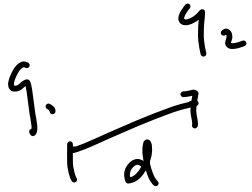
Physics 102 - February 21, 2011

- EXAM I Wed. regular class time
  Hoyt Auditorium

- Formula sheet
- 3x5 index card
- Calculator w/ powers of ten



$$F \propto \frac{q_1 q}{d^2}$$

$$F = k\frac{q_1 q_2}{r^2} \quad - \quad F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}$$

Time dilation

' frame

$$\Delta t = \gamma \underbrace{\Delta t'}_{\text{proper frame}}$$

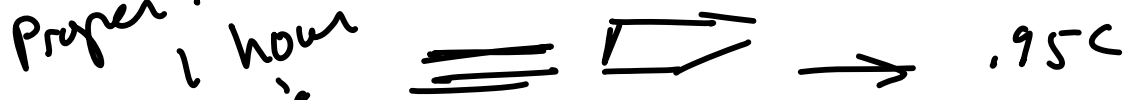
Special frame → event at rest

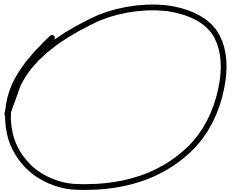
Proper frame

Length contraction

$$\Delta l \gamma = \underbrace{\Delta l'}_{\text{proper frame}}$$

Proper Time
1 hour
Velma



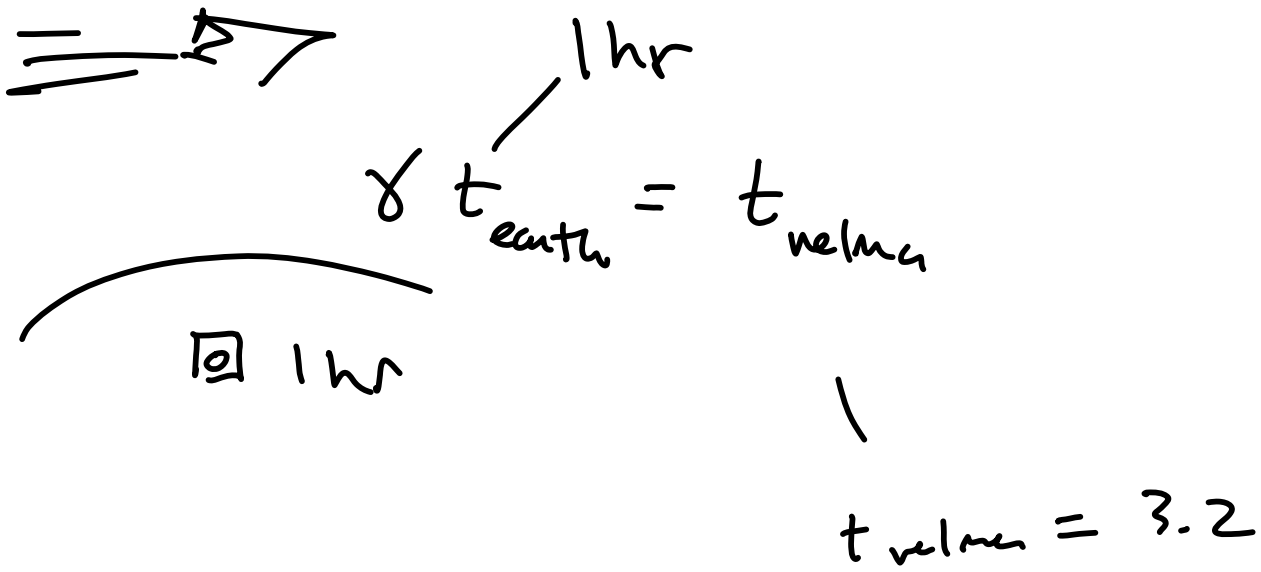


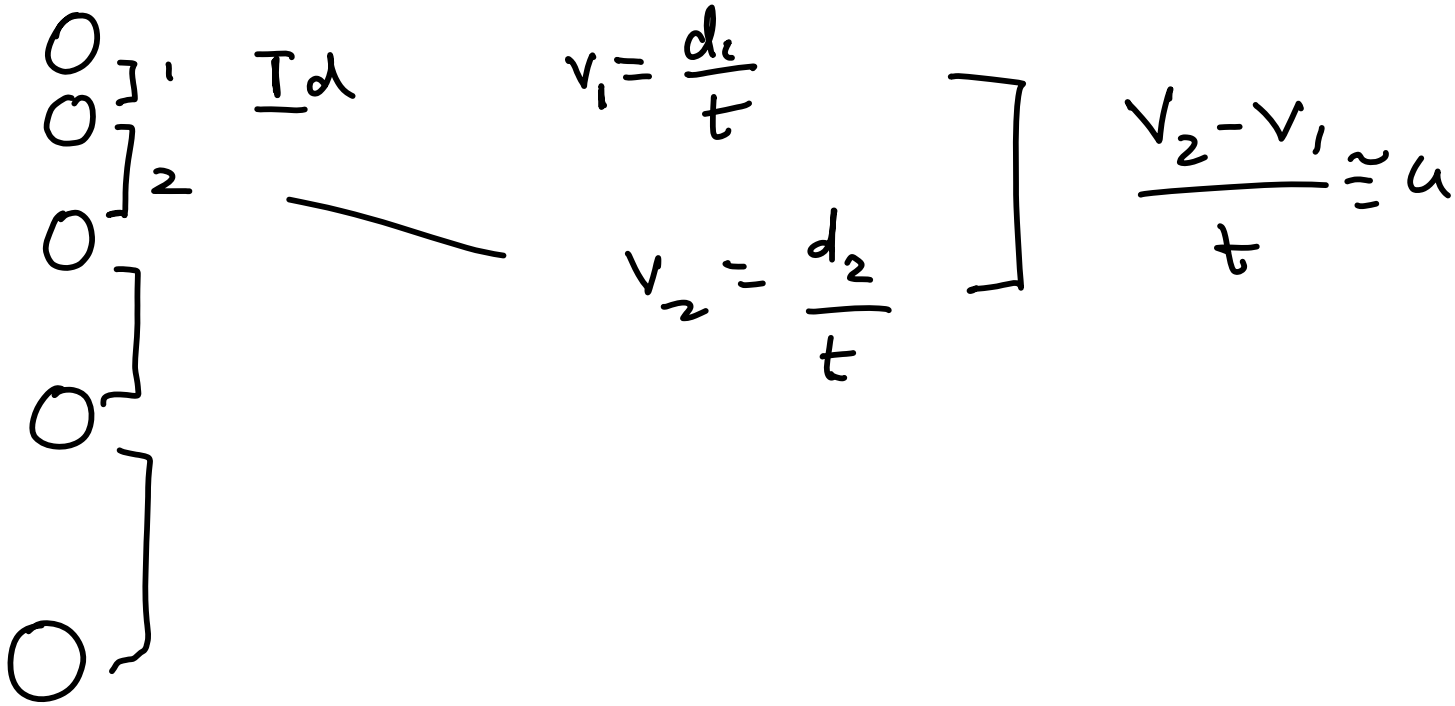
$\gamma = 3.2$

$$t_{earth} = \gamma t_{velma}$$

$$\frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$$

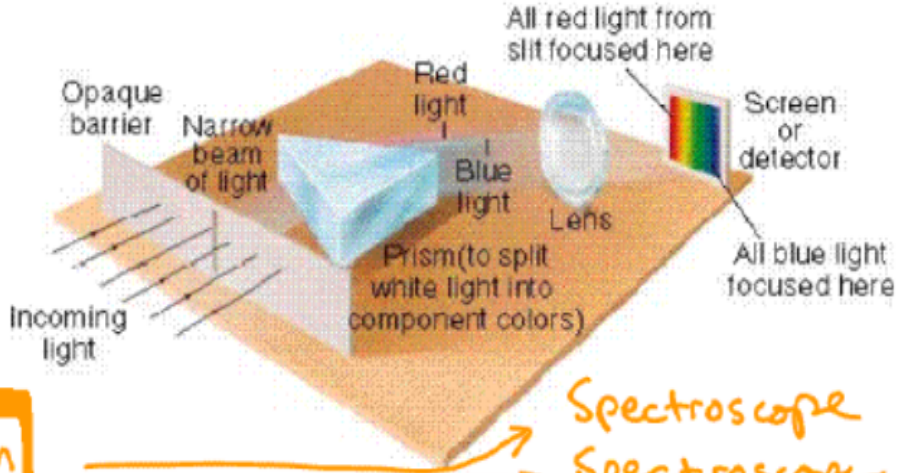
3.2 hours


1hr
$\gamma\, t_{earth} = t_{velocity}$
回 1hr
$t_{velocity} = 3.2$


1
2
Td
$v_1 = \frac{d_1}{t}$
$v_2 = \frac{d_2}{t}$
$\frac{v_2 - v_1}{t} \simeq a$

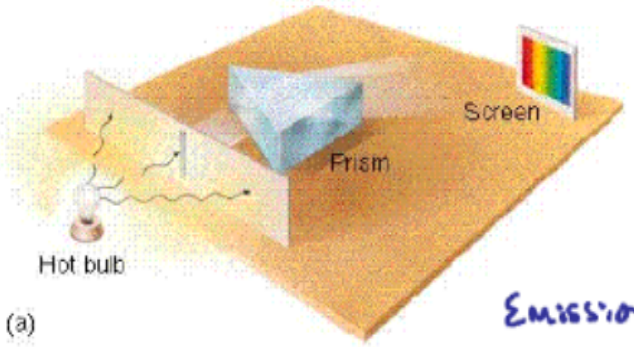
CAN split light to study as a function of Frequency (ν) [or Color]

