Module 1: Introduction to the Course

15 kiloton detonation in Hiroshima
Physics/Global Studies 280, Goals

(1) to provide a basic understanding of the nature of nuclear weapons, the threat they pose to humankind, and possible ways to reduce and eventually eliminate this threat.

(2) to improve writing skills, in particular technical essays/briefs common in academia, government and business.
Aren’t nuclear weapons a problem of the past, 25 years after the end of the cold war?

Three Examples:

(I) “Limited scale” nuclear conflict still appears possible

Temperature change from soot ejected into the atmosphere would lead to a temperature decrease:

“Nuclear Winter”
II) Nuclear Terrorism
If terrorists could gain access to nuclear weapons they could target events such as the NATO summit that took place in Chicago in May of 2012 with all NATO heads of state present.

chicagotribune.com

Trial to begin of three charged with planning attacks at NATO summit

Mary Wisniewski
Reuters
7:31 AM CST, January 21, 2014

CHICAGO (Reuters) - Opening statements are due to begin on Tuesday in the trial of three men accused of plotting to attack high-profile targets, including President Barack Obama's reelection campaign headquarters, during the 2012 NATO summit in Chicago.

Brent Betterly, 25, Brian Church, 25, and Jared Chase, 29, are being prosecuted under an Illinois anti-terrorism law adopted after the September 11, 2001 al Qaeda attacks.
III) Challenge to maintain and motivate high quality missile force under “hair trigger alert” over decades:

The New York Times

http://nyti.ms/1iX3ZG8

POLITICS

Cheating Accusations Among Officers Overseeing Nuclear Arms

By HELENE COOPER   JAN. 15, 2014

WASHINGTON — The Air Force said on Wednesday that 34 officers responsible for launching the nation’s nuclear missiles had been suspended, and their security clearances revoked, for cheating on monthly proficiency tests that assess their knowledge of how to operate the warheads.

Defense experts say that the end of the Cold War and the elevation of counterterrorism in the American military has led to low morale among the men and women, known as missileers, who live and work within a hair trigger of the country’s 450 nuclear missiles. The missileers have increasingly come to view their mission as a backwater, with little chance of advancement to the top ranks of the Air Force.
III) Challenge to maintain and motivate high quality missile force under “hair trigger alert” over decades:

The New York Times

http://nyti.ms/1iX3ZG8

POLITICS

Cheating Accusations Among Officers Overseeing Nuclear Arms

By HELENE COOPER  JAN. 15, 2014

Last May the Air Force disclosed that it removed 17 officers assigned to stand watch over nuclear-tipped Minuteman missiles after finding safety violations, potential violations in protecting codes and attitude problems.

And last November, The Associated Press reported that Air Force officers with nuclear launch authority had twice been caught napping with the blast door open. That is a violation of security regulations meant to prevent a terrorist or intruder from entering the underground command post and compromising secret launch codes.
History of Physics 280

• First offered in Spring 1982
  — Course development motivated by concern about the growing threat of nuclear weapons and nuclear war
  — Professor Fred Lamb initiated the course and organized a team of 13 faculty volunteers from the Physics, Astronomy, and the Nuclear Engineering departments to create course materials and to teach it

• Second offering in Spring 1983
  — Co-taught by Professors Fred Lamb and Jeremiah Sullivan
  — Was submitted and approved as a regular course

• Has been taught every spring semester since
  — Has served as model for courses elsewhere
  — Most courses elsewhere have now disappeared
  — Physics 280 is arguably the longest running course of its kind
Physics 280 Topics

• Introduction
• Nuclear weapons
• Effects of nuclear explosions
• Nuclear terrorism
• Military systems for delivering nuclear weapons
• Arsenals of “nuclear weapon” states
• Defenses against nuclear attack
• Nuclear arms control
• Future directions
The class subject is multidisciplinary and so are the backgrounds of the students and TAs in class.

Great opportunity to learn from each other!

