detector of the reactor AntiNeutrino based on Solid-state plastic Scintillator, a reactor neutrino experiment in Russia.

DAQ : Data Acquisition

Glossary

Dark Light : An experiment at **JLab** searching for dark photons using an **FEL**.

Dark Matter : A type of matter not contained in the **Standard Model** and very weakly coupled to electromagnetism that makes up most of the matter in the universe.

Dark Sector : A set of particles neutral under the **Standard Model** forces and coupled only weakly to ordinary matter.

DarkSide : A **Dark Matter** search experiment at **Gran Sasso** using a liquid argon detector.

Daya Bay : A reactor neutrino experiment located near Daya Bay, China.

DC-DC converters : digital current to digital current converters.

DECam : Dark Energy Camera, used to conduct the **DES**.

Decay Constant : A parameter that determines the size of the matrix element for the decay of a hadron.

DeepCore : A low-energy extension to the **IceCube** experiment with a high density of photodetectors in a central region of the cube.

DEI : Diversity, Equity, and Inclusion.

DEIA : Diversity, Equity, Inclusion, and Accessibility.

DeeMe : Direct Emission of Electrons from Muon to Electron conversion, an experiment at **J-PARC** searching for neutrinoless muon to electron conversion

DES : Dark Energy Survey.

DESC : Dark Energy Science Collaboration.

DESI : Dark Energy Spectroscopic Instrument.

DESY : Deutsches Elektronen SYnchrotron, the major high energy physics laboratory in Germany, located in Hamburg.

Dichroicon : A Winston-style light concentrator built out of dichroic reflectors.

DIRC : Detection of Internally Reflected Cherenkov light, a detector using quartz bars for tracking and particle identification.

DIS : Deep Inelastic Scattering, a process of lepton scattering from a nucleon or nucleus with large momentum transfer, especially when only the lepton recoil is observed.

DJ-LGAD : Deep Junction **LGAD**.

DM : **Dark Matter**.

DMNI : Dark Matter New Initiatives, a DOE-supported program to fund small **Dark Matter** search experiments.

DOE : U.S. Department of Energy.

Double Chooz : A reactor neutrino experiment in Chooz, France, utilizing detectors at two distances from the source.

DPF : Division of Particles and Fields, a division of the American Physical Society.

DR : Dual Readout, a method for hadron calorimetry that corrects the charge/neutral response ratio by separate measurement of Cherenkov and scintillation light.

DREAM : Dual REAdout Method (**DR**)

Drive beam : A high energy particle beam used to create an electromagnetic field that can then accelerate another beam to high energy.

DS-LGAD : Double Sided **LGAD**.

DSNB : Diffuse Supernova Neutrino Background.

dSphs : dwarf Spheroidal satellite galaxies of the Milky Way.

DUNE : Deep Underground Neutrino Experiment, a next-generation long-baseline neutrino oscillation experiment, based at **Fermilab** and **SURF**.

E821 : Experiment at **BNL** to measure the anomalous magnetic moment of the muon; predecessor to **Muon $g - 2$** .

E989 : **Muon $g - 2$** Experiment at **Fermilab** to measure the anomalous magnetic moment of the muon.

EAS : Extensive Air Shower, produced by high energy cosmic rays in the Earth's atmosphere.

EBL : Extra-galactic Background Light.

eBOSS : Extended **BOSS**, program in **SDSS-IV**.

ECFA : European Committee for Future Accelerators

ECHo : Electron Capture ^{163}Ho experiment, a proposed neutrino mass microcalorimeter experiment.

EDM : Electric Dipole Moment.

eEDM : Electron **EDM**.

EFT : Effective Field Theory, a method of quantum field theory in which the effects of new particles or interactions that might be present at high energies are expressed by the addition of more complex operators to the equations of motion of the **SM**.

EIC : Electron-Ion Collider, an electron-proton and electron-heavy ion collider to be constructed at **BNL**.

EM : Electro-Magnetic.

EMPHATIC : Experiment to measure hadron scattering and production cross sections for improved neutrino flux predictions.

ENUBET : Enhanced NeUtrino Beams from kaon Tagging, a proposed project that aims to produce an artificial neutrino beam in which the flavor, flux, and energy of the produced neutrinos are known with unprecedented precision.

EP : Equivalence Principle.

ESA : European Space Agency.

Glossary

ESS : European Spallation (neutron) Source, a future facility in Lund, Sweden.

ESS ν SB : European Spallation Source Neutrino Super Beam, a proposal to use the **ESS** proton linac to generate a neutrino superbeam.

\cancel{E}_T : Missing Transverse Energy, unobserved momentum in a high-energy particle collision carried away by weakly interacting neutral particles.

ETROC : **CMS** timing **ASIC**.

Euclid : A dark energy space mission currently under development by the European Space Agency.

EVA : ExaVolt Antenna, a proposed balloon-based neutrino antenna experiment in Antarctica.

EW : ElectroWeak interaction, the unified description of the electromagnetic and weak interactions.

EWSB : ElectroWeak Symmetry Breaking.

Exascale : Of the order of 10^{18} , used in computing to refer to next-generation computation resources in memory or speed.

Exclusive decay : Particle decay to a specific, completely specified, final state.

EXO : Enriched Xenon Observatory, an experiment searching for neutrinoless double beta decay of the isotope Xe^{136} .

FACA : Federal Advisory Committee Act, the legislation that governs questions of openness and transparency for certain Federal committees. The act generally covers grant review panels of the **NSF** but not those of the **DOE**.

FACET, FACET II : Facility for advanced ACcelerator Experimental Tests, a user facility at **SLAC** for experiments on high-gradient electron accelerator technology.

FAIR : Facility for Antiproton and Ion Research, a proton, antiproton, and heavy ion accelerator at **GSI**.

FASER : Forward Search Experiment, designed to search for light, weakly interacting particles produced at the **LHC**.

FASERnu : An emulsion-based experiment to detector forward-produced neutrinos from the **LHC**.