Spectrum



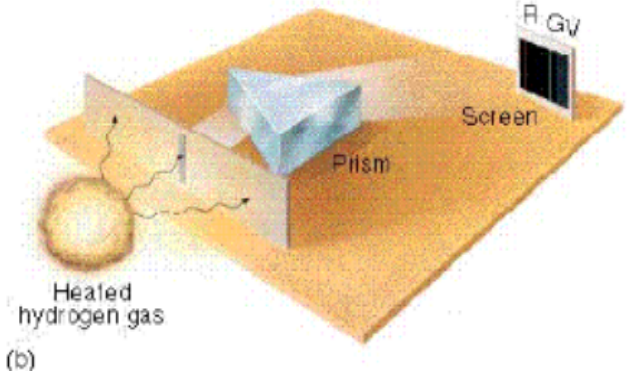
Spectroscope
Spectroscopy

Light from Many Atoms
$\Rightarrow$ Continuous ν

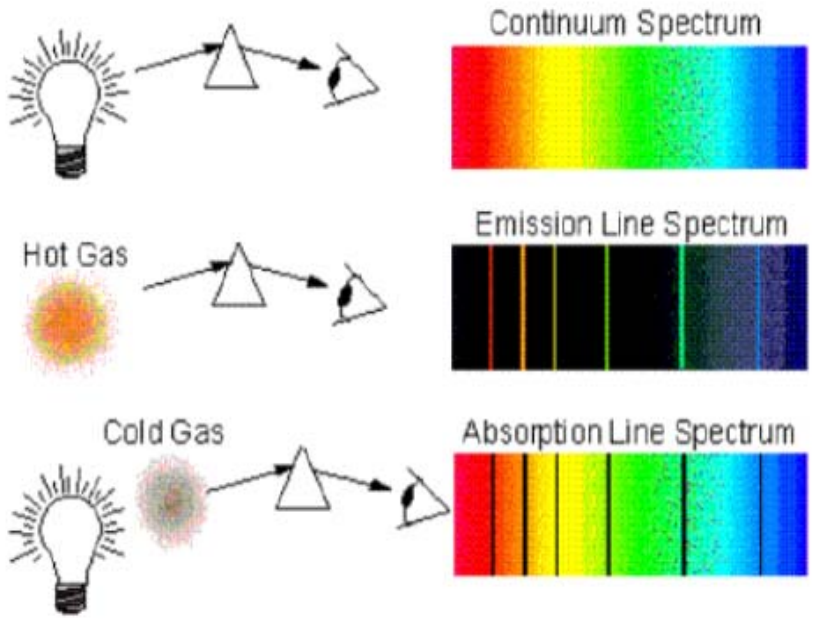


Emission Spectrum

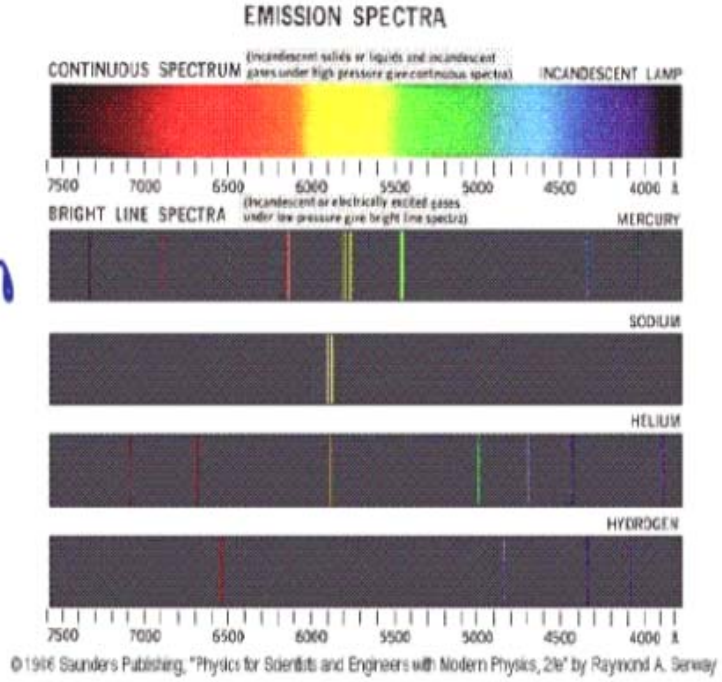
Light from specific atoms
$\Rightarrow$ discrete ν



Emission vs. Absorption



Different Atoms → different discrete frequency pattern



Atomic Fingerprinting

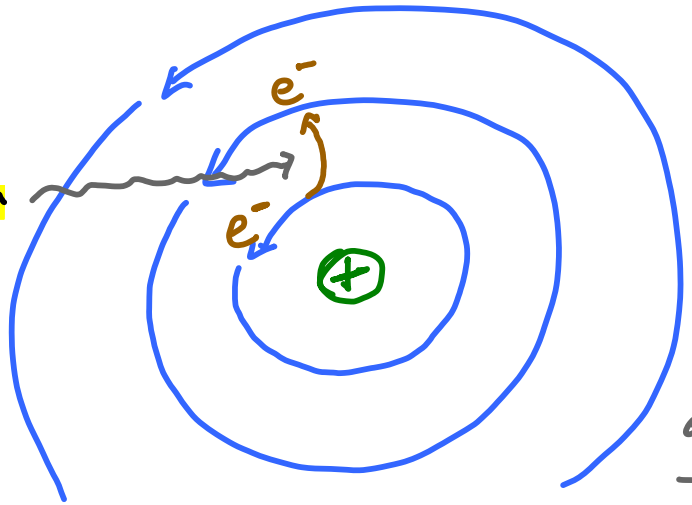
Bohr model of the atom (1912)

1913

- positive Nucleus
- electrons orbit in circles
- only particular "discrete" orbits
  - ↑ known as quantization
- electric (Coulomb) force holds electron on circle as it orbits ... attracts electron toward Nucleus