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<th>Major</th>
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<td>Political Science</td>
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<td>Global Studies</td>
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<td>Nuclear, Plasma, Radiological Eng.</td>
<td>4</td>
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<td>Chemistry</td>
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<td>9 other majors</td>
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</table>
Introduction of Physics 280 Staff

Matthias Grosse Perdekamp, Course Director and Instructor
Physics

Andrew Barr, TA
Political Science/ACDIS

Hannah Gelman, TA
Physics

Tony Hegg, Guest Lecturer
Physics

Sphurti Joglekar, TA
Civil Engineering

Mark Kamuda, TA
Nuclear, Plasma and Radiological Engineering

Michael Nelson, TA
European Studies
• Professor in the Physics Department and at U of I Nuclear Physics Laboratory

• Accelerator based research in Nuclear Physics
  — Quark and gluon sub-structure of protons and neutrons
  — Modification of protons and neutrons in nuclei
  — Instrumentation development for radiation detection

• Three large experiments:
  — PHENIX, using RHIC at Brookhaven National Laboratory, Long Island
  — COMPASS, using SPS at CERN, Geneva, Switzerland
  — Belle, using KEK-B, at KEK, Tsukuba, Japan

• Study utility of RPCs we developed for PHENIX for port scanners detecting nuclear materials
RPCs to Measure Quark and Anti-Quark Substructure of the Proton with the PHENIX Detectors

Detector testing

RPC Construction at the U of I

Installation at Brookhaven National Laboratory

Readout Electronics & online computers
The Physics 280 web site is the “Information Center” for this course:

http://online.physics.uiuc.edu/courses/phys280/Spring14/

Consult it often for assignments and updates.

Student handbook → read *carefully*

→ instructions related to essay writing and submission
  will be followed very closely!
If you send e-mail: please start the subject line with 14p280 or Physics 280

This sorts the e-mail in my “teaching in” folder and makes sure that I will reply promptly.

Without proper subject line your e-mail goes along with all my research + admin related e-mail (~120/day and it will take a while to get back to you)
The Structure of Physics 280 – 1

• Lecture-Discussion Meetings
  — Lectures
    (slides posted on Physics 280 website at the end of each module)
  — Videos, demos, Q&A, discussions of readings and current events

• Writing Labs
  — Explanation of the writing assignments and scoring of your work
  — Instruction and guidance on how to write for the course
  — Writing exercises, discussion of readings and current events, assessments
  — Help in revising first versions of assignments
Required Textbooks

- *The Little, Brown Essential Handbook for Writers*, by Jane E. Aaron
- *What Terrorists Want*, by Louise Richardson (paperback)

Required Online Readings

- Selections from *The Day After Midnight: The Effects of Nuclear War* (available as a PDF file on the P280 ‘Documents’ page)
- *Preventing Catastrophic Nuclear Terrorism*, by Charles Ferguson (available as a PDF file on the P280 ‘Documents’ page)
- *The Gravest Danger*, by Sidney D. Drell and James E. Goodby (available as a PDF file on the P280 ‘Documents’ page)
Other sources of information about the subject —

- You are strongly encouraged to read *The New York Times*, *The Washington Post*, *The Los Angeles Times*, and other high-quality sources of news about topics related to the course.

- You are encouraged to *bring questions and interesting articles to class to share or ask about*.

- You may also mention questions, interesting articles, TV programs, or movies to your Writing Lab TA or to me.
Physics 280 is an Advanced Composition Course

- Previous credit for a Composition course is a prerequisite
- Even if you have already met the UI Advanced Composition requirement, you must do all the writing assignments

Physics 280 has three types of Required Writings

- Required essays
- Research paper proposal
- Research paper
Writing Assignment Details

• **We strictly enforce the UI’s rules on academic integrity**
  
  — All assignments are checked by course staff for compliance with the University’s rules on academic integrity (see the first reading assignment)
  
  — All writing assignments are scanned using plagiarism detection software

• You must write and revise four Required Essays
  
  — Lengths are 1, 2, 3, and 4 pages, respectively
  
  — Each must be revised once (you must submit a second, revised version)
  
  — Both versions count equally
  
  — There are penalties for late submissions
Writing Assignment Details (cont’d)

