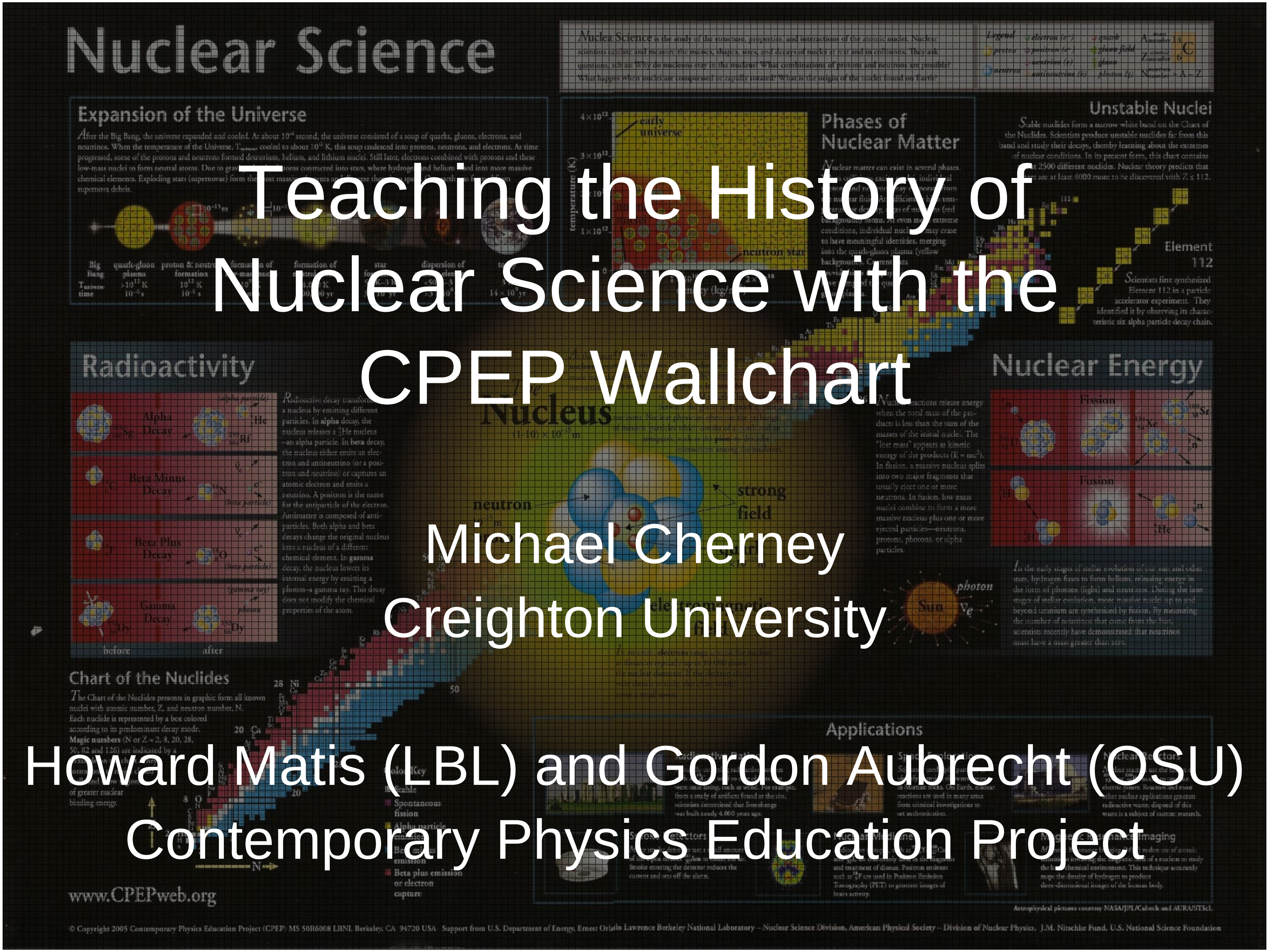


Teaching the History of Nuclear Science with the CPEP Wallchart

Michael Cherney
Creighton University

Howard Matis (LBL) and Gordon Aubrecht (OSU)
Contemporary Physics Education Project

Nuclear Science in High School

- At Creighton we have done multiple 5 hr. mini-courses in nuclear science with high school students, gifted junior high students and boy scouts
- High school students (and gifted junior high students) outperform university astronomy students in nuclear physics problem solving