FAST : Fermilab Accelerator Science and Technology facility, a accelerator research complex at **Fermilab**.

FCC : Future Circular Collider, a large circular collider project proposed for **CERN**.

FCC-ee : A large circular e^+e^- collider proposed as a phase of the **FCC** project.

FCC-hh : A large circular proton-proton collider proposed as a phase of the **FCC** project.

FCNC : Flavor-Changing Neutral Current.

FE : Front End.

FEL : Free Electron Laser, an electron accelerator that produces high-intensity coherent synchrotron radiation.

Fermi : Femtometer = 10^{-13} cm.

Fermi-GBM : Fermi Gamma-ray Burst Monitor, a space-based gamma-ray detector.

Fermi-LAT : Fermi Large Area Telescope, a space-based gamma-ray detector.

Fermion : A type of elementary particle whose intrinsic spin is a half-integer ($\frac{1}{2}, \frac{3}{2}, \dots$) multiple of \hbar . Such particles can form rigid structures of matter such as atoms and atomic nuclei.

Fermilab : Fermi National Accelerator Laboratory, in Batavia, Illinois.

FFA, FFAG : Fixed-Field Alternating Gradient accelerator, an accelerator based on time-independent magnetic fields and alternating gradient focusing.

FinFET : Fin-shaped Field Effect Transistor.

FLAG : Flavor Lattice Averaging Group, a collaboration of experts in lattice **QCD** and weak-interaction theory who evaluation and average results from the various lattice **QCD** collaborations.

fm : Femtometer or **Fermi** = 10^{-13} cm.

FNAL : Fermi National Accelerator Laboratory, or **Fermilab**.

FOA : Funding Opportunity Announcement.

Form Factor : A Lorentz-invariant function of kinematic variables characterizing an elementary particle scattering or decay process.

FoV : Field of View.

FPGA : Field-Programmable Gate Array, a programmable hardware device for very rapid computation.

FRIB : Facility for Rare Isotope Beams, a linear accelerator at Michigan State University for isotope production and nuclear structure research.

FrPNC : Francium Parity Non-Conservation, at experiment at **TRIUMF** to measure **P**-violating atomic transitions in francium atoms.

FSR : Final State Radiation, radiation from a lepton, quark, or gluon produced in a high-energy scattering process.

FTM : Fast Timing **MPGD**.

GaAs : Gallium Arsenide.

GALLEX : GALLium EXperiment, a radiochemical solar neutrino experiment located at **Gran Sasso**.

GammeV-CHASE : An experiment at **Fermilab** to search for **axions** using a laser beam in a strong magnetic field.

GAPS : General Antiparticle Spectrometer, an experiment to detect anti-matter, especially deuterons, produced by annihilating dark matter particles.

GARD : General Accelerator Research and Development program of the **DOE**.

GC : Galactic Center.

GDD : Gaseous Detector Development laboratory at **CERN**.

Glossary

GDE : Global Design Effort, the collaboration responsible for the **ILC** Technical Design Report.

GE1/1, GE2/1 : **GEM** muon system stations in the **CMS** experiment

GEANT4 : A library of simulation programs describing the passage of high-energy particles through matter.

GEM : Gas Electron Multiplier, a type of **MPGD** ionization detector.

GEMMA : Germanium Experiment for measurement of the Magnetic Moment of Antineutrino, a neutrino magnetic moment experiment at the Kalinin nuclear power plant in Russia.

GERDA : Ge experiment searching for neutrinoless double beta decay.

GeV : Giga-electron Volt (10^9 eV), the energy scale of the proton mass and the subnuclear strong interactions.

GIM : Glashow-Iliopoulos-Maiani mechanism, a method for coupling quarks to the weak interactions that avoid flavor-changing **NC** processes, realized in the **SM**.

GLACIER : Giant Liquid Argon Charge Imaging Experiment, a proposed large liquid argon detector in Europe.

GNO : Gallium Neutrino Observatory, a radiochemical solar neutrino experiment at **Gran Sasso** (successor to **GALLEX**).

GPU : Graphics Processing Unit.

GR : General Relativity, Einstein's theory of gravity.

Gran Sasso : An Italian national laboratory under a mountain of the same name, about 120 km from Rome.

Grid : In computing, a network of distributed computer and storage resources. Typically, it refers to a network in which users need not know at which node the processor or data they are using resides.

GSI : Society for Heavy Ion Research (Gesellschaft für Schwerionenforschung), a nuclear physics research center in Darmstadt, Germany.

GUT : Grand Unified Theory, a unified theory of all microscopic particle interactions.

GW : Gravitational Wave.

GZK neutrinos : Greisen-Zatsepin-Kuzmin neutrinos, produced by ultra-high energy cosmic ray protons scattering off **CMB** photons.

HALO : Helium And Lead Observatory, lead-based supernova neutrino detector at **SNOLAB**.

HAWC : High-Altitude Water Cherenkov, a gamma-ray detector currently operating in Mexico.

HAYSTAC : Haloscope at Yale Sensitive To Axion CDM.

HE-LHC : High-Energy LHC, a proposed stage of the **LHC** in which the bending magnets are replaced by higher-field magnetics, to create pp collisions at center-of-mass energies of 26–33 TeV.

HEMT : High Electron Mobility Transistor.

H.E.S.S. : High Energy Stereoscopic System, a telescope for high-energy gamma rays seen as air showers in Cherenkov radiation, located in Namibia.

HEP : High-Energy Physics, the generic term for the areas of research described in this report.

HEPAP : High-Energy Physics Advisory Panel, a panel convened by the U.S. **DOE** and **NSF** to advise the federal government on high-energy physics research.

HERA : Hadron Elektron Ring Anlage, an electron-proton and positron-proton collider at **DESY** that operated from 1990 to 2007.

HETDEX : Hobby-Eberly Telescope Dark Energy Experiment.