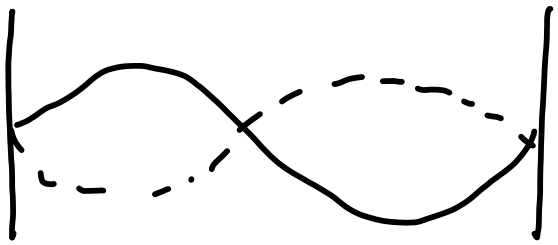
- Nuclear ATOM
- Discrete STABLE circular orbits

Absorb γ (photon) – e⁻ makes transition from low Energy orbit to high energy orbit

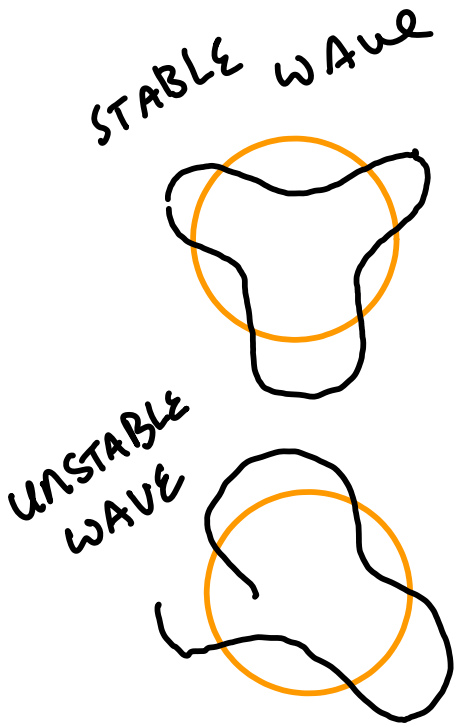


← possible orbits for electron

Transition from high energy orbit to low energy orbit → emission of photon



STANDING WAVE ON STRING



STANDING electron wave in Bohr Model

Discrete Atom Emission + Absorption lines come from e^- transitions between discrete Energy levels