Calculus-based physics students do better
Boy scouts were not assessed

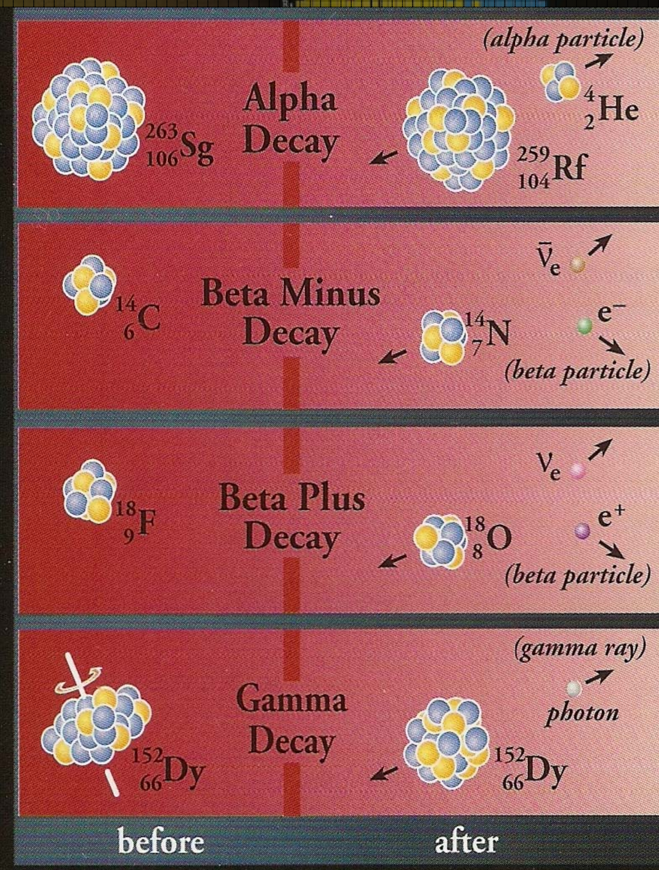
Cherney, I. D., Winter, J., & Cherney, M. G. (2005). Nuclear physics problem solving: A case study of expert-novice differences. *Transactions of the Nebraska Academy of Sciences, 30,* 9-15.

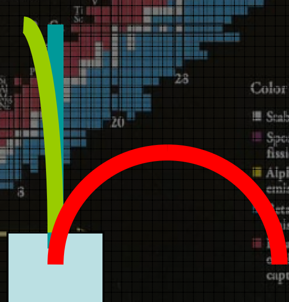
The History of Nuclear Science

- Particles and Waves
- Nuclei
- Building-up and Breaking-down Nuclei
- Fission and Fusion
- Nuclear Thermodynamics

