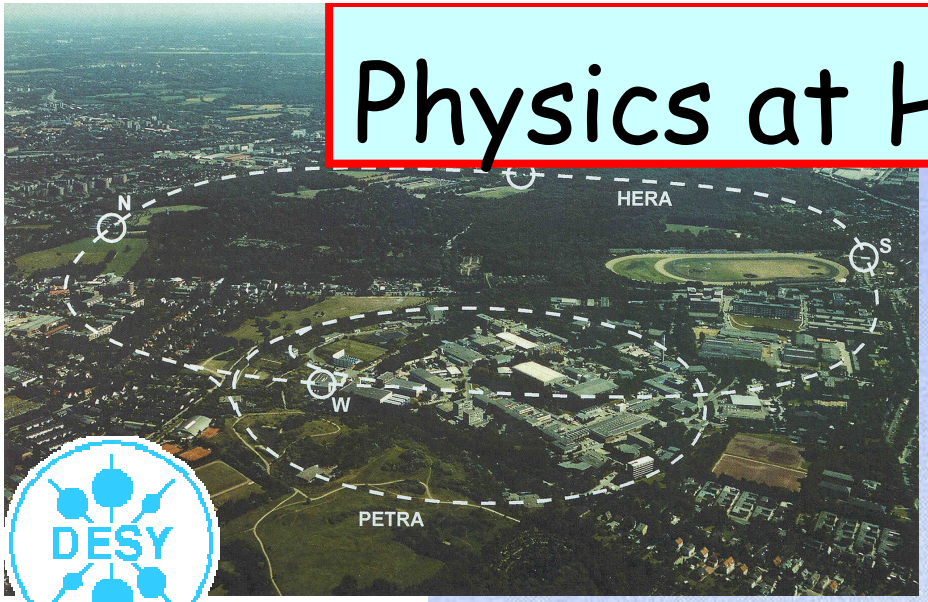
Physics at HERA (DESY)



Achim Geiser, DESY Hamburg

Iasi 4-Seas-Conference
Iasi, Romania, May 29, 2007

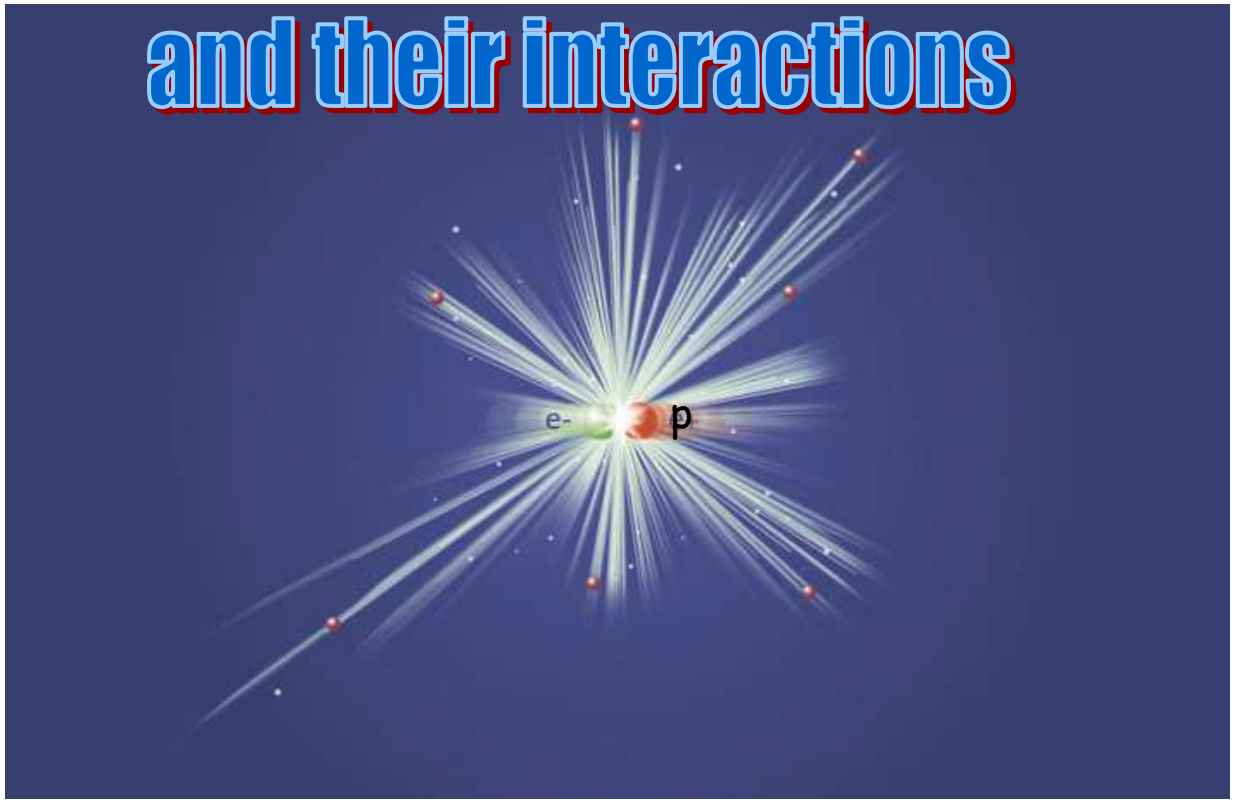
- Introduction for non-particle physicists
- **HERA as a proton imaging device**
- Electroweak physics at HERA
- HERA as a QCD machine
- (Beyond Standard Model -> talk C. Diaconu)
- Nucleon spin structure
- Conclusions

What is Particle Physics?