HFIR : High Flux Isotope Reactor, reactor facility at Oak Ridge National Laboratory.

HGCal : **CMS** High Granularity Calorimeter for **HL-LHC**.

HHCAL : Homogeneous Hadron Calorimeter, a concept for hadron calorimetry based on total absorption of hadrons in large crystals equipped with dual readout (see **DREAM**).

HIGS : High Intensity Gamma-ray Source, a free electron laser at Duke University.

HIKE : High Intensity Kaon Experiments, a proposed long-term, high-intensity experimental program at CERN to study rare K decays.

HiBM : High Intensity Muon Beam, a proposal at **PSI** for a high-intensity muon beamline.

HiRes : High Resolution Fly's Eye cosmic ray experiment in Utah.

HLbL : Hadronic Light-by-Light scattering contribution to the muon anomalous magnetic moment.

HL-LHC : High Luminosity LHC, the highest-luminosity phase of the **LHC**.

HNL : Heavy Neutral Lepton.

HPC : High Performance Computing, such as that done using supercomputers.

HPGARTPC : High pressure gaseous argon **TPC**.

HPQCD : High-Precision QCD, an international collaboration carrying out lattice **QCD** calculations.

HPS : Heavy Photon Search, an experiment at **JLab** searching for the decay of dark photons to e^+e^- .

HQE : Heavy Quark Expansion, a method for computing decay rates of heavy hadrons using **HQET**.

HQET : Heavy Quark Effective Theory, a method for computing properties of hadrons with a single c or b quark by expanding about the limit in which this quark is extremely heavy.

HSC : Hyper-Suprime Cam, wide-field camera for the Subaru telescope.

HSF : **HEP** Software Foundation

HTC : High Throughput Computing, i.e, data-intensive computing.

HTS : High-Temperature Superconductivity.

HVP : Hadronic Vacuum Polarization contribution to the muon anomalous magnetic moment.

Glossary

Hyper-K : Hyper-Kamiokande, a proposed large water Cherenkov detector at Kamioka in Japan.

Hyperon : A baryon containing strange quarks.

IACT : imaging Atmospheric Cherenkov Telescope.

IAEA : International Atomic Energy Agency.

IAXO : International Axion Observatory.

IBD : Inverse Beta Decay, usually referring to the reaction $\bar{\nu}_e + p \rightarrow e^+ + n$.

IC : Integrated Circuit.

ICAL : Iron CALorimeter atmospheric neutrino experiment at **INO**.

ICARUS : Imaging Cosmic And Rare Underground Signals, a liquid argon neutrino detector originally located at **Gran Sasso** and now moved to the **SBN** beamline at **Fermilab**.

ICEBERG : Integrated Cryostat and Electronics Built for Experimental Research Goals, a **LAr** cryostat at **Fermilab**.

IceCube : A neutrino telescope located at the Amundsen–Scott South Pole station in Antarctica.

IceTray : A software framework developed and used by the IceCube experiment for both online and offline processing.

IDEA : Innovative Detector for an Electron-positron Accelerator.

IDS : International Design Study (for the Neutrino Factory).

IHEP : Institute of High Energy Physics of the Chinese Academy of Sciences, the major particle physics laboratory in China, located in Beijing.

ILC : International Linear Collider, an electron-positron linear collider with design **CM** energy 500 GeV.

ILD : International Linear collider Detector, a large detector proposed for **ILC** and **CLIC**.

InAs : Indium Arsenide.

Inclusive decay rate : Rate of particle decay to final states not fully specified by meeting a general description (for example, the “one-pion inclusive” decay rate).

InGrid : **MPGD** with integrated pixel readout.

Initial-state radiation : Radiation (in the form of photons or gluons) emitted by a primary particle in a collision process.

INO : India-based Neutrino Observatory, a future underground laboratory in Tamil Nadu, India.

I/O : Input/Output

IOPS : Input/output Operations Per Second.

IOTA : Integrable Optics Test Accelerator, an electron storage ring and an electron and proton storage ring at **FAST** for beam dynamics research.

IP : Intellectual Property.

IPPOG : International Particle Physics Outreach Group, a network of science educators and communicators based at **CERN**.

IR : Infrared light.

ISIS : Research center at Rutherford Appleton Laboratory near Oxford.

IsoDAR : Isotope Decay At Rest experiment, a proposed cyclotron-based sterile neutrino experiment.

ISR : Initial State Radiation, radiation from a high-energy lepton, quark, or gluon emitted as it scatters from another high-energy particle.

JEF : JLab Eta Factory, an experiment at **JLab** for precision measurements of η and η' meson decays.

JLab : Thomas Jefferson National Accelerator Facility, in Newport News, Virginia.

J-PARC : Japan Proton Accelerator Research Complex, the laboratory hosting the major Japanese proton accelerator, located in Tokai.

JEM-EUSO : Extreme Universe Space Observatory onboard the Japanese Experiment Module, proposed ultra-high energy cosmic ray detector on the International Space Station.

JUNO : Jiangmen Underground Neutrino Observatory, a proposed large scintillator experiment for reactor neutrino oscillations located in China.

K2K : KEK to Kamioka, the first-generation long-baseline oscillation experiment using beam from **KEK** to **Super-K**.

KA25 : DOE funding stream for detector R&D and detector facilities.

KamLAND : Kamioka Liquid scintillator ANTineutrino Detector, a reactor neutrino experiment at Kamioka in Japan.

KamLAND-Zen : Zero neutrino double beta decay search, a neutrinoless double beta decay experiment using a Xe-doped balloon deployed in **KamLAND**.

KATRIN : Karlsruhe TRITium Neutrino experiment, an experiment to measure neutrino mass from the endpoint of the tritium beta decay spectrum.

KEK : Ko-Enerugi Kenkyusho, the major high energy physics laboratory in Japan, located in Tsukuba.

KEKB : An e^+e^- collider operated at **KEK** from 1998 to 2010 in the center-of-mass energy region of 10 GeV. This collider is now upgraded to **SuperKEKB**.