Particles and Waves

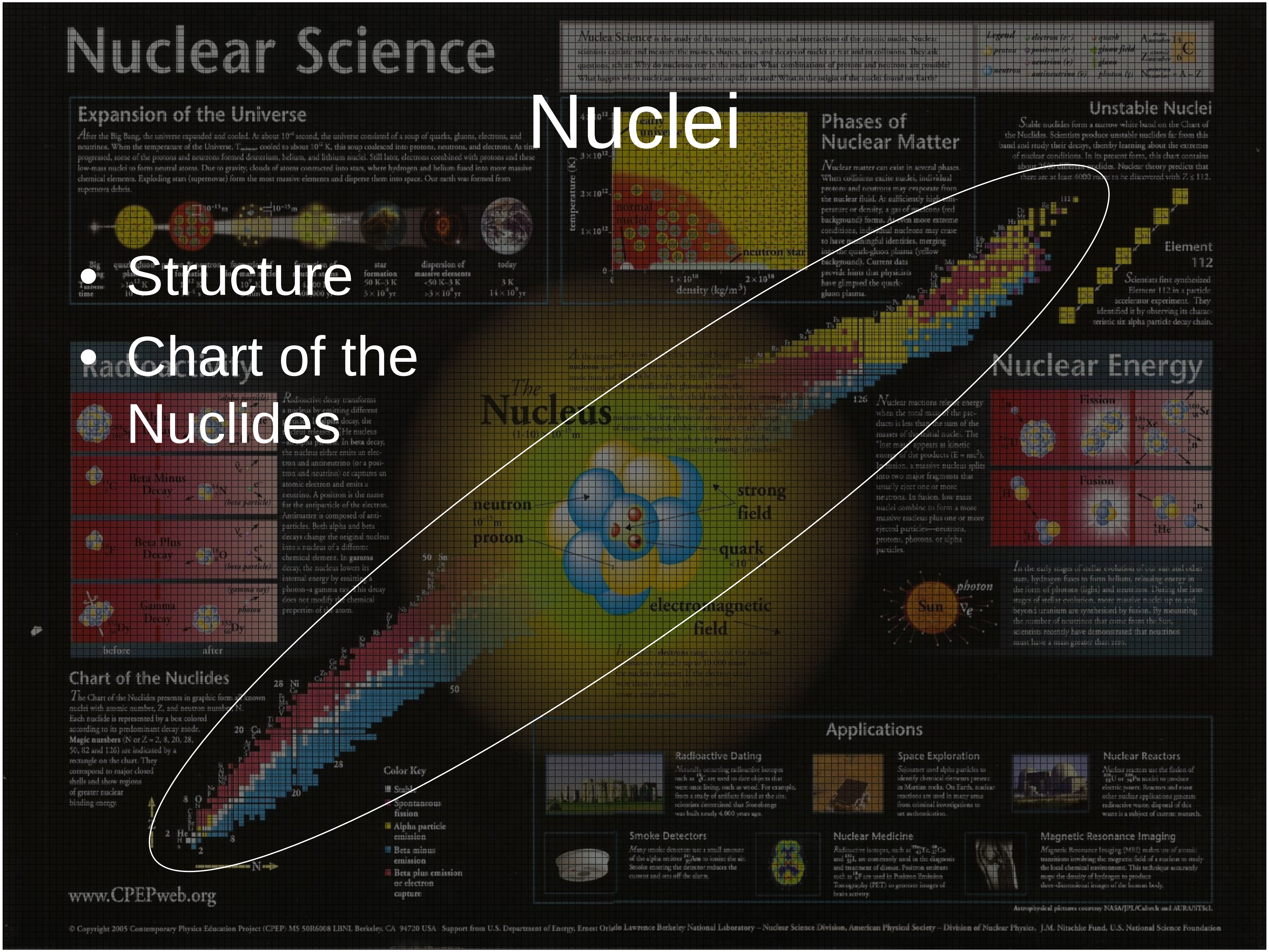
- X-Rays
- Cathode Rays
- Cosmic Rays
- Alpha Rays
- Beta Rays
- Gamma Rays