Particle Physics

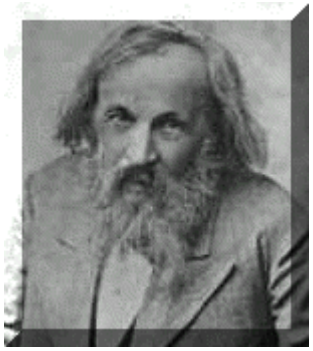
= science of elementary particles

and their interactions



What is „elementary“?

Greek: atomos = smallest indivisible part



Dmitry Ivanowitsch Mendeleyev 1868 (elements)

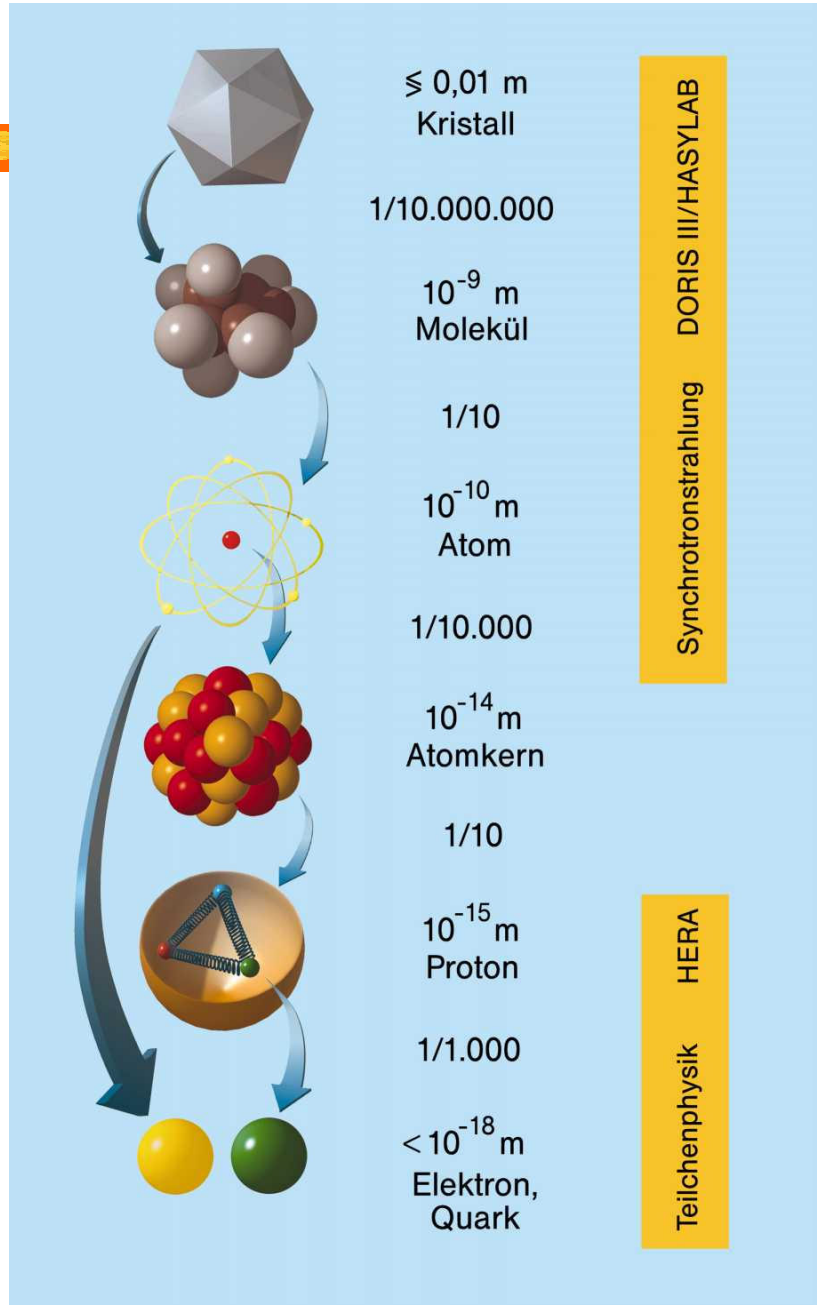
Ernest Rutherford 1911 (nucleus)

(Nobel 1908)

Murray Gell-Mann 1962 (quarks)

(Nobel 1969)

elementary = no detectable substructure



How to determine the „structure" of a particle?

