Physics 114 - January 14, 2015

Physics 114 is the continuation of Physics 113. This is an introductory course in electromagnetism and modern physics. Topics covered include electromagnetism, light, optics, quantum mechanics, atomic physics, nuclear physics, and a little bit of relativity. Students are assumed to have a working knowledge of basic calculus and the material covered in Physics 113. The course is designed for science majors who are not majoring in physics or engineering.

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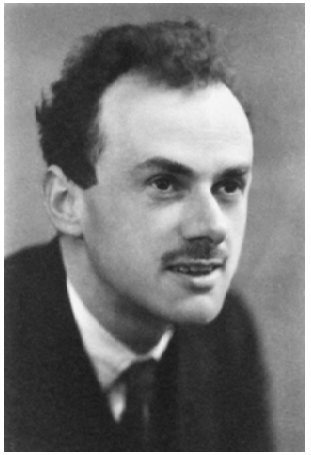
Should have gotten email w/ syllabus + info
If not → email me + I'll send you a copy
→ get properly registered

EM + quantum mechanics → EXACT Soln of H atom

, and the difficulty is only that the exact application of these laws leads to equations much too complicated to be soluble. It therefore becomes desirable that approximate practical methods of applying quantum mechanics should be developed, which can lead to an explanation of the main features of complex atomic systems without too much computation.

- *Proceedings of the Royal Society of London. Series A, Containing Papers of a Mathematical and Physical Character, Vol. 123, No. 792* (6 April 1929)

P.A.M. Dirac



The essence of chemistry is
electromagnetism + quantum mechanics

X-rays, mass spectroscopy, visible light spectroscopy, IR spectroscopy, nature of the chemical bond, CAT scans, NMR of all sorts, EKG, nerve function, cell phones, elevator motors, ambulance lights, microscopes, dental drills, surgical lights, electrophoresis, carbon-14 dating, LASIK, laser surgery, radionuclide labeling, radiation treatments of cancer with beams and with implanted sources, mp3 players, radios, televisions, cathode ray tubes of all sorts, defibrillators, computers, digital imaging, cameras, copy machines, refrigerators, heaters, power from the wall, heating espresso, PIXUS, automatic toilets, microwaves, CD's, DVD's, streaming video, Napster, Ipods, any aspect of the internet, optical fibers, telephones, electric power transformers, credit card information stored in magnetic strips, bar code scanning, signal cables, eye glasses, MRI, contact lenses ….

Plus This is a great opportunity to work on your problem Solving skills!

Maxwell's equations (integral Form)

$$\begin{cases} \int_S \vec{E}\cdot d\vec{A} = \dfrac{Q_{encl}}{\epsilon_0} \\ \int_S \vec{B}\cdot d\vec{A} = 0 \\ \int_L \vec{E}\cdot d\vec{l} = -\dfrac{d\int_S \vec{B}\cdot d\vec{A}}{dt} \\ \int_C \vec{B}\cdot d\vec{l} = \mu_0 I_{encl} + \mu_0\epsilon_0 \dfrac{d}{dt}\int_S \vec{E}\cdot d\vec{A} \end{cases}$$

James Clerk Maxwell
1831-1879

Components of the class

lectures / demos

Workshops

Problem Sets

labs

Text

other things

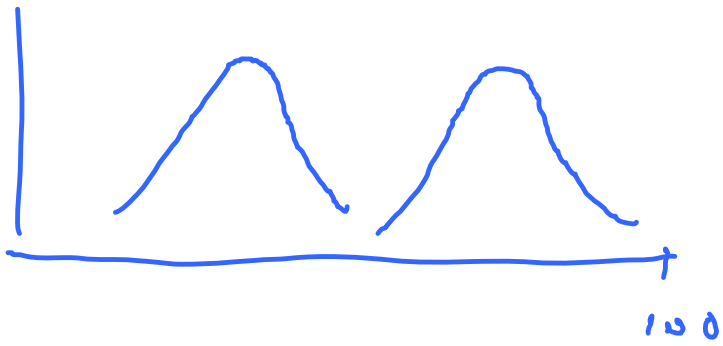
Prob Set + Exam drops

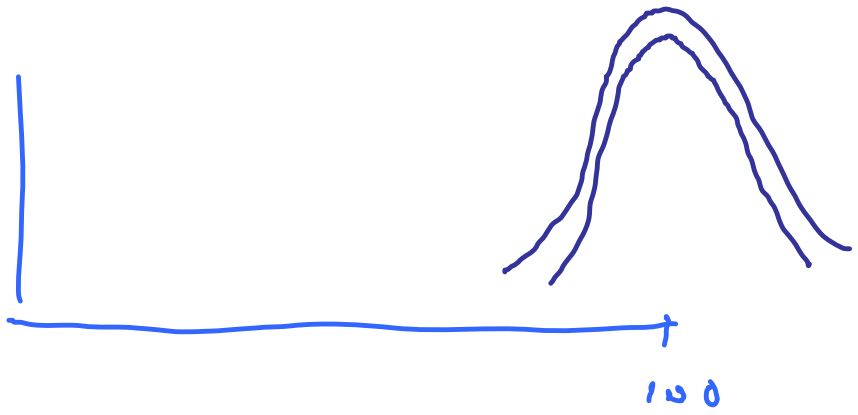
Office hour(s)