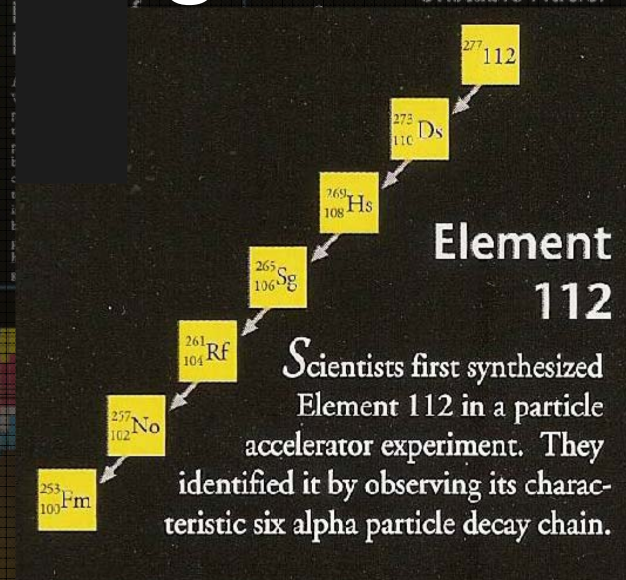
Nuclei

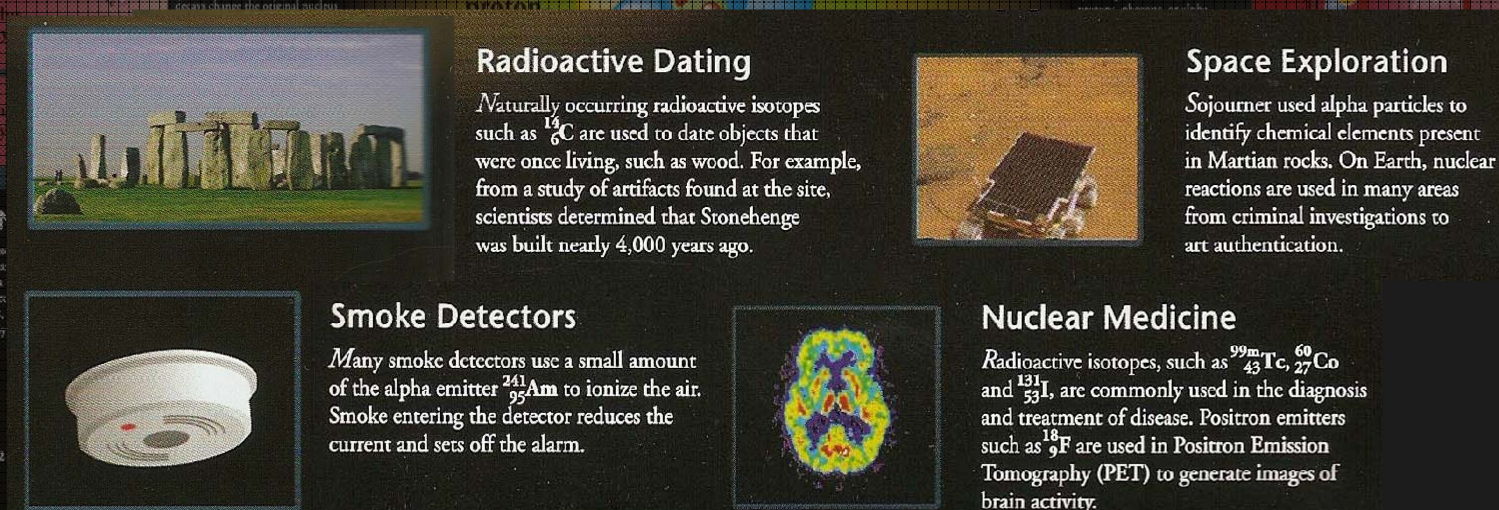
- Structure
- Chart of the Nuclides



Building Up and Breaking Down Nuclei

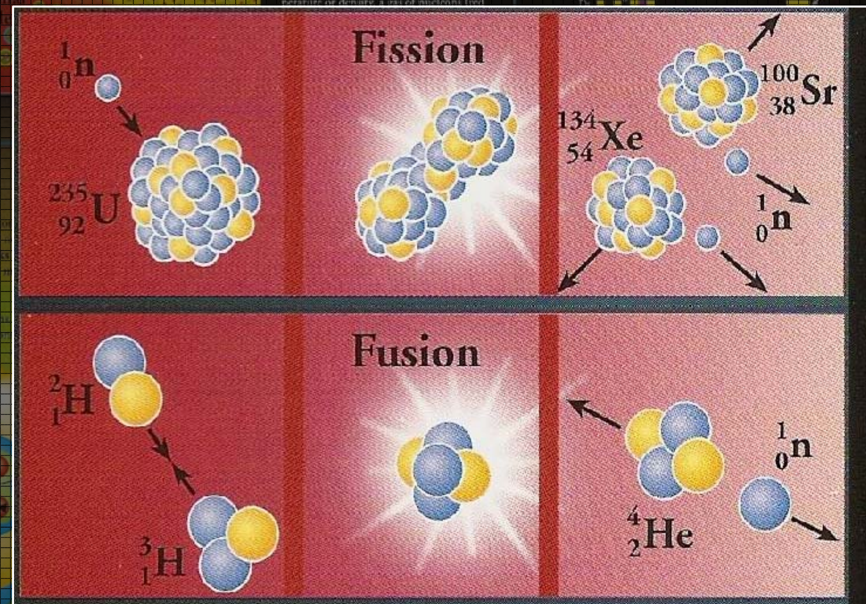
- Identifying the Super-heavy Nuclei from Decay Chains
- Nuclear Decay Applications