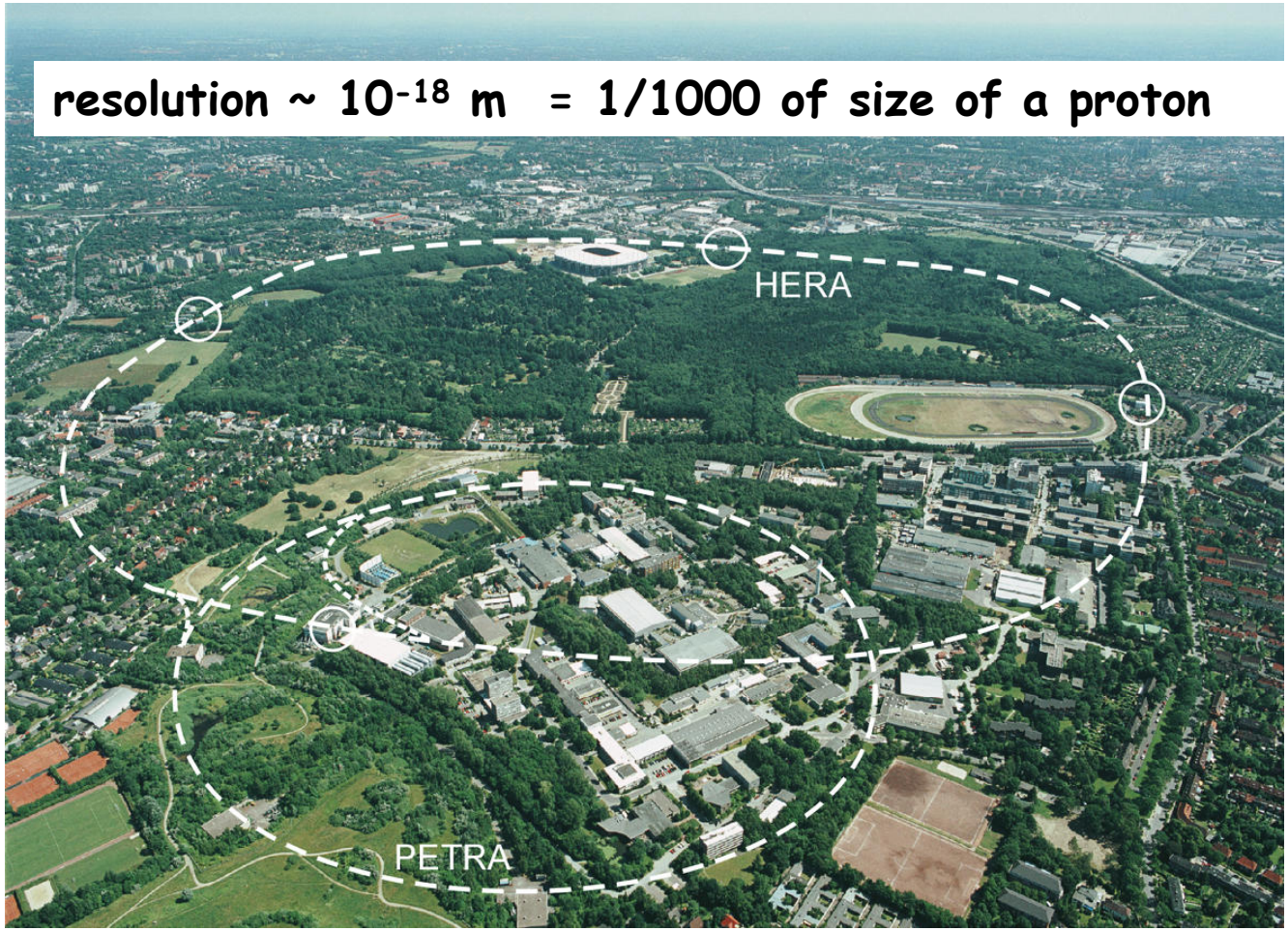
microscope:

low resolution

-> small instrument

high resolution

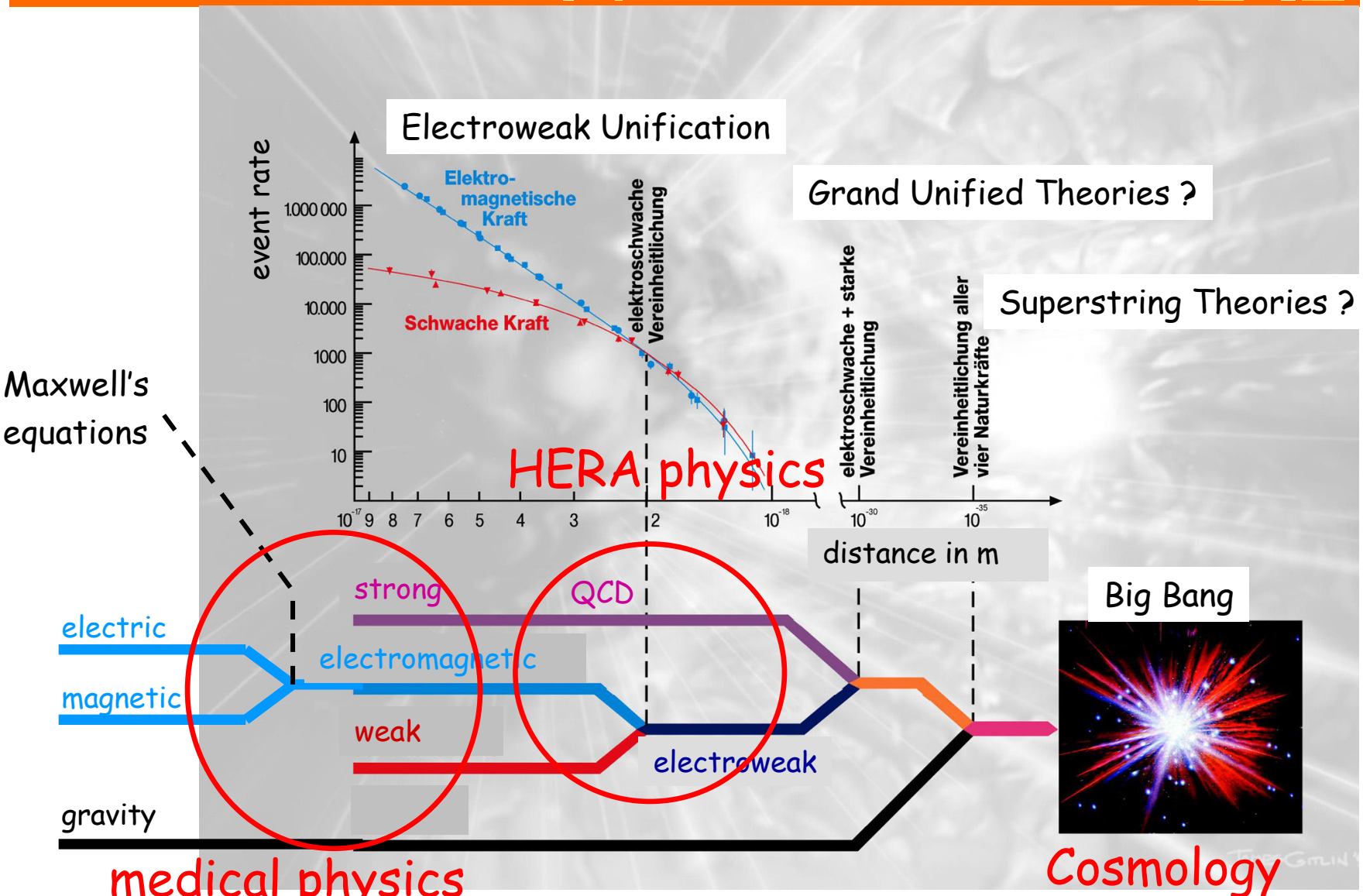
-> large instrument



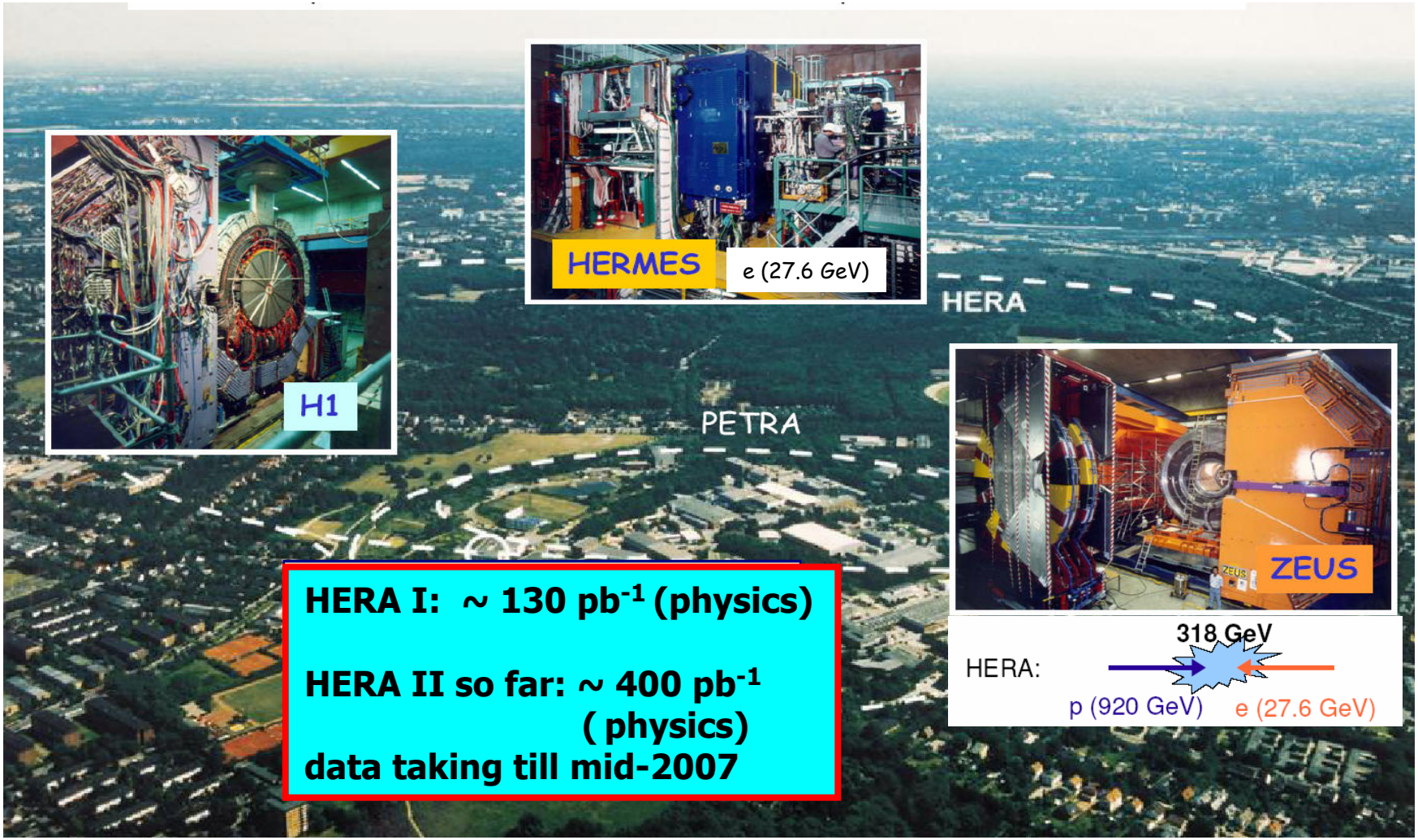
HERA = giant electron microscope