• You must write and revise a Research Paper Proposal (2 pages)
  — The topic should be chosen in consultation with the course staff
  — Your proposal must be approved in advance by the course staff
  — Your paper must address both technical and policy aspects of some issue
    (but the weights need not be 50–50)
    — Your scores on the first and second versions count equally

• You must write and revise a Research Paper (7–10 pages)
  — Scores on the first and second versions count equally

• You may submit one Extra Credit Essay (about 1.5 pages)

• Your Writing Lab participation counts 6% of your writing grade
Exams

• Mid-Term Exam: 2:00–3:30 p.m., (March 20th)
  — Location TBD (*it will not be in this room*)
  — Closed book
  — Tests factual knowledge and understanding
  — The writing quality of your answers will not be graded

• Final Exam: (time TBD)
  — Location TBD (*it will not be in this room*)
  — Closed book
  — Tests factual knowledge and understanding
  — The writing quality of your answers will not be graded
  — The final exam will emphasize material presented after the mid-term exam
We will ask you to use an iClicker to answer questions in class —

• to encourage and facilitate discussion and interaction
• to poll you about your experiences and opinions
• to help me communicate more successfully
• to help you determine which topics and points are important
• to give you immediate feedback on how well you are learning

Correct answers using iClickers will earn you —

• full Quiz credit for the class if you answer 50% of the Qs correctly
• all answers to polls will be considered correct

We will not excuse you if you do not have a working iClicker with you, but your lowest iClicker Quiz score will be dropped.

Acquire an iClicker, register it, and bring it to the next class meeting!
Course Grades Will be Assigned Using an Absolute Scale

Writing Component
- Required essays (8 versions) 34%
- Research paper proposals and research papers 30%
- Writing Lab participation 6%
- Extra credit essay 2%

Exam Component
- Midterm exam 10%
- Final exam 15%
- Lecture-Discussion (iClicker) questions 8%
Plan for Session 2

Announcements and Questions

Video “Race for the Superbomb” (PBS), Part 2

Discussion of the video

Write Required Essay 1 Version 1 (RE1v1) in class (1 page)
Be sure to bring pen and paper to class on Thursday

Your RE1v1 must be handed to a TA before you leave Session 2
Video “Race for the Superbomb” (PBS)
Plan for This Session

Announcements and questions about the course

Types of Clicker Questions

Video “Race for the Superbomb” (PBS), Part 2

Discussion of the video

Write Required Essay 1 Version 1 (RE1v1) in class today
(RE1v1 will be returned in class on Tuesday)

*Your RE1v1 must be handed to a TA before you leave class*
Physics 280: Session 2

Announcements About The Course

First Writing Lab Sessions: Monday, January 28th
First office hours: Tuesday and Wednesday, January 29th and 30th

Please acquire an iClicker, register it online (see the link on the 12p280 home page), and bring it to the next class meeting!

You will be asked to answer iClicker questions for practice beginning today. You will be asked to answer iClicker questions for credit beginning the second week of classes.

Questions About The Course
iClicker Question: Type 1 -> Discussion with your neighbors!

Why did the US attack two Japanese Cities with Nuclear Bombs?

A = In order to test both Plutonium and Uranium based weapons
B = As a demonstration of force directed towards the Sowjetunion in postwar negotiations with the US, Britain and France
C = A purely tactical decision to destroy important military or industrial targets.
D = To leave uncertain with regards to US ability to create large amounts of fissile nuclear weapons material (Plutonium & Uranium).
E = It was US strategy to continue nuclear attacks until Japanese surrender

Please discuss this question with your neighbors. Then give the best answer!
Why did the US attack two Japanese Cities with Nuclear Bombs?

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Physics 280: Session 2

iClicker Question
Type 2 -> Important facts that you might be asked about in the midterm or final

What year did the United States first test a nuclear bomb?

A = 1943
B = 1944
C = 1945
D = 1946
E = 1947

Discuss with your neighbors. Then give your answer.
iClicker Question
Type 2 -> Important facts that you might be asked about in the midterm or final

What year did the United States first test a nuclear bomb?

A = 1943
B = 1944
C = 1945
D = 1946
E = 1947

Please discuss this question with your neighbors. Then give your answer.
iClicker Question

Which of the following *are allowed* by University rules?