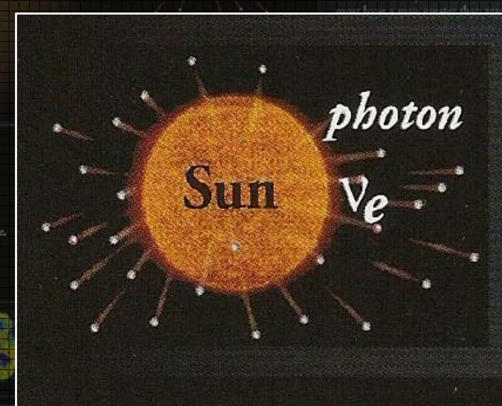


Fission and Fusion

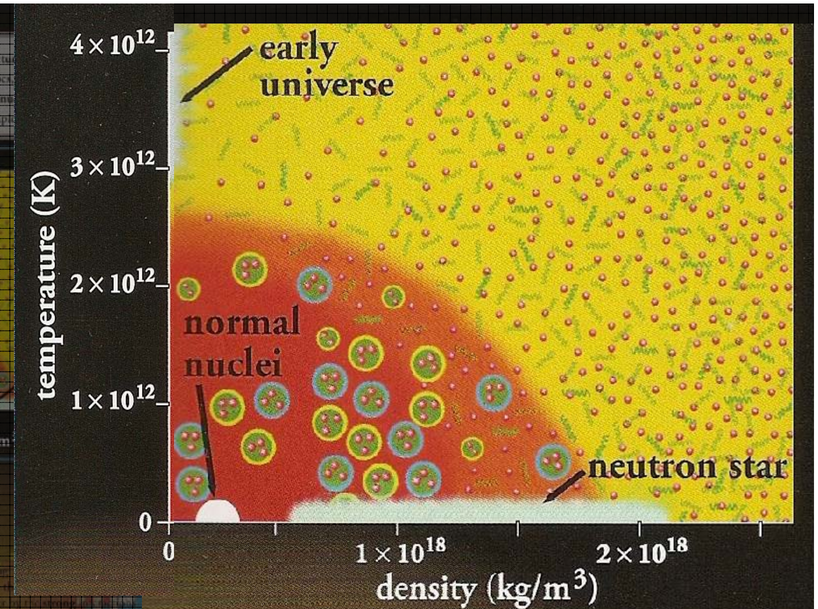
- Nuclear Power



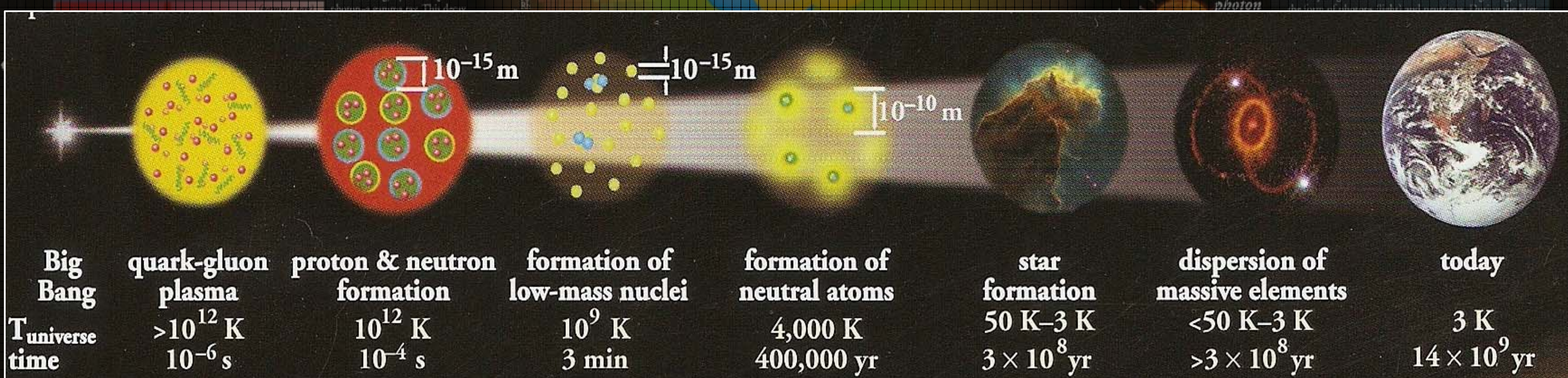
- Light and Neutrinos from the Sun
  – The Solar Neutrino Problem



Nuclear Thermodynamics



- Phase Diagram
- Particles of the Big Bang
  - kinetic energy vs. binding energy



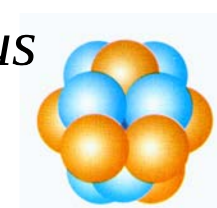
Heavy Ion Physics Probing Nuclear Thermodynamics