Scheme	Exam 1	Exam 2	Exam 3	Final exam	Lab	Prob sets
1	---	20%	20%	35%	16%	9%
2	20%	---	20%	35%	16%	9%
3	20%	20%	---	35%	16%	9%
4	18%	18%	18%	21%	16%	9%

Dealing with drops + Fairness given that exams may differ in difficulty

	Exam 1	exam 2	exam 3	final exam								
BNA1		0.3	0.3	0.4								
BNA2	0.3		0.3	0.4								
means	50	80	75	75								BNA
stud 1	0	80	75	75		BNA1	76.5	BNA2	52.5			76.5
stud 2	50	0	75	75			52.5		67.5			67.5



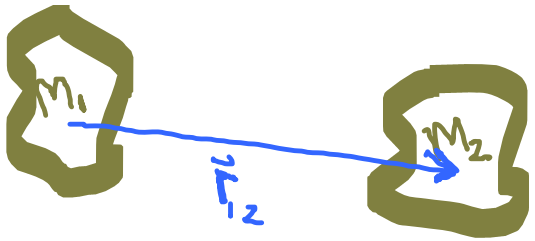


Prob set 1 posted – Due 1/23

Workshops begin week of Jan 26

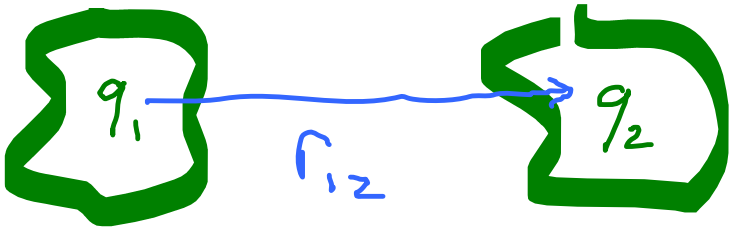
Synchronization

Gravitation



$$\vec{F}_{1on2} = -\frac{G M_1 M_2}{r_{12}^2}\hat{r}_{12}$$

Electrostatics



$$\vec{F}_{1on2} = \frac{k q_1 q_2}{r_{12}^2}\hat{r}_{12}$$

Permittivity of free space

$$8.99 \times 10^9 \frac{N m^2}{C^2}$$

$$\frac{1}{4\pi\epsilon_0}$$

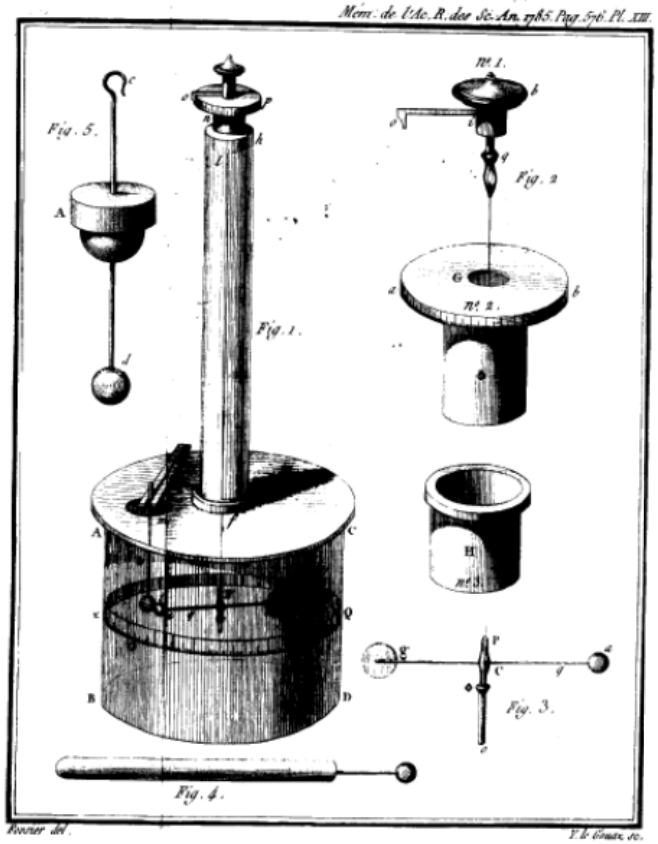
$$\epsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{N m^2}$$

Charles
Augustin