KLOE, KLOE-2 : An experiment at **LNF** studying e^+e^- annihilation at energies near 1 GeV.

KM3NET : Multi-Km³ Neutrino Telescope, a future deep-sea neutrino telescope in the Mediterranean sea.

KOTO : An experiment at **J-PARC** studying the rare decay $K_L^0 \rightarrow \pi^0 \nu \bar{\nu}$.

kt : Kilotonne = 10⁶ kilograms.

KID : Kinetic Inductance Detector.

Λ CDM : The standard model of cosmology in which the Universe consists of known particles, cold **Dark Matter** (CDM), and dark energy (Λ).

Glossary

L/E : Length (**baseline**) / Energy, a figure of merit for neutrino oscillation experiments.

LAGUNA : Large Apparatus studying Grand Unification and Neutrino Astrophysics, a collaborative project to assess the possibilities for a deep underground neutrino observatory in Europe; includes the **GLACIER** , **MEMPHYS**, and **LENA** concepts.

LANL : Los Alamos National Laboratory.

LANSCE : Los Alamos Neutron Science Center.

LAPPD : Large Area Picosecond Photo-Detectors project, a collaboration working to develop large-area flat-panel photon detectors.

LAr : Liquid argon.

LAr1 : A proposal to add additional liquid argon TPCs to the **Fermilab** Booster neutrino beamline.

LAr1-ND : A proposal to add a liquid argon TPC near detector in the **Fermilab** Booster neutrino beamline.

LArIAT : Liquid Argon In A Testbeam, a liquid argon TPC test beam experiment at **Fermilab**.

LARP : LHC Accelerator Research Program, a collaboration of U.S. national laboratories to develop technology for the current and future stages of the **LHC**.

LArPix : A low-power pixilated charge readout for an **LArTPC**.

LArTPC : Liquid Argon Time Projection Chamber.

LBNF : Long Baseline Neutrino Facility, comprising two installations, the LBNF Near Site at **Fermilab** and the LBNF Far Site at **SURF**, which together provide the beam, underground experimental halls, and infrastructure required to support **DUNE**.

LBNL : Lawrence Berkeley National Laboratory (formerly LBL, Lawrence Berkeley Laboratory).

LCF : Leadership Computing Facility, one of the **DOE**'s high-performance computing centers.

LDO : Low Dropout Regulators.

LEM : Large Electron Multipliers.

LENA : Low Energy Neutrino Astronomy, a proposed next-generation liquid scintillator detector.

LENS : Low Energy Neutrino Spectroscopy, a low-energy indium-based solar neutrino experiment.

LEP, LEP-2 : The Large Electron-Positron collider at **CERN**, which performed precision studies of the Z meson and searches for new phenomena from 1989 to 2000.

Lepton flavor universality : The feature of the **Standard Model** that the gauge forces act identically on the three types of charged leptons.

Leptonic decay : A particle decay with only leptons in the final state.

LGAD : Low Gain Avalanche Diode/Detector.

LHC : Large Hadron Collider, a large proton-proton collider at **CERN**, with design **CM** energy 14 TeV.

LHCb : An experiment at the Large Hadron Collider specialized to measure the production in the forward direction of hadrons containing heavy quarks.

LHeC : Large Hadron-electron Collider, a proposal for a high-energy electron beam colliding with the proton beam of the **LHC** at **CERN**.

LNF : Laboratori Nazionali di Frascati, the leading particle physics laboratory in Italy, located in Frascati, near Rome.

LO : Leading Order, applied to the level of a quantum field theory calculation (see also **NLO**).

LOI : Letter of Intent.

LPA : Laser Plasma Acceleration.

LRGs : Luminous Red Galaxies.

LSND : Liquid Scintillator Neutrino Detector, an experiment at Los Alamos National Laboratory searching for sterile neutrinos.

LSO : Lutetium Silicate (Lu_2SiO_5).

LSST : Legacy Survey of Space and Time (formerly, Large Synoptic Survey Telescope), now renamed the Vera Rubin Observatory.

LuSEE-Night : Lunar Surface Electromagnetics Experiment, Night phase.

LUX : Large Underground Xenon detector, a large **Dark Matter** detector using liquid Xenon.

LVD : Large Volume Detector, a neutrino observatory at **Gran Sasso** studying low-energy neutrinos from gravitational stellar collapse.

LXe : Liquid Xenon.

LYSO : Lutetium Yttrium OxyorthoSilicate ($\text{Lu}_2(1-x)\text{Y}_2(x)\text{SiO}_5$).

LZ : LUX-Zeplin, a current-generation xenon TPC **Dark Matter** detector.

MACS : Muonium-Antimuonium Conversion Spectrometer, an experiment at **PSI** searching for muonium-antimuonium conversion.

MADMAX : Magnetized Disc and Mirror Axion Experiment.

MAGIC : Major Atmospheric Gamma-ray Imaging Cherenkov telescope, a telescope for high-energy gamma rays seen as air showers in Cherenkov radiation, located in the Canary Islands.

MAJORANA : An experiment searching for neutrinoless double-beta decay in Ge, located at **SURF**.

MAMI : MAInzer MIcrotron, a low-energy electron accelerator at the University of Mainz.

Many-core : Refers to computer chips that contain many more cores than **multi-core CPUs**, i.e., more than 16 **CPUs**.

MAPS : Monolithic Active Pixel Sensor.

MCP : Micro-Channel Plate.

Glossary

ME0 : **GEM** muon system station in the **CMS** experiment.

MEG : MuEGamma experiment, an experiment at **PSI** searching for the decay $\mu \rightarrow e\gamma$. This experiment is now in its second phase, MEG-II.

MEMPHYS : MEgaton Mass PHYSics, a large water Cherenkov detector proposed for **CERN** or **ESS**.

MESA : Mainz Energy-Recovering Superconducting Accelerator, a proposed electron accelerator at the University of Mainz.