- Phases of Atomic Matter
  - solid
  - liquid
  - gas
  - plasma of constituents
- Phases of Nuclear Matter
  - liquid drop model
  - hadron gas
  - quark-gluon plasma

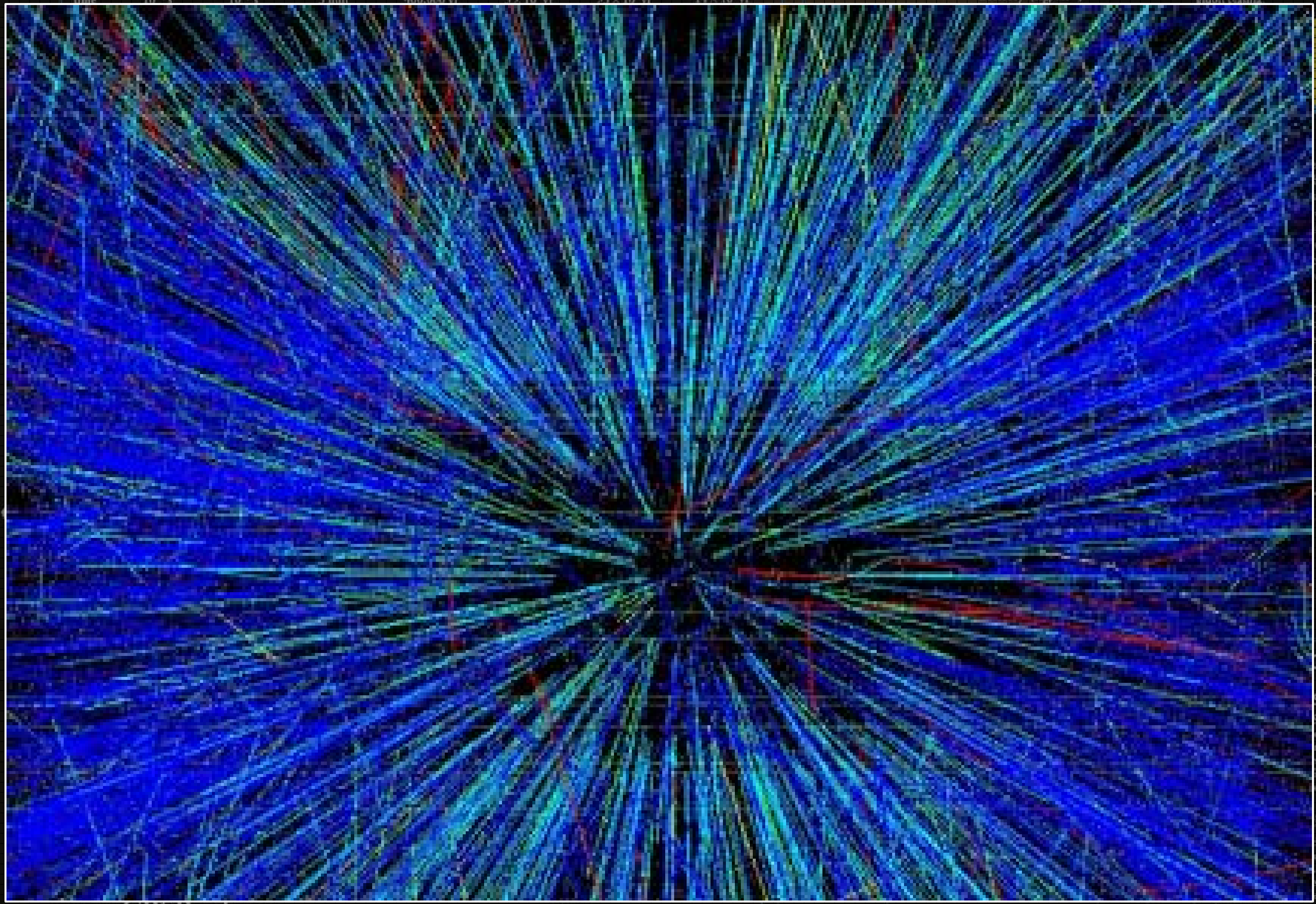
Nearest neighbor forces govern the binding