First and only large e-p collider

Which interactions?

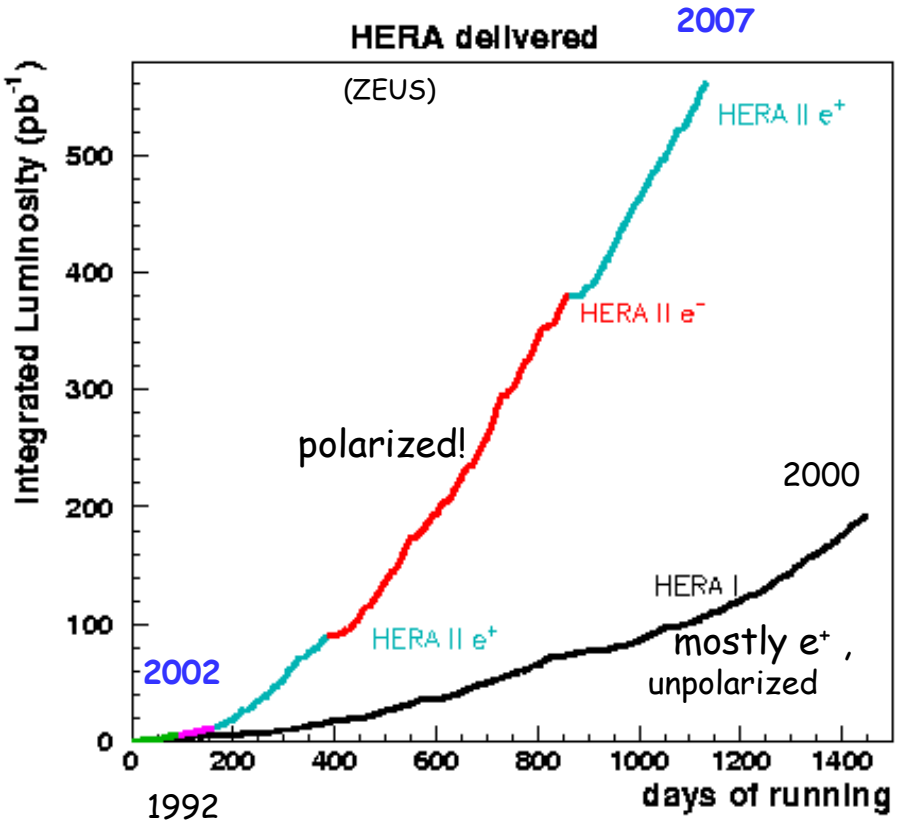


The HERA ep collider and experiments



HERA I and HERA II

HERA I + II luminosity:



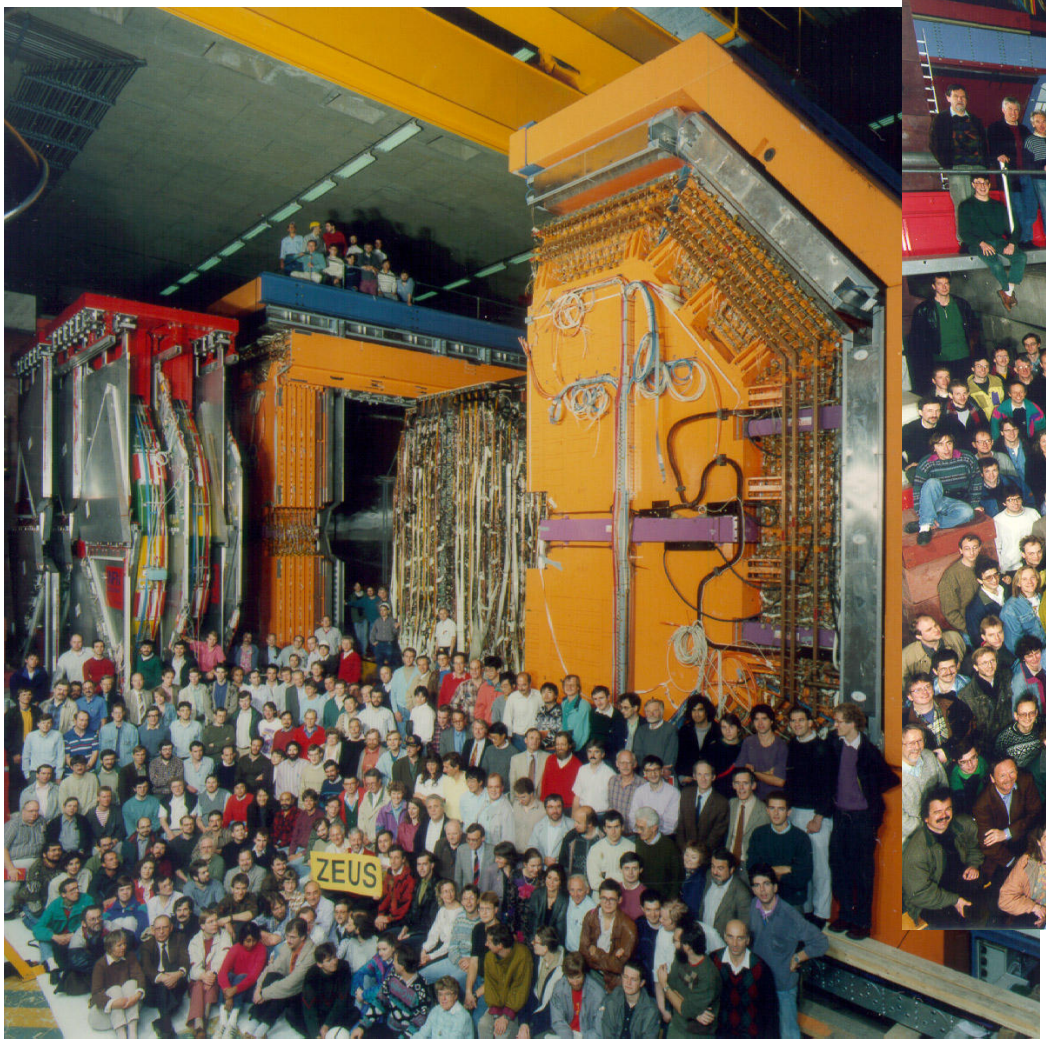
HERA I:

- E_e = 27.5 GeV, electron or positron
- E_p = 820 GeV 1992-97
  920 GeV since 1998

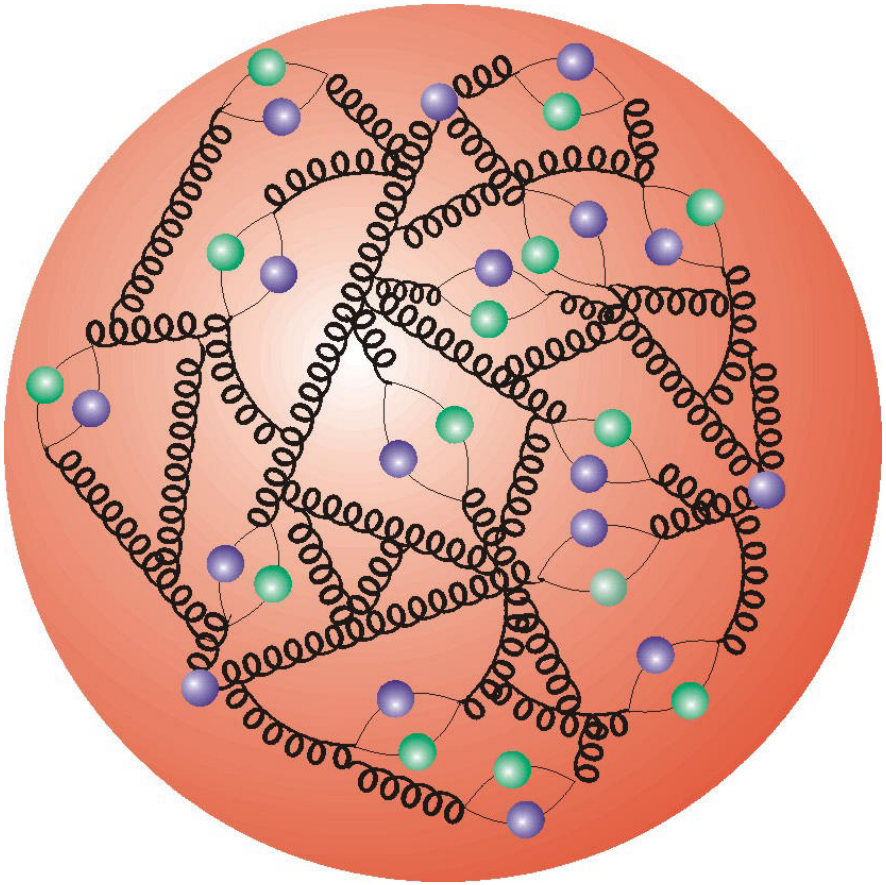
HERA II:

- detector and luminosity upgrade, polarized beams, both e+ and e-
- efficient data taking since fall 2003
- running till end of June 2007, **data analysis at least till 2010**

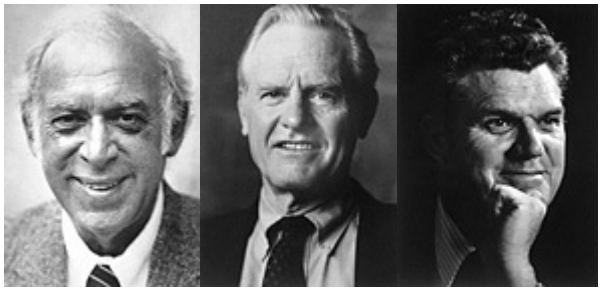
Particle Physics = People



HERA as a proton imaging device



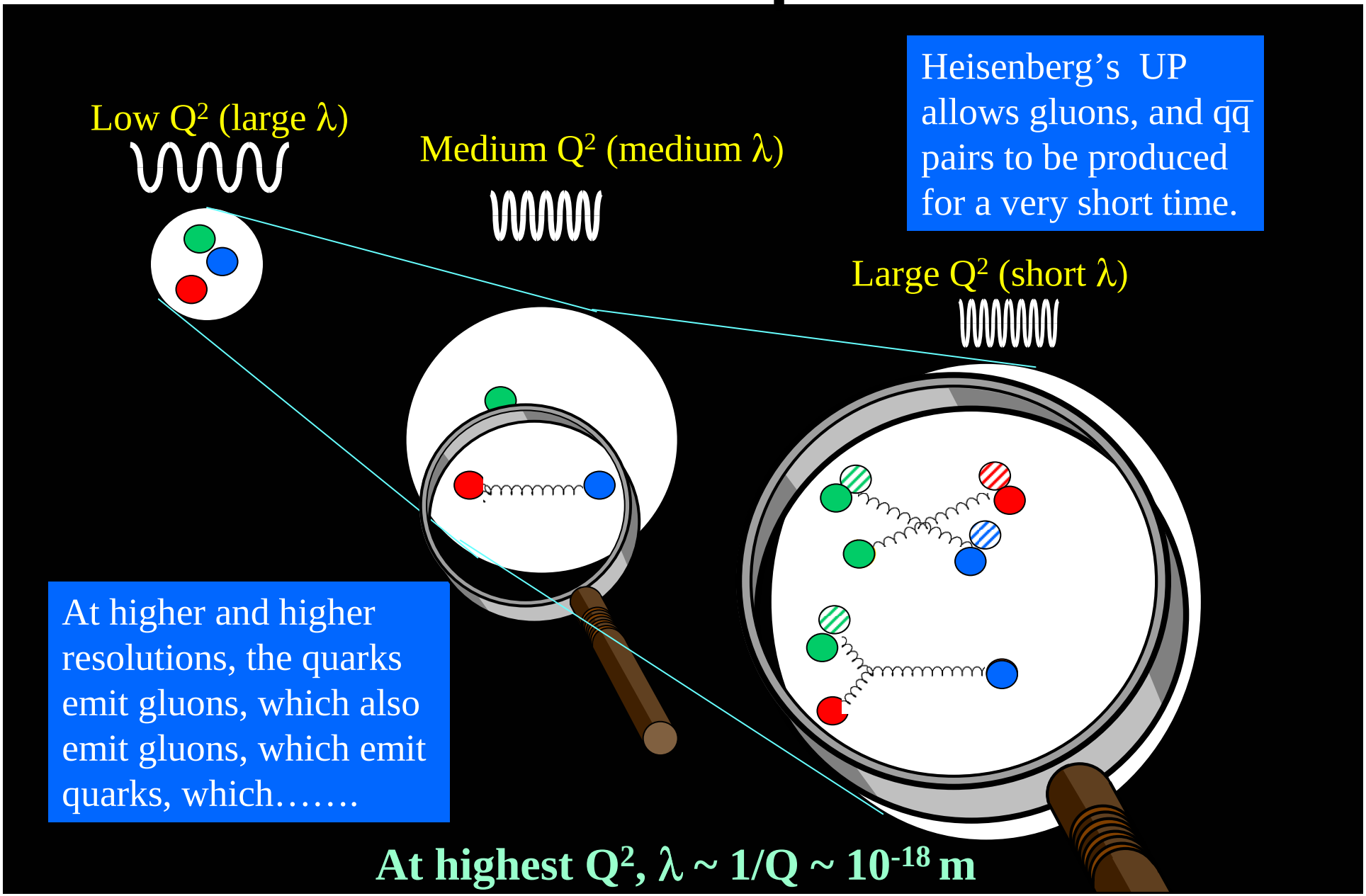
first at SLAC ~1970



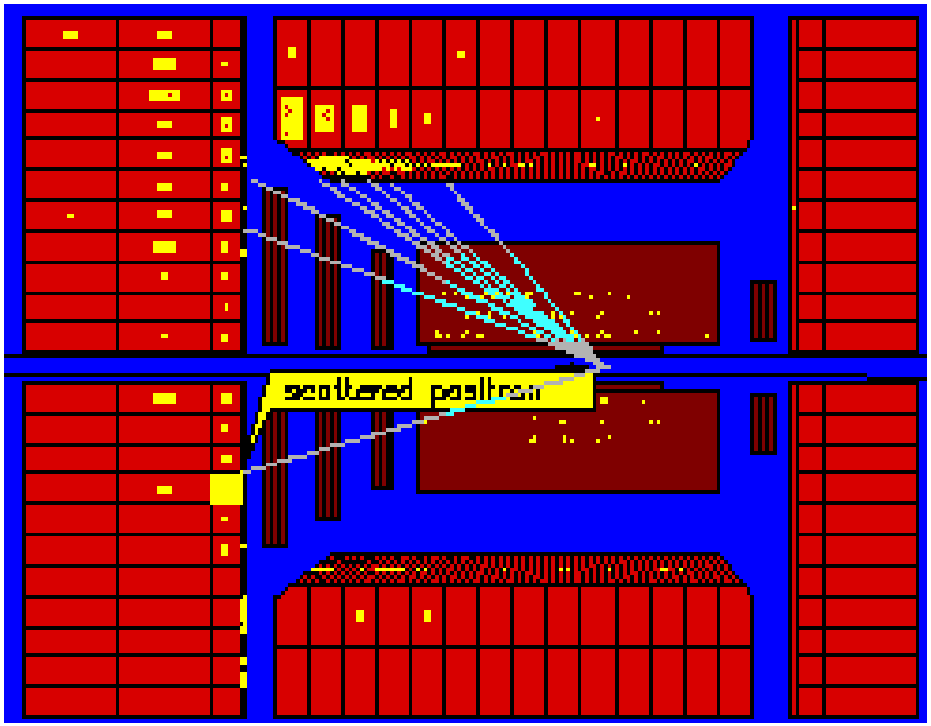