MicroBooNE : Liquid argon TPC experiment in the Booster neutrino beamline at **Fermilab**.

MicroMegas : Micro-Mesh gas detector, a type of **MPGD** ionization detector.

Milagro : A water Cherenkov gamma-ray telescope located near **LANL**.

MILC : MIMD Lattice Computation, an international collaboration carrying out lattice **QCD** computations.

MINER ν A : Main Injector Experiment for ν -A, a neutrino scattering experiment in the NuMI beamline at **Fermilab**.

MiniBooNE : A short-baseline neutrino oscillation experiment using a mineral oil-based Cherenkov detector in the Booster neutrino beamline at **Fermilab**.

MIND : Magnetised Iron Neutrino Detector, a proposed neutrino factory detector.

Minimal Flavor Violation : A scenario for models of new physics in which quark flavor is violated only by the **CKM** matrix, as in the **Standard Model**.

MINOS : Main Injector Neutrino Oscillation Search, a neutrino oscillation experiment located at **Soudan** using the NuMI beamline at **Fermilab**.

MIP : Minimum-Ionizing Particle.

MIT-LL : MIT Lincoln Laboratory.

MKID : Microwave Kinetic Inductance Detector.

ML : Machine Learning.

MNS : Maki-Nakagawa-Sakata matrix (see **PMNS**).

MOLLER : An experiment at **JLab** to measure the **P**-violating asymmetry in electron-electron scattering.

MOS : Metal Oxide Semiconductor, a class of semiconductor devices.

MOSFET : Metal Oxide Semiconductor Field Effect Transistor.

MOSIS : Metal Oxide Semiconductor Implementation Service.

MPGD : Micro-Pattern Gaseous Detector.

MPPC : Multi-Pixel Photon Counter.

\overline{MS} : Modified Minimal Subtraction, a prescription for removing divergences commonly used in high-precision quantum field theory calculations.

MS-DESI : Mid-Scale Dark Energy Spectroscopic Instrument.

MSE : Maunakea Spectroscopic Explorer, a multi-object spectroscopy telescope on Mauna Kea.

MSSM : Minimal Supersymmetric Standard Model, the simplest (though, not very simple) model that extends the **SM** by the addition of **SUSY**.

MSW : Mikheyev-Smirnov-Wolfenstein effect, the modification of the neutrino oscillation probability as neutrinos pass through matter.

Multi-core : Refers to computer chips that contain up to about 16 **CPUs**.

Muon capture : Capture of a μ^- by a proton in an atomic nucleus, resulting in the reaction $\mu^- p \rightarrow n \nu_\mu$.

Muon $g - 2$: An experiment at **Fermilab** to measure the anomalous magnetic moment of the muon.

Muonium : The bound state of a positive muon and a negative electron; antimuonium is the bound state of a negative muon and a positron.

Mu2e : An experiment at **Fermilab** searching for muon-to-electron conversion in the field of a heavy nucleus.

Mu3e : An experiment at **PSI** searching for the flavor-violating decay $\mu^+ \rightarrow e^+ e^- e^+$.

mwe : Meters water-equivalent, a measure of the depth of an underground detector.

MWPC : Multi-Wire Proportional Chamber.

NA61/SHINE : **SPS** Heavy Ion and Neutrino Experiment, studying the hadronic final states produced in interactions of pion, proton, and beryllium, argon, and xenon nuclei beam with a variety of fixed nuclear targets.

NA62 : An experiment at **CERN** measuring the rare kaon decay $K^+ \rightarrow \pi^+ \nu \bar{\nu}$.

NASA : National Aeronautics and Space Administration.

NC : Neutral Current weak interactions.

ND-Gar : **DUNE** near detector made of gaseous argon.

nEDM : Neutron **EDM**.

NERSC : National Energy Research Scientific Computing Center.

NESSiE : Neutrino Experiment with SpectrometerS in Europe, a proposed experiment to search for sterile neutrinos using the **CERN** SPS beam and the **ICARUS** detector.

Neutrino mass ordering, or Neutrino mass hierarchy : The question of whether the neutrino mass eigenstate ν_3 , with the smallest content of ν_e , has the heaviest or lightest of the neutrino masses. These two cases are called the “Normal hierarchy” and “Inverted hierarchy”, respectively.

Neutrino octants : Sectors of the parameter space of neutrino mixing in which the mixing angle θ_{23} is greater than or less than 45° . The region $\theta_{23} > 45^\circ$ is also called the “dark side”.

NEXT : Neutrino Experiment with Xenon TPC, a neutrinoless double beta decay experiment at the **Canfranc Underground Laboratory**.

Glossary

NF : Neutrino Factory.

NIST : National Institute of Standards and Technology.

NLO, NNLO : Next-to-Leading Order, Next-to-Next-to-Leading Order, terms designating a quantum field theory calculation with two and three terms, respectively, in the power series in the coupling constant.

NLWCP : New, Light, Weakly-Coupled Particles.

NMR : Nuclear Magnetic Resonance.

NN : Neural Network.

NNbarX : An experiment proposed at **Fermilab** to search for neutron-antineutron oscillations.

NNSA : National Nuclear Security Administration.

NOMAD : Neutrino Oscillation MAGnetic Detector, a neutrino oscillation experiment at **CERN**.

Nonleptonic decay : A particle decay only hadrons in the final state.

NO ν A : NuMI Off-Axis electron-neutrino Appearance experiment, a neutrino oscillation experiment in the **NuMI** beamline at **Fermilab**.

NP : Nuclear Physics.

NREN : National Research and Education Network, a high performance network designed for large scale data movement.

NSF : U.S. National Science Foundation.

NUFO : National User Facility Organization, the umbrella group for U.S. national user facility users' organizations.

NuMAX : Neutrinos from Muon Accelerators at Project X, a proposed neutrino oscillation experiment using a muon-storage ring as a source of neutrinos.