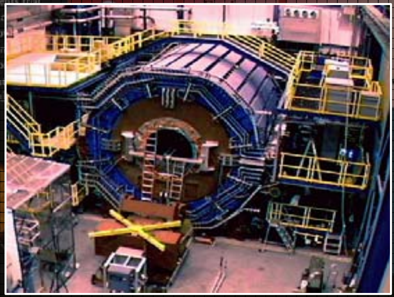
Spherical Water Drops

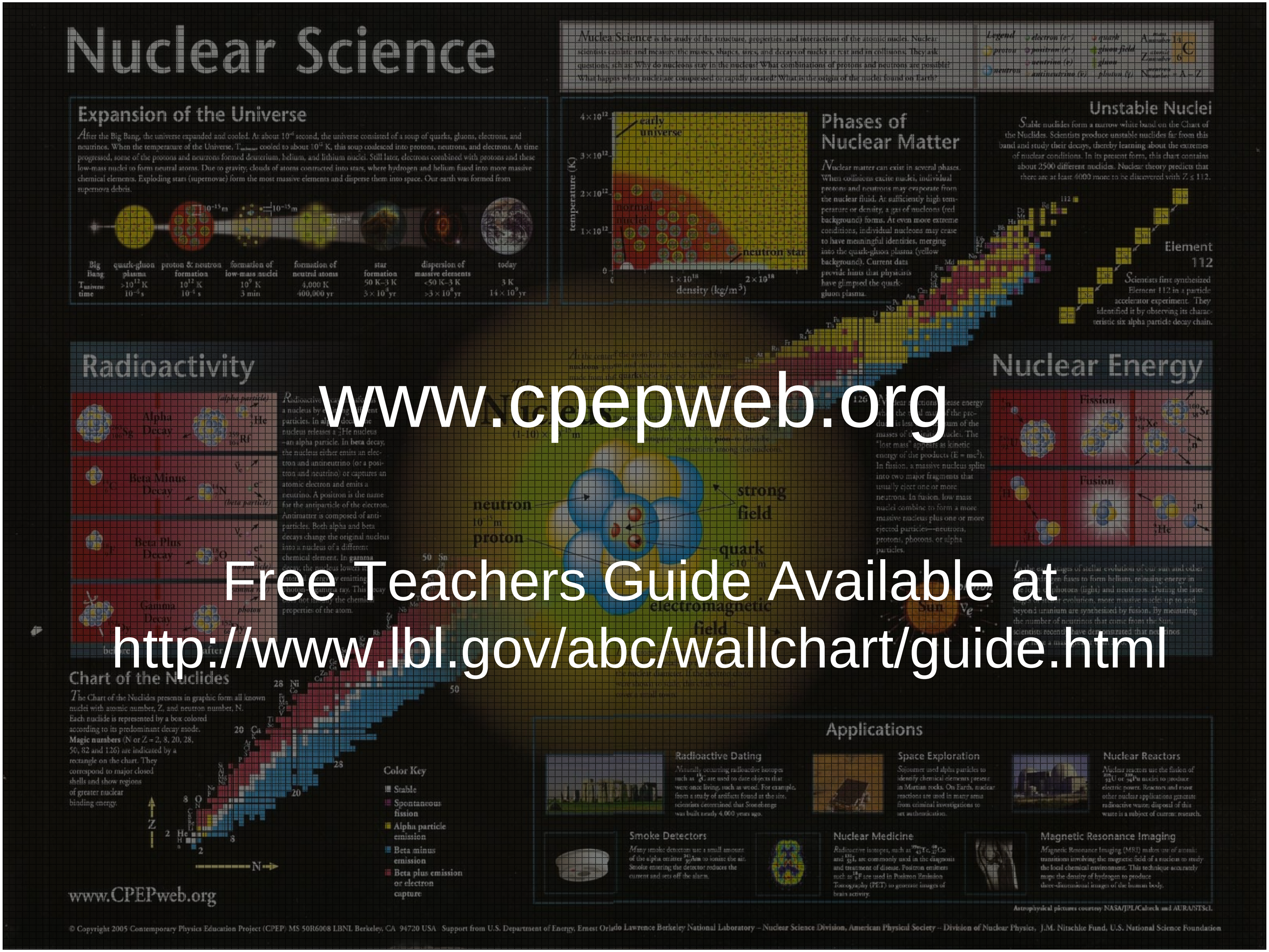
Spherical Nucleus



The Little Bang at CERN and Brookhaven







www.cpepweb.org

Free Teachers Guide Available at
http://www.lbl.gov/abc/wallchart/guide.html