Phenomenology

QCD

Formal Theory

Particle Theory
As a working definition for this presentation, I’m going to consider phenomenology the parts of theory which interact directly with experiments.

This could be either something like:

A suggestion for how to search for some kind of fundamental physics [including improving on existing searches].

Taking a feature in data and providing the “theory support” needed to put it in context.
(Random) Examples
DAMA "Signal"

- DAMA Signal
- $\sigma_{SI}$
- CDMS Xenon (etc)
- Exothermic Scattering
- Iso-spin Violation
- Inelastic DM
- Collider Signals
- Y-lines
- Velocity Distributions
- Recoil Spectra
- Inelastic DM
- MiDM
- Exciting DM
- Sommerfeld
- IVDM Models

Phenomenology
Experimental Results
Model Building
Dark Matter
Outlook

- Phenomenology is the glue that holds many areas of particle theory together and interfaces it with experimental data.

- The last decades have illustrated this point very well. We saw a couple of specific (but randomly chosen) examples. Many, many more exist.

- The next decade is hard to predict with any accuracy; but the essential role is established, and the importance of phenomenology in interpreting and guiding the current “data rich” era is very easy to appreciate. A few one could easily imagine in the next ten years:
  - Taking experimental discoveries of dark matter and distilling them into a particle physics Lagrangian.
  - Measuring the parameters of the (N)MSSM\(^{(++)}\) from collider measurements.
  - Contrasting our newest and greatest theories attempting to explain flavor with measurements to indicate hints that they are (in)correct.
Theories of Dark Matter

- mSUGRA
- R-parity Conserving Supersymmetry
- pMSSM
- R-parity violating
- Gravitino DM
- MSSM
- NMSSM

Extra Dimensions
- UED DM
- Warped Extra Dimensions
- Little Higgs
- Soliton DM
- Q-balls
- Quark Nuggets
- 6d
- 5d
- RS DM
- Warm DM
- Asymmetric DM
- Dirac DM
- WIMPless DM
- Techni-baryons
- Self-Interacting DM
- Dark Photon
- Light Force Carriers
- Axion DM
- Axion-like Particles
- QCD Axions
- Sterile Neutrinos
- Force Carriers
- T-odd DM
- Dark Photon
- Axion DM
- Techni-baryons
- Axion-like Particles
- QCD Axions
- Axion DM
- Axion-like Particles
- QCD Axions
- Axion DM