NuMI : Neutrinos at the Main Injector, a neutrino beamline at **Fermilab** using the Main Injector, extending to **Soudan** and Ash River, Minnesota.

nuSTORM : Neutrinos from STORed Muons, a proposed short-baseline neutrino experiment to study sterile neutrinos using a muon storage ring as a source of neutrinos.

NVRAM : Non-Volatile Random Access Memory.

OHEP : Office of High Energy Physics of the U.S. **DOE**.

OLCF : Oak Ridge Leadership Computing Center.

OPE : Operator Product Expansion, a method in Quantum Field Theory that approximates a product of operators at closely spaced points by a sum of local operators.

OPERA : Oscillation Project with Emulsion-tRacking Apparatus, an emulsion- and tracker-based neutrino oscillation experiment at **Gran Sasso**.

ORCA : Oscillation Research with Cosmics in the Abyss, a proposed experiment to measure the neutrino mass hierarchy using the **KM3NeT** neutrino telescope.

ORKA : A proposed **Fermilab** experiment to measure the rate of the decay $K^+ \rightarrow \pi^+ \nu \bar{\nu}$.

ORNL : Oak Ridge National Laboratory.

OscSNS : Oscillations at the Spallation Neutrino Source, a proposed sterile neutrino search using the SNS facility.

P : Parity, the inversion of all spatial coordinates.

PAMELA : Payload for Antimatter Matter Exploration and Light-nuclei Astrophysics, space-based anti-matter detector.

PANDA : antiProton ANnihilation at Darmstadt, a proposed experiment at the GSI Helmholtzzentrum in Darmstadt, Germany, studying proton-antiproton annihilation at few-GeV energies.

PandaX : A liquid xenon **Dark Matter** experiment to be located in the Jin-Ping Underground Laboratory in Sichuan, China.

PB : PetaByte, equal to 10^{15} bytes of information.

PDC : Photon to Digital Converter.

PDF : Parton Distribution Function, a function that describes the internal structure of the proton by giving the momentum distribution of a particular constituent, for example, the up quark or gluon.

PEN : An experiment at **PSI** to measure the ratio of decay rates $\pi^+ \rightarrow e^+ \nu / \pi^+ \rightarrow \mu^+ \nu$.

Persistency management : Management of persistent data on disk, tape, or other media. This includes reducing the risk of loss to an appropriate level.

PEP-II : An e^+e^- collider operated at **SLAC** from 1998 to 2008 in the center-of-mass energy region of 10 GeV.

PF : PetaFlop, 10^{15} floating point operations (usually, per second).

PF : Particle Flow.

PFA : Particle Flow Analysis/Algorithm, a method for hadron calorimetry based on separate measurement of the components of a hadronic shower with charged particles, photons, and neutral hadrons.

PFS : Prime Focus Spectrograph, wide-field multi-object spectrograph for the Subaru telescope.

PI : Principal Investigator.

Picosec : A fast timing **MPGD**.

PID : Particle Identification.

PIENU : An experiment at **TRIUMF** to measure the ratio of decay rates $\pi^+ \rightarrow e^+ \nu / \pi^+ \rightarrow \mu^+ \nu$.

Pile-up : In collisions of a particle bunch with a fixed target or of two particle bunches in a colliding beam experiment, additional collision events superposed on the collision of primary interest. Pile-up is a major source of background events in high-intensity experiments.

PINGU : Precision IceCube Next Generation Upgrade, a proposed low-energy extension to **IceCube**.

PIONEER : An experiment at **PSI** to study lepton universality and CKM unitarity in rare pion decays.

Glossary

PIP-II : Proton Improvement Plan II, a project to upgrade the Fermilab proton beam to 1.2 MW.

Pipeline computing : Data analysis that proceeds in stages.

PLL : Phase-Locked Loop.

pMSSM : phenomenological Minimal Supersymmetric Standard Model, a 19-parameter subspace of the full MSSM.

PMNS : Pontecorvo-Maki-Nakagawa-Sakata matrix, the matrix linking the mass and flavor eigenstates of neutrinos.

PMT : PhotoMultiplier Tube.

Port : To adjust and test a computer program to run on a new architecture, or the result of this process.

Portal : An interaction that connects particles in a **Dark Sector** with particles of the **Standard Model**.

PQ : Peccei-Quinn symmetry, an approximate symmetry of quark-Higgs boson interactions, which must also be spontaneously broken, that allows the possible **CP**-violating term in **QCD** to be set to zero. A consequence of this symmetry is the existence of the **axion**.

PRD : Primary Research Direction.

PREM : Preliminary Reference Earth Model, a model for the Earth's density distribution.

PREP : Physics Research Equipment Pool.

PRISM : Precision Reaction-Independent Spectrum Measurement, a technique to use measurements of neutrino beams at multiple off-axis angles to construct a data-driven prediction of the beam energy spectrum.

protoDUNE : Prototype detectors for **DUNE** operated in a test beam at **CERN**.

Project 8 : A proposed tritium-based neutrino mass experiment.

Project X : A planned upgrade of the proton accelerator injector complex at **Fermilab**, with a superconducting proton linear accelerator capable of producing multi-megawatt beams.

PROSPECT : Precision Reactor Neutrino Oscillation and Spectrum Experiment, a U.S.-based reactor short-baseline oscillation search experiment.

Protvino : The major particle physics laboratory in Russian, located in Protvino, Moscow region.

PSI : Paul Scherrer Institute, a national laboratory and accelerator center in Switzerland.

PTOLEMY : Princeton Tritium Observatory for Light Early-universe Massive neutrino Yield, a proposed relic Big Bang neutrino background experiment.

PUMA : Packed Ultrawideband Mapping Array.

PWFA : Plasma Wake Field Acceleration.

QC : Quantum Computer.

QCD : Quantum Chromodynamics, the well-established theory describing the strong subnuclear interactions.

QE : Quantum Efficiency.

