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## **Energy Frontier Working Group**

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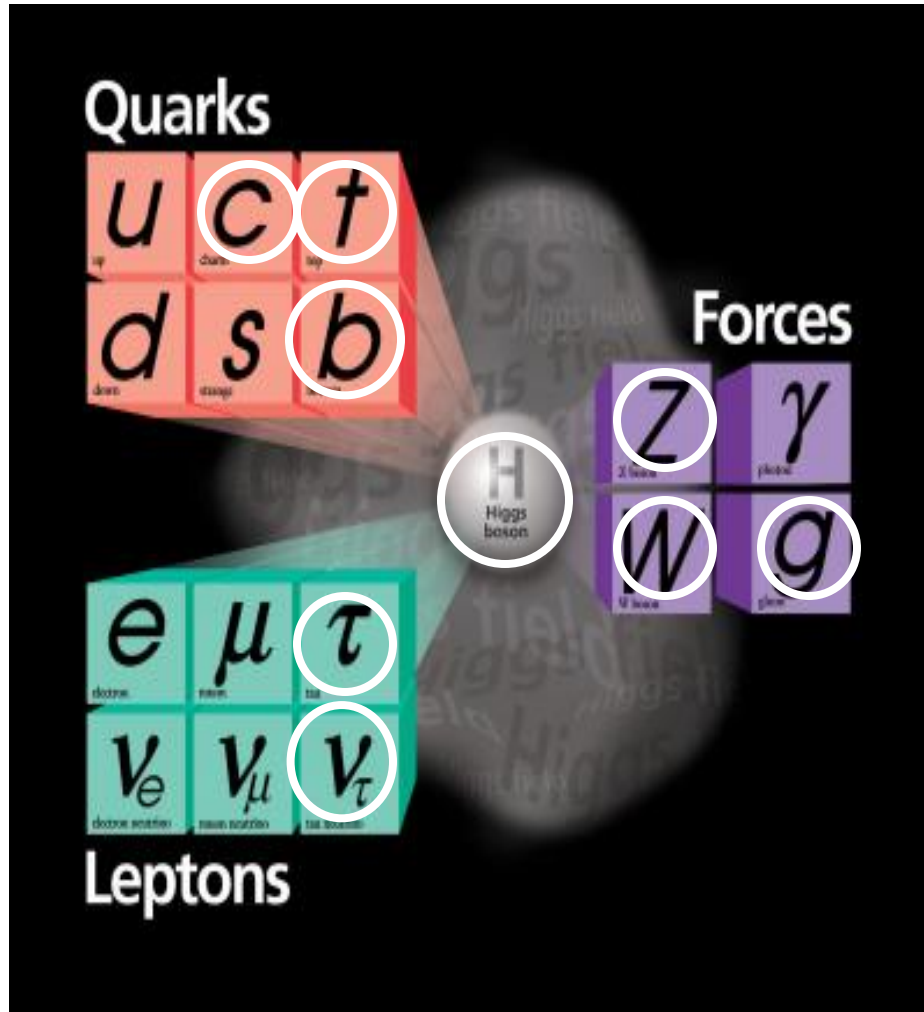
April 10, 2017

# Working Group Goals

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- The goal of our working group is to present at the scientists retreat (May 4<sup>th</sup>) options for future Fermilab energy frontier activities
- Time scales we consider
  - 2017-2021 – period before next Snowmass
  - 2021-2026 – period of developments of large projects beyond current P5 plan, based on Snowmass/P5 recommendations
  - 2026 and beyond – large scale construction funding for beyond current P5 activities to become available
- Our goal is to discuss all scientifically interesting and technically achievable options

