

1.

## Notices

### Notices

- **Evaluations today**
- **Homework 5 due Tuesday - last assignment**
- **One more class**
- **Final May 5 3:30-5:30**
- re Copenhagen - cloud chamber pictures
  - <http://www.cloudchambers.com/index.htm>

5/10/2006

Physics 6 - G.R. Goldstein - Spr.03  
- Spring 06 - G.R. Goldstein

1

(c) 2006, Gary R. Goldstein, Ph.D.

2.

## Fusion

### Fusion

- Example - deuteron =  $d = {}^2_1\text{H} \sim p$  and  $n$ 
  - $m_d c^2 < m_p c^2 + m_n c^2$  by 2.2 MeV (binding energy)
  - So  $n + p \rightarrow d + 2.2 \text{ MeV}$  (extra KE or radiation)
- Solar energy
  - $d + t \rightarrow \text{He} + n + 17.6 \text{ MeV}$  extra energy
  - or  ${}^2_1\text{H} + {}^3_1\text{H} \rightarrow {}^4_2\text{He} + {}^1_0n + \text{Energy}$
  - need cycle at very high temperature to overcome Coulomb repulsion between plus charges
  - Enhance energy by many  $N_{\text{avogadro}}$  for sun or star
- H bomb
  - Use Lithium Deuteride (Li d) a solid salt-like material
  - reaction  ${}^6_3\text{Li} + n \rightarrow {}^3_1\text{H} + {}^4_2\text{He}$  and then  ${}^3_1\text{H} + {}^2_1\text{H}$  or  $d+t$

5/10/2006

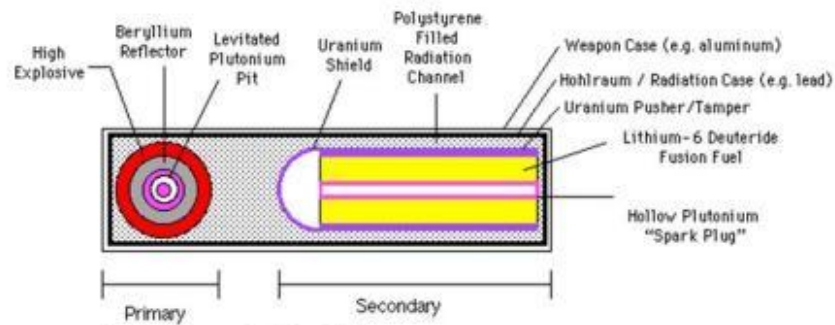
Physics 6 - G.R. Goldstein - Spr.03  
- Spring 06 - G.R. Goldstein

2

(c) 2006, Gary R. Goldstein, Ph.D.

3. H-bomb or nuclear fusion bomb

**H-bomb or nuclear fusion bomb**  
Teller-Ulam design  
Secret of the H-Bomb is X-ray compression



Source: <http://nuclearweaponarchive.org/Library/Teller.html>

Fission-fusion-fission (U238)

5/25/2006

Physics 6 - Spring 06 - G.R. Goldstein

2

(c) 2006, Gary R. Goldstein, Ph.D.

4. Controls

**Controls**

- Treaties limit testing, deployment & mandate levels, reductions & inspections - **US bunker busters & testing, mini-nukes?**
- ABM treaty limits defensive systems - **gone**
- No space-based offense - **program in works?**
- Strategic planning - retaliation, force and counterforce - **MAD obsolete**
- Non-proliferation treaty (allows non-military development for nuclear power - with inspections) - requires build-down, sanctions - **US & India deal vitiates NPT?**

5/10/2006

Physics 6 - G.R. Goldstein - Spr.03  
- Spring 06 - G.R. Goldstein

4

(c) 2006, Gary R. Goldstein, Ph.D.

5.

## Delivery systems

### Delivery systems

- Triad : Air, Land, Sea **Space?** (Gen.Myers)
- **Intercontinental missiles**
  - ICBM, SLBM, Bombers
- Intermediate range - IRBM
- Tactical - battlefield - shells, mortars
- Cruise (fighter plane drones)
- **Terrorists** - carried on trucks, boats, planes, suitcases(?) - bombs (crude?), contaminants

5/10/2006

Physics 6 - G.R. Goldstein - Spr.03  
Physics 6  
- Spring 06 - G.R. Goldstein

5

(c) 2006, Gary R. Goldstein, Ph.D.