Today’s homework is homework #1, due 7pm, Monday, Sept. 3!!
Announcements

• Reading assignment #1: Read and follow through all sections in appendices A and B by Monday, Sept. 3
  – There will be a quiz on Wednesday, Sept. 5, on this reading assignment

• No class next Monday, Sept. 3, Labor day
  – But homework#1 is still due 7pm that day
Who am I?

- **Name:** Dr. Jaehoon Yu (You can call me Dr. Yu)
- **Office:** Rm 342, Chemistry and Physics Building
- **Extension:** x22814, E-mail: jaehoonyu@uta.edu
- **My profession:** High Energy Physics (HEP)
  - Collide particles (protons on anti-protons or electrons on anti-electrons, positrons) at the energies equivalent to 10,000 Trillion degrees
  - To understand
    - Fundamental constituents of matter
    - Interactions or forces between the constituents
    - Origin of Mass
    - Creation of Universe (The Big Bang Theory)
  - A pure scientific research activity
    - Direct use of the fundamental laws we find may take longer than we want but
    - Indirect product of research contribute to every day lives; eg. WWW
Structure of Matter

Matter

10^{-2}m

Molecule

10^{-9}m

Condensed matter/Nano-Science/Chemistry

Atom

10^{-10}m

Atomic Physics

Nucleus

10^{-14}m

Nuclear Physics

Baryon (Hadron)

10^{-15}m

protons, neutrons, mesons, etc.

π, Ω, Λ...

Quark

<10^{-19}m

top, bottom, charm, strange, up, down

Electron (Lepton)

<10^{-18}m

High Energy Physics

10^{-19}m

protons, neutrons, mesons, etc.
The Particle Physics Standard Model

• Assumes the following fundamental structure:

• Three families of leptons and quarks together with
  12 force mediators → Simple and elegant!!!

- Discovered in 1995, \(\sim 170 m_p\)
- Directly observed in 2000
- \(\sim 0.1 m_p\)
Accelerators are Powerful Microscopes.

They make high energy particle beams that allow us to see small things.

seen by low energy beam (poorer resolution)

seen by high energy beam (better resolution)
Accelerators are also **Time Machines.**

They make particles last seen in the earliest moments of the universe.

Particle and anti-particle annihilate.

\[ E = mc^2 \]
Fermilab Tevatron and LHC at CERN

• Present world’s Highest Energy proton-anti-proton collider
  – 4km circumference
  – $E_{cm}=1.96$ TeV ($=6.3\times10^{-7}$ J/p $\Rightarrow$ 13M Joules on $10^{-4}$ m$^2$)
  ⇒ Equivalent to the kinetic energy of a 20t truck at a speed 81 mi/hr $\Rightarrow$ 130km/hr

• World’s Highest Energy proton-proton collider end of this year
  – 27km circumference
  – $E_{cm}=14$ TeV ($=44\times10^{-7}$ J/p $\Rightarrow$ 1000M Joules on $10^{-4}$ m$^2$)
  ⇒ Equivalent to the kinetic energy of a 20t truck at a speed 711 mi/hr $\Rightarrow$ 1140km/hr
The International Linear Collider

- An electron-positron collider on a straight line
- CMS Energy: 0.5 – 1 TeV
- 10~15 years from now
- Takes 10 years to build the accelerator and the detector
**DØ Detector**

- Weighs 5000 tons and 5 story tall
- Can inspect \(3,000,000\) collisions/second
- Record 75 collisions/second
- Records approximately \(10,000,000\) bytes/second
- Records \(0.5 \times 10^{15}\)\ ((500,000,000,000,000) bytes per year (0.5 PetaBytes)).

**ATLAS Detector**

- Weighs 10000 tons and 10 story tall
- Can inspect \(1,000,000,000\) collisions/second
- Will record 100 – 200 collisions/second
- Records approximately \(300,000,000\) bytes/second
- Will record \(1.5 \times 10^{15}\)\ ((1,500,000,000,000,000) bytes each year (1.5 PetaByte)).
Computers put together a picture of data. Digital data is then used in data reconstruction.
How does an Event Look in a Collider Detector?

Highest $E_T$ dijet event at DØ

$$E_T^1 = 475 \text{ GeV}, \eta^1 = -0.69$$

$$E_T^1 = 472 \text{ GeV}, \eta^2 = +0.69$$

Monday, Aug. 28, 2007

PHYS 1443-002, Fall 2007
Dr. Jaehoon Yu
Information & Communication Source

• My web page: [http://www-hep.uta.edu/~yu/](http://www-hep.uta.edu/~yu/)
  – Contact information & Class Schedule
  – Syllabus
  – Homework
  – Holidays and Exam days
  – Evaluation Policy
  – Class Style & Communication
  – Other information

• Primary communication tool is e-mail: Register for PHYS1443-002-FALL07 e-mail distribution list as soon possible
  Instruction available in Class style & Communication
  – 5 points extra credit if done by next Friday, Aug. 31
  – 3 points extra credit if done by next Wednesday, Sept. 5

• Office Hours: 2:30 – 3:30pm, Mondays and Wednesdays or by appointment
Evaluation Policy

• Term Exams: 45%
  – Total of three exams (9/24, 10/24 and 12/10)
  – Two best of the three exams will be used for the final grade
  – Each will constitute 22.5% of the total
  – Missing an exam is not permissible unless pre-approved
    • No makeup test
    • You will get an F if you miss any of the exams without a prior approval

• Lab score: 20%

• Homework: 25%

• Pop-quizzes: 10%

• Extra credits: 10% of the total
  – Random attendances
  – Strong participation in the class discussions
  – Other many opportunities

• Will be on sliding scale unless everyone does very well
Homeworks

- Solving homework problems is the only way to comprehend class material
- An electronic homework system has been setup for you
  - Details are in the material distributed today and on the web
  - [https://hw.utexas.edu/studentInstructions.html](https://hw.utexas.edu/studentInstructions.html)
  - Download homework #1 (1 problem), attempt to solve it, and submit it ➔ You will receive a 100% credit for HW#1
  - Roster will close Wednesday, Sept. 5
- Each homework carries the same weight
- ALL homework grades will be used for the final grade
- Homework will constitute **25% of the total** ➔ A good way of keeping your grades high
- Strongly encouraged to collaborate ➔ Does not mean you can copy
Attendances and Class Style

• Attendances:
  – Will be taken randomly
  – Will be used for extra credits

• Class style:
  – Lectures will be on electronic media
    • The lecture notes will be posted on the web AFTER each class
  – Will be mixed with traditional methods
  – Active participation through questions and discussions are STRONGLY encouraged ➔ Extra credit...
Lab and Physics Clinic

• **Physics Labs:**
  – Begins on Sept. 10
  – Important to understand physical principles through experiments
  – 20% of the grade

• **Physics Clinic:**
  – Free service
  – They provide general help on physics, including help solving homework problems
  – 12 – 6pm, Mon – Fri, starting today
  – SH 224
What do we want from this class?

• Physics is everywhere around you.
• Understand the fundamental principles that surrounds you in everyday lives…
• Identify what law of physics applies to what phenomena and use them appropriately
• Understand the impact of such physical laws
• Learn how to research and analyze what you observe.
• Learn how to express observations and measurements in mathematical languages.
• Learn how to express your research in systematic manner in writing
• I don’t want you to be scared of PHYSICS!!!

Most importantly, let us have a lot of FUN!!