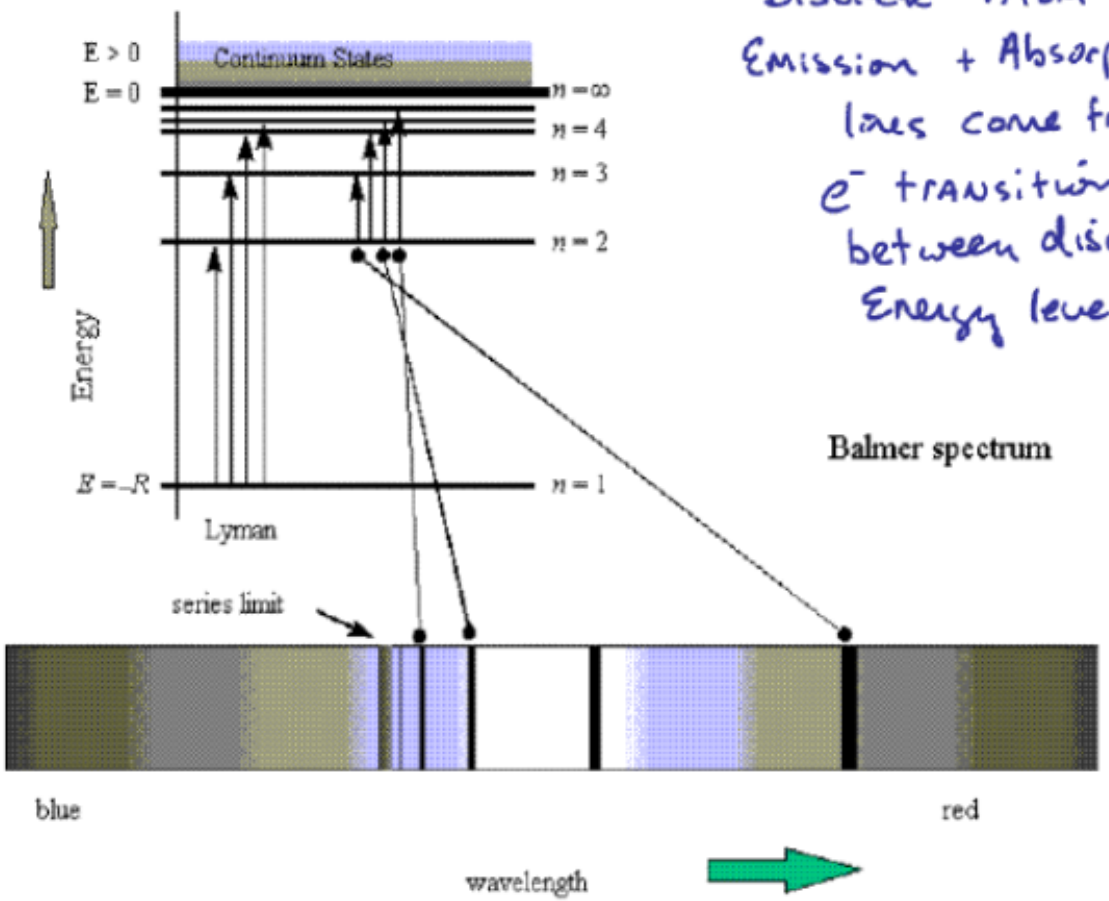
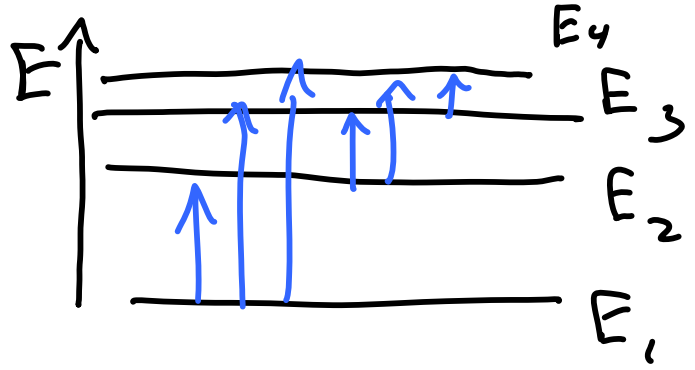


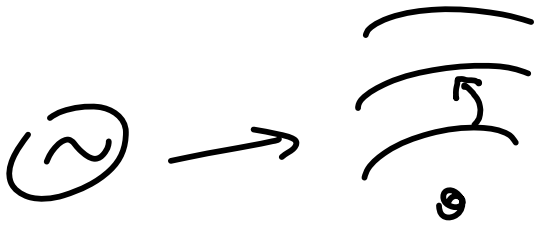
Figure from

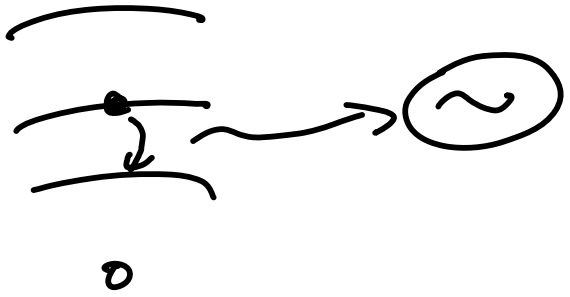
http://www.uclan.ac.uk/facs/science/physastr/x99/PAM98/UCert/Ch06/6_6ato~1.htm

Question: if I have 4 energy levels how many spectral lines do I have?



6





Werner Karl Heisenberg

(1901 - 1976)

Nobel Prize in physics - 1932

for "the creation of quantum Mechanics"

(Max Born, Pascual Jordan - co-workers)

Erwin Rudolf Josef Alexander Schrödinger

(1887 - 1961) Austria

1933 Nobel Prize in physics

1926 - Paper on wave Mechanics of Matter

Annalen der Physik

"for discovery of new and productive forms of atomic theory"

$$-\frac{\hbar^2}{2m}\frac{d^2\psi(x)}{dx^2} + V\psi(x) = E\psi(x)$$ Schrödinger Equation

Just so you've seen it