PHY215 F2017

your hosts

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the coordinates

in space: 1420 BPS and the atrium (see below) course website: chipbrock.org syllabus schedule this is how I'll blog: set up feedburner communicate with you D2L for homework and maybe gradebook the calendar: M, T, W, F regular class

problem workshop (more below)

the sources

course textbooks:

Modern Physics for Scientists and Engineers, 4th Edition, Thornton and Rex

chapters 1-9, 12-15

physical book or ebook

be careful...should be less than \$140

Physics, Bauer and Westfall: special packet, chapters 17-20

1. Go to https://create.mheducation.com/shop/

2. Search for and select book by Title, ISBN, Author, or State/ School.

ISBN: 9781307109009

Title: MSU Modern Physics

3. Add the book to your cart and pay using a credit card or access code.

the blog

some useful stuff some history some links

the content

relativity

special relativity

thermodynamics

first and second laws of thermodynamics

kinetic theory, Maxwell-Boltzmann Iaw quantum theory

experimental basis structure of the atom

wave properties of matter

Quantum Mechanics the hydrogen atom atomic physics statistical physics nuclear and particle physics

the atomic nucleus

nuclear reactions

particle physics

general relativity general relativity cosmology

homework workshop

read the syllabus for the details

you work homework together every Monday during class

in 1420 or atrium. we'll wander around among you

turn it in at the beginning of Tuesday class

no late submissions since solutions will be up that night

work must be yours

funky Sunday thing...read about it

questions?

let's get started

sad book:

Night Thoughts of a Classical Physicist, Russell McCormmach

the story of Victor Jakob, a professor of physics at an unnamed, small German university...set in 1918

What would you believe to be "true"...and you'd use that word...if you were a European Physicist in 1900?

without a doubt:

Newton's three laws of mechanics

Newton's Universal Law of Gravitation

Thermodynamics

Conservation of energy of Joule and Helmholtz, 1st law Maxwell-Boltzmann distribution and kinetic theory Entropy and the 2nd law Stefan–Boltzmann law

Wien's law

Maxwell's Equations

luminiferous aether, or ether maybe Lorentz's force law

Milky Way is all there is and it's comfortingly stable

you'd really doubt

the "atomic hypothesis"

that there's much new left to discover:

"While it is never safe to affirm that the future of Physical Science has no marvels in store even more astonishing than those of the past, it seems probable that most of the grand underlying principles have been firmly established and that further advances are to be sought chiefly in the rigorous application of these principles to all the phenomena which come under our notice. It is here that the science of measurement shows its importance where quantitative work is more to be desired than qualitative work. An eminent physicist remarked that the future truths of physical science are to be looked for in the sixth place of decimals." Albert Michelson 1894



this is PHY215

PRETEND THAT YOU'RE A PAYSICIST IN 1900 ...

what do you know?

NEWTON'S LAWS ...

zrd. $\sum_{i=1}^{cll \text{ forces } \rightarrow} F = \frac{d\vec{p}}{d\vec{r}}$

Uh-Oh #1

Α

easy to determine relative \vec{v} 's what about \vec{a} 's? with respect to what?



Ernsf Mach 1838-1916



p=mi ... so 2nd is about à

1** Low?
$$\sum_{i} \vec{F_{i}} = 0$$
 so just a special case of 2^{rd} .
 $3^{rd}Law$? $\vec{F_{ij}} = -\vec{F_{ji}}$... just momentum conservation
(and due to galileo and Descrites anylow)
Lot's of formetism in the 18th \$19th centuries...
A force acting on an object for a given time interval.
 $\langle \vec{F} \rangle \Delta t = \Delta \vec{p} \Rightarrow \int \vec{F} dt = \Delta \vec{P} = \vec{J}$
Impulse.

Energy and Energy conservation
The to Huggens & Leibnitz
$$\rightarrow$$
 while bundle of people \rightarrow Jones Jones
A frice acting on an object through a given distance
 $d\vec{x} = \vec{F} = \vec{F} \cdot d\vec{x} = W_{ab} = \vec{F} \cdot d\vec{x} = W_{ab}$
 $\vec{F} = u d\vec{v} = con durge at acch position.$
Since $\vec{F} = u d\vec{v} = con durge at acch position.$
 $\vec{S} = d\vec{v} = d\vec{v} d\vec{x} = v d\vec{v}$
 $W_{ab} = \int_{a}^{b} \vec{F} \cdot d\vec{x} = \int_{a}^{b} u d\vec{v} dx = \int_{a}^{b} v d\vec{$

If the work doesn't depend on the path $\int_{a}^{b} \vec{F} \cdot dx = f(\vec{x}_{b}) - f(\vec{x}_{a})$ usually uniten $-\int_{a}^{b} \vec{F} \cdot dx = \mathcal{U}(\vec{x}_{b}) - \mathcal{U}(\vec{x}_{a}) = -\Delta \mathcal{U}$ and $W_{Ab} = -U(x_b) + U(x_o)$ Wab = AK then $K_h - K_a = - U_h + U_a$ no $K_a + U_a = K_b + U_b$ K+U = constant conservative free U(x) Brential due to "configuration at X

uh-oh #2 ≠3

what's m? ... how do you weare it?

some law 12

At least Florida knows a law when it sees one

GRAVITATION

Gravitation R17. 2 mi my Newtris real triumph: $\vec{F}_{12} = G \frac{m_i m_2}{R_{12}^2} \hat{r}$ m here the same as in in Zed law? 4h-0h #5 force instantly transmitted from 1 to 2 ? "Action at a distance " hh-oh #6

Electromagnetism A 19th century Sot of miraclos: Fava day - Max well - Loventz RIZ $\frac{1}{4\pi\epsilon_{s}} = 8.99 \times 10^{9} \text{Nm}^{2}$ $F_{12} = \frac{1}{4\pi\epsilon_0} \frac{Q_1 Q_2}{R_{12}^2}$ - F₂₁ ~v a coulown is ennums. Q1=Q2=1C, R12=1m? F = 1Mtunits will be nor evening throughout your caveer! TER: MKS. No 1 's stich around. 4TES like wise for mequets! F~ 1/2 -> more "Action at a Distance"

Michael Faladay said "no". "Lives of force" --- fields

(there will never be another Foraday,)

real thing for Favoday.

Maxwell's Equations A standard hind of relationship : (fancy field & vector colculus) & sources stuff " Integral Fam 1. Gauss' Low for electrostatics $e_0 \oint \vec{E} \cdot d\vec{s} = Q$ 43 avbitvary methemotical Surface



2. Gass' haw for magnetostatics. É \$ B. ds = 0 => us magnetic mourpoles 13

3. Generatized Amperès Law E(L) M $\vec{E}(t)$ Ë(t) B arbitrary mancondical d, Loop... enclosing an avea \$ B. di = Moto di St. dis + MoI creates emf "displacement curvent" Maswell Prediction $\mu_{0} = 4\pi \times 10^{-7} \frac{NS^{2}}{C^{2}}$ permiability constant



5. Loventy Force 1892 $\vec{F} = d\vec{o} = q\vec{E} + q\vec{v} \times \vec{B}$

1900

state of theory state of experiment's with light