QE : Quasi-Elastic scattering. In neutrino physics, a reaction such as $\nu n \rightarrow \mu^- p$ in which no mesons are produced. In other contexts, a quasi-elastic reaction on a nucleon can involve production of a low-lying nucleon resonance.

QED : Quantum ElectroDynamics.

QI : Quantum Information.

QIS : Quantum Information Science.

QPix : A pixilated readout technique for **LArTPCs** based on charge integration and reset (CIR) circuits.

Qweak : An experiment at **JLab** to measure Q_{weak} , the charge with which the proton couples to the Z boson at very low momentum transfer.

RADAR : R&D Argon Detector at Ash River, proposal to add a **LAr TPC** to the **NO ν A** far detector building in Ash River, Minnesota.

Radiative decay : Particle decay with a photon in the final state.

RAT : A simulation and analysis package for optical detectors developed for the Braidwood project and now used within **SNO+**, **MiniClean**, and **DEAP**.

RAY : Rydberg Atoms at Yale.

RBC-UKQCD : RIKEN-BNL-Columbia-United Kingdom QCD, an international collaboration carrying out lattice **QCD** computations.

RD51 : **CERN** R&D collaboration for the development of MGPD technologies.

REAPR : Resonantly Enhance Axion Photon Regeneration, an experiment at **Fermilab** to search for **axions** using a laser beam in a strong magnetic field, the successor to **GammeV-CHASE**.

REDTOP : A proposed next-generation η and η' meson factory.

RENO : Reactor Experiment for Neutrino Oscillations, a reactor neutrino experiment in South Korea.

RENO-50 : A proposed reactor-based experiment with **baseline** ~ 50 km to measure the neutrino mass hierarchy with a large scintillator detector.

RF : Radio Frequency.

RFSoc : Radio Frequency System on Chip.

RHIC : Relativistic Heavy Ion Collider, a colliding beam accelerator for protons and heavy ions at **BNL**.

RIB : Rare Isotope Beam.

RICE : Radio Ice Cherenkov Experiment, neutrino detector in Antarctica.

RICOCHET : A proposed bolometric sterile neutrino search using **CENNS**.

Glossary

RICH : Ring Imaging CHerenkov detector.

RIKEN : Rikagaku Kenkyujo, a major Japanese research institute covering physics, chemistry, and engineering, operating multiple research groups in Japan and one in the U.S. at **BNL**.

ROI : Region Of Interest. In neutrino physics, the region of a measured energy spectrum where the signal (typically a peak or dip from an oscillation) lies. In collider physics, a region of a detector whose data is used in trigger calculations.

RPC : Resistive Plate Chamber, a type of particle tracking detector.

RPWELL : Resistive-Plate Well Detector.

SAGE : Soviet American Gallium Experiment, a solar neutrino experiment in the **Baksan** Neutrino Observatory in Russia.

SBC : Scintillating Bubble Chamber, a proposed **DM** detector.

SBIR : Small Business Innovation Research, a grant category of the **DOE** for collaboration of small businesses with experimental projects.

SBN : Short Baseline Neutrino program at **Fermilab**.

SBND : Short Baseline Near Detector, a **LArTPC** detector in the **Fermilab SBN** program.

SCGSR : Science Graduate Student Research.

SciDAC : Scientific Discovery through Advanced Computation, a program of the **DOE**.

SCTF : Super Charm Tau Factory, a proposed e^+e^- collider at **BINP**.

Science DMZ : A portion of a computer network designed for high-performance scientific applications rather than general-purpose computing such as web browsing.

SciNO ν A : A proposed neutrino scattering experiment adding a fine-grained scintillator detector at the **NO ν A** near detector site.

SDSS : Sloan Digital Sky Survey, a survey of more than a quarter of the sky using the 2.5-meter telescope at Apache Point Observatory, New Mexico.

Secondary vertex : In a collision process, the location of the decay of a long-lived particle produced in the primary reaction.

Semileptonic decay : A particle decay with leptons plus one or more hadrons in the final state.

SiD : Silicon Detector, a detector with silicon tracking proposed for **ILC** and **CLIC**.

SiGe : Silicon Germanium.

SIMD : Single Instruction Multiple Data style of parallel programming.

SINDRUM-II : An experiment at **PSI** searching for muon-to-electron conversion in the field of Au atoms.

SiPM : Silicon PhotoMultiplier, a silicon-based photodetector operated in Geiger mode.

SKA : Square Kilometer Array radio telescope.

SLAC : SLAC National Accelerator Laboratory, originally named the Stanford Linear Accelerator Center, a U.S. national laboratory in Menlo Park, California.

SLC : SLAC Linear Collider, an electron-positron collider operated at **SLAC** from 1989 to 1998 to study the Z boson and develop the technology of linear colliders.

SM : Standard Model of particle physics, which describes the strong, electromagnetic, and weak interactions as mediated by vector fields.

SNO : Sudbury Neutrino Observatory, a solar neutrino experiment located in Sudbury, Ontario, Canada.

SNO+ : A successor to the **SNO** experiment aimed at the measurement of neutrinoless double-beta decay of tellurium.

SNOLAB : Underground science laboratory in the Vale Creighton Mine located near Sudbury, Ontario.

SNS : Spallation Neutron Source, at Oak Ridge National Laboratory.

SNSPD : Superconducting Nanowire Single Photon Detector.

SOI : Silicon on Insulator.

SOTA : State of the Art.

SOTP : State of the Practice.

Soudan : An underground laboratory in northern Minnesota, housing **MINOS** and low-background experiments.

SOX : A chromium and/or cesium source used with the **Borexino** detector to study the reactor neutrino anomaly.

SPAD : Single Photon Avalanche Detector.

Spec-S5 : Stage V Spectroscopic Facility

SpecTel : Spectroscopic Telescope, a proposed **Spec-S5** implementation.

SPS : Super Proton Synchrotron at **CERN**.

SQuAD : Superconducting Qubit Advantage for **Dark Matter**.