Jerome I. Friedmann | Henry W. Kendall (Nobel 1990) | Richard E. Taylor

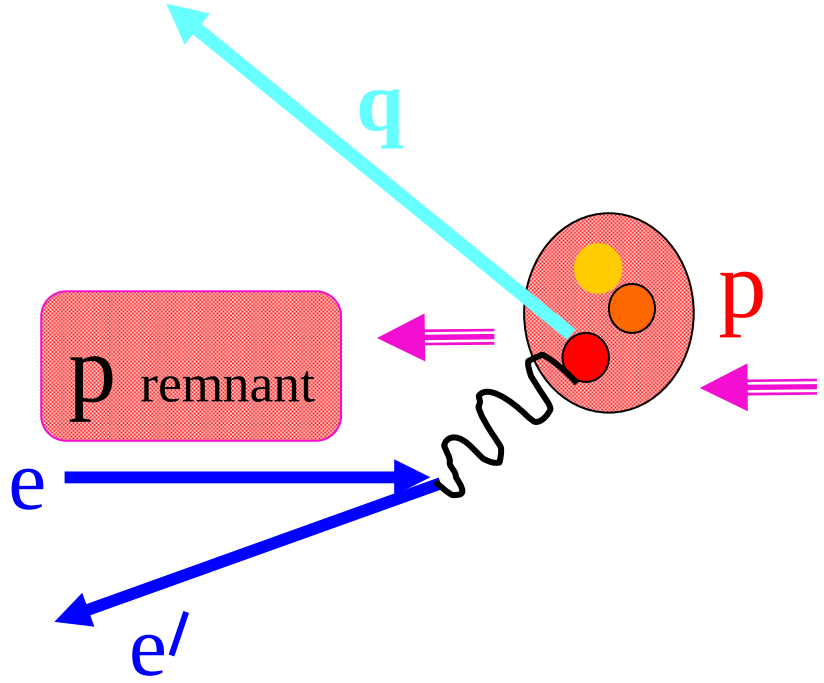
structure of the proton

Inside the proton



Deep Inelastic ep Scattering at HERA





Measure parton density functions (PDF)
= density of quarks and gluons in proton

Kinematics of Deep Inelastic Scattering (DIS)

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