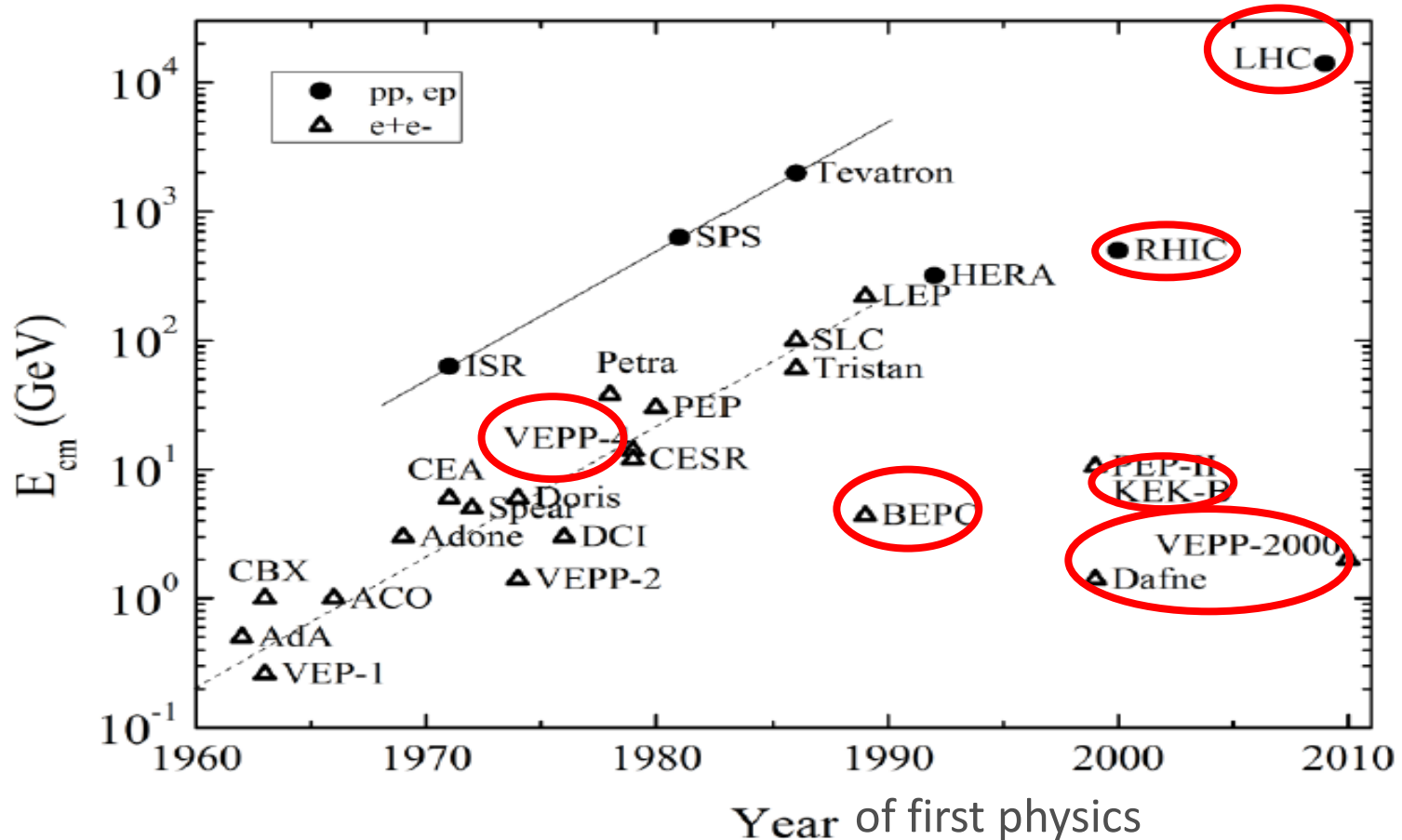
# Accelerators and the Particle Physics



- Progress in particle physics was closely related to discoveries at ever more powerful accelerators and colliders
- $e^+e^-$  colliders
  - c quark, tau lepton, gluon
- Hadron colliders
  - W and Z bosons
  - Top quark and the Higgs boson
- Fixed target at the energy frontier
  - Tau neutrino and b quark

High energy provides opportunity to study smallest distances ( $x=h/E$ ) and highest masses ( $E=mc^2$ ) particles

# Operating or Soon to be Operating Colliders



- Single high energy hadron collider – the LHC, now at 13 TeV
  - RHIC at BNL – nuclear studies
- DAFNE (Frascati), VEPP (Novosibirsk), BEPC (Beijing) – low energy e<sup>+</sup>e<sup>-</sup> colliders
- SuperKEK-B – b-factory at KEK to restart in 2016 with ~40 times higher luminosity
  - Studies of particle containing b-quarks

# Plan of the Energy Frontier Group Meetings

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- Today
  - a. LHC physics, detectors and accelerators from Phase I to HE-LHC and LARP – Anadi and Sergo.
  - b. FCC, CLIC, ILC, CepC – world-wide energy frontier program under development - Dmitri.
  - c. Future energy frontier options and critical accelerator technologies - Vladimir.
  - d. What future energy frontier colliders might teach us - Bogdan and John.
- Our next meeting will be on April 24, at 1:00pm in 1 West
  - To go over various options taking into account today's feedback
- We need your input and active participation to help with the ideas for the future of the energy frontier at the laboratory
  - Please contact us with questions, comments, and proposals

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# Discussion Slide

# Fermilab Activities at the Energy Frontier

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- 2017-2021
  - Highest priority is LHC
    - Phase I upgrade, HL-LHC detectors design and LARP, data analysis
  - Participate in activities in Asia and Europe: ILC, CepC and FCC
    - To be ready for active involvement
  - Develop critical accelerator technologies: SRF and high field magnets
  - Start discussions about potential energy frontier facility in US
- 2021-2026
  - Participate in HL-LHC detectors upgrades and LARP construction/installation and LHC data analysis
  - Based on Snowmass/P5 outcome develop proposals of US energy frontier project
  - Participate in the projects under construction/design in Europe and/or Asia
- 2026 and beyond
  - Participate in HL-LHC data collection and analysis
  - Design/construction of the next energy frontier facility in US
  - Participation in the energy frontier programs in other regions