SRAM : Static Random Access Memory.

srEDM : A proposed storage ring experiment to measure the proton's **EDM**.

SRF : Superconducting Radio Frequency (**RF**) cavities and associated technology.

SRS : Scalable Readout System.

STTR : Small business Technology TRansfer, a **DOE** program for this purpose.

STAR : Solenoidal Tracker at RHIC, a relativistic heavy ion collider experiment at Brookhaven.

STCF : Super Tau Charm Factor, a proposed e^+e^- collider at **IHEP** with a center of mass energy range of 2–7 GeV.

STEM : Science, Technology, Engineering, and Mathematics, typically describing a domain of education.

Glossary

STEREO : Search for Sterile Neutrinos at ILL reactor, a reactor short-baseline oscillation search in France.

Subaru : An optical/infrared telescope on Mauna Kea operated by the National Observatory of Japan.

Super-K : Super-Kamiokande experiment, water Cherenkov detector in the Kamiokande mine in Japan studying proton decay as well as solar, atmospheric, and accelerator-produced neutrinos.

SuperKEKB : A high-luminosity electron-positron collider, with **CM** energy about 10 GeV, at **KEK**.

Super-NEMO : Super Neutrino Ettore Majorana Observatory, a neutrinoless double beta decay experiment in the Fréjus underground laboratory in France.

SURF : Sanford Underground Research Facility: An underground laboratory in the former Homestake Mine in Lead, South Dakota.

SUSY : SUperSYmmetry, a symmetry that links together **fermions** and **bosons**. In any realistic theory, supersymmetry requires a new space-time structure extending and generalizing that of relativity.

SWG0 : Southern Wide-Field Gamma-Ray Observatory.

Theia : A proposed large-scale optical neutrino detector in which both Cherenkov and scintillation signals are used.

T : Time reversal, the transformation of reversing the direction of time.

T2K : Tokai to Kamiokande experiment, a neutrino oscillation experiment in Japan, using the **J-PARC** neutrino beam and the **Super-K** detector.

TA : Telescope Array, ultra-high-energy cosmic ray detector in Utah.

TCA : Telecommunications Computing Architecture.

TeV : Tera-electron Volt (10^{12} eV), the order-of-magnitude energy scale of Higgs boson physics.

TDAQ : Trigger and **DAQ**.

TDC : Time to Digital Converter.

TDR : Technical Design Report.

TES : Transition Edge Sensor, a cryogenic sensor based on the very small amount of energy needed to destroy superconductivity in a thin film painted on the surface of a detector.

Theta-QCD, θ_{QCD} : . The coefficient of an allowed **CP**-violating interaction in the Lagrangian of **QCD**.

THGEM : Thick **GEM** detector.

TKID : Thermally-mediated **KID**.

TLEP : Triple Large Electron-Positron collider, a proposed e^+e^- collider in a large circular tunnel, with **CM** energies from 90 to 350 GeV.

TPC : Time Projection Chamber, a type of particle detector in which ionization from a track flows to a wall of a detector and the arrival time and location are measured, producing a 3-dimensional image of the track.

TPU : Tensor Processing Unit.

TREK : Time Reversal Experiment with Kaons, an experiment at **J-PARC** to search for **T**-violating muon polarization in the decay $K^+ \rightarrow \pi^0 \mu^+ \nu$.

Trigger : Hardware and software decision process that determines which signals from an experiment will be recorded for further analysis.

Trigger bandwidth : The maximum rate of interactions in an experiment that can be accepted by the **trigger** and written to permanent storage.

TRIUMF : TRI-University Meson Facility, the national accelerator laboratory of Canada, located in Vancouver. It is now operated by a consortium of 15 universities.

TSV : Though-Silicon Via.

TWIST : TRIUMF Weak Interaction Symmetry Test, an experiment at **TRIUMF** measuring the decay distributions of polarized muons with high precision.

UCN : Ultra-cold neutrons.

UHE : Ultra High Energy, typically applied to cosmic rays with energies $> 10^{18}$ eV.

UQ : Uncertainty Quantification, in the context of **QIS**.

USQCD : A collaboration of U.S. scientists carrying out lattice **QCD** computations.

UV : Ultraviolet light.

VCSEL : Vertical Cavity Surface Emitting Laser.

VEPP : One of a series of electron-positron colliders at the Budker Institute of Nuclear Physics in Novosibirsk, Russia.

VERITAS : Very Energetic Radiation Imagine Telescope Array System, a telescope for high energy gamma rays seen as air showers in Cherenkov radiation, located in Arizona.

Vev : Vacuum expectation value, the value of a condensed field, such as the Higgs field, at every point in space.

Volunteer computing : A distributed computing effort in which computer resources are donated by the owner, for example, the SETI At Home project.

VUV : Vacuum ultraviolet light.

Wakefield : The electromagnetic field trailing a bunch of high-energy particles in an accelerating structure.

WATCHMAN : WATER CHerenkov Monitoring of Anti-Neutrinos, a collaboration of U.S.-based universities and laboratories conducting a site search for an advanced water Cherenkov demonstration detector.

WCTE : Water Cherenkov Test Experiment facility at **CERN**.

WDM : Wavelength Distribution Multiplexing.

WFIRST-AFTA : Wide-Field InfraRed Survey Telescope-Astrophysics Focused Telescope Assets

Glossary

Wilson Coefficients : Coefficients of operators appearing in **OPEs** and **EFTs**, named after Kenneth G. Wilson.

WIMP : Weakly Interacting Massless Particle, a category of particle that might make up the **Dark Matter** of the universe.

WIPP : Waste Isolation Pilot Plant, an underground facility located in New Mexico.

Wire-Cell : Software package for signal processing and reconstruction in **LArTPCs**.

WLCG : Worldwide **LHC** Computing Grid.

XLZD : A proposed future Xenon-based **Dark Matter** detector.

YBCO : Yttrium Barium Copper Oxide, $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$, one of the first high-temperature superconductors.