A. Helping another student write a paper
B. Using a quotation from a source that is quoting another source
C. Allowing another student to borrow your notes on an Extra Credit Essay event to help them write their Extra Credit Essay
D. Writing papers for two different courses on the same topic
E. Using original material from an earlier paper in a P280 paper
Answer

Which of the following *are allowed* by University rules?

A. Helping another student write a paper
B. Using a quotation from a source that is quoting another source
C. Allowing another student to borrow your notes on an Extra Credit Essay event to help them write their Extra Credit Essay
D. Writing papers for two different courses on the same topic
E. Using original material from an earlier paper in a P280 paper

None of these are allowed
Physics 280: Session 2

Video

“Race for the Superbomb”, Part 2
Write Required Essay 1 Version 1 (RE1v1)
Required Essay 1 Version 1 (RE1v1)

This essay must be handed in before leaving class.

Choose one important problem related to nuclear weapons that the United States currently faces. It need not be the most important problem. It should involve a technological issue, a policy issue, or both. Write a 2-paragraph essay with the following structure:

- A title centered at the top of the first page.
- A first paragraph that states clearly the problem you are addressing and why it is important.
- A second paragraph that presents your recommendation for how the United States should deal with the problem stated in the first paragraph.

Further guidance:

- Write your name (e.g., Jean Doe), the code for this writing assignment (RE1v1), and your Writing Lab number (e.g., WL99) in an identification block in the top right-hand corner of the top page. Use the following layout:

  Jean Doe  
  RE1v1 WL99

- If your essay has more than 2 paragraphs, the score it would have received will be marked down heavily.
- Each paragraph should begin with a strong topical sentence that tells the reader what to expect in the paragraph.
- Do not make the paragraphs too long. This is a 1-page (typed) essay.
- Use active voice.
- You will be graded on the content and clarity of your writing, not the number of words.
- Avoid unnecessary words, especially adjectives and adverbs.
- A 2-paragraph essay has no room for telling the reader what you will do or for repetition—just say what you want to say, once.
Physics 280: Session 3

Your RE1v2 (printed copy) must be turned in
Thursday, January 30th, at the beginning of Class
(do not submit electronic copies of 2nd versions of papers)

Plan for This Session

Announcements and questions about the course

Video “Race for the Superbomb” (PBS), Part 3

Discussion of the video
Announcements About The Course

Please acquire an iClicker, register it online (see the link on the 14p280 home page), and bring it to the next class meeting!

We will do a few iClicker questions for practice today.

You will asked to answer iClicker questions for credit in the next lecture-discussion (Thursday, January 30th).

Be sure to do the reading assignments
Posted on the course web-page
http://courses.physics.illinois.edu/phys280/sp2014/reading.html

Questions About The Course
Physics 280: Session 3

Video

“Race for the Superbomb”, Part 3
“Race for the Superbomb”, Part 3

Discussion
iClicker Question

What years did the US and Russia first test a nuclear bomb?

A = Both 1945
B = US 1944 - SU 1945
C = US 1943 – SU 1945
D = US 1945 – SU 1949
E = SU 1943 – US 1945
What years did the US and Russia first test a nuclear bomb?

A = Both 1945
B = US 1944 - SU 1945
C = US 1943 – SU 1945
D = US 1945 – SU 1949
E = SU 1943 – US 1945
iClicker Question

What triggered President Truman to order the Development of the Hydrogen Bomb?

A = Edward Teller’s campaign for the H-bomb

B = Consultations with British and French Allies following the test of the first Russian Nuclear Weapon, August 29th, 1949

C = Concern among political and military leaders as well as in the public discussion of the first Russian nuclear weapon test and the resulting need for a response.

D = The view of senior scientific advisors that the H-bomb will be needed to deter a possible Russian attack with nuclear weapons.
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The year each declared nuclear weapon state first tested a nuclear device:

- United States: 1945
- Russia: 1949
- United Kingdom: 1952
- France: 1960
- China: 1964
- Pakistan: 1998
- North Korea: 2006
World Nuclear Weapon Stockpiles 1945–2006

End of Introduction to Physics 280