Today’s homework is homework #1, due 7pm, this Friday!!
Announcements

• Reading assignment #1: Read and follow through all sections in appendices A and B by Thursday, June 1

• There will be a quiz on Thursday, June 1, on this reading assignment.
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 (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 → Molecule → Atom → Nucleus

- Condensed matter/Nano-Science/Chemistry
- Atomic Physics
- Nuclear Physics
- High Energy Physics

**Quark**

- Baryon (Hadron)
  - 10^{-15} m protons, neutrons, mesons, etc. \( \pi, \Omega, \Lambda \ldots \)
- Quark
  - <10^{-19} m top, bottom, charm, strange, up, down

**Matter**

- 10^{-2} m

**Molecule**

- 10^{-9} m

**Atom**

- 10^{-10} m

**Nucleus**

- 10^{-14} m

**Electron**

- <10^{-18} m
The Standard Model

- Assumes the following fundamental structure:

  - Quarks: discovered in 1995
  - Leptons: directly observed in 2000
Fermilab Tevatron and LHC at CERN

- Present world’s Highest Energy proton-anti-proton collider
  - $E_{cm}=1.96 \text{ TeV} (=6.3x10^{-7} \text{J/p})$
  - 13M Joules on $10^{-4}\text{m}^2$
  - Equivalent to the kinetic energy of a 20t truck at a speed 80 mi/hr

- World’s Highest Energy proton-proton collider in 2 years
  - $E_{cm}=14 \text{ TeV} (=44x10^{-7} \text{J/p})$
  - 1000M Joules on $10^{-4}\text{m}^2$
  - Equivalent to the kinetic energy of a 20t truck at a speed 212 mi/hr
DØ Detector

- Weighs 5000 tons
- Can inspect 3,000,000 collisions/second
- Will record 50 collisions/second
- Records approximately 10,000,000 bytes/second
- Recording $0.5 \times 10^{15}$ (500,000,000,000,000) bytes per year (0.5 PetaBytes).

ATLAS Detector

- Weighs 10,000 tons
- Can inspect 1,000,000,000 collisions/second
- Will record 100 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).
How does an Event Look in a Collider Detector?

```
<table>
<thead>
<tr>
<th>CAL+TKS R-Z VIEW 25-MAR-1997 12:22</th>
<th>Run 87288 Event 22409</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-DEC-1994 02:20</td>
<td></td>
</tr>
</tbody>
</table>

**Highest E_T dijet event at DØ**

- E^1_T = 475 GeV, \( \eta^1 = -0.69 \)
- E^2_T = 472 GeV, \( \eta^2 = +0.69 \)

Tuesday, May 30, 2006

Dr. Jaehoon Yu
Information & Communication Source

- My web page: 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 PHYS1443-001-SUMMER06 e-mail distribution list as soon possible
  Instruction available in Class style & Communication
  - 5 points extra credit if done by next Monday, June 5
  - 3 points extra credit if done by next Wednesday, June 7

- Office Hours: 10:00 – 11:00am, Mondays, Wednesdays and Thursdays or by appointments
Evaluation Policy

- **Term Exams: 45%**
  - Total of two exams (6/15 and 6/30)
  - Both 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 Friday, June 2

• Each homework carries the same weight

• ALL homework grades will be used for the final grade

• Home work 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….
Why do Physics?

Exp.{
- To understand nature through experimental observations and measurements (Research)
- Establish limited number of fundamental laws, usually with mathematical expressions

Theory
- Predict the nature’s course

⇒ Theory and Experiment work hand-in-hand
⇒ Theory works generally under restricted conditions
⇒ Discrepancies between experimental measurements and theory are good for improvements
⇒ Improves our everyday lives, though some laws can take a while till we see amongst us
Models, Theories and Laws

• **Models**: A kind of analogy or mental image of a phenomena in terms of something we are familiar with
  – Often provides insights for new experiments and ideas
• **Theories**: More systematically improved version of models
  – Can provide quantitative predictions that are testable and more precise
• **Laws**: Certain concise but general statements about how nature behaves ➔ The statement must be found experimentally valid
• **Principles**: Less general statements of how nature behaves
  – Has some level of arbitrariness
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 of importantly, let us to have a lot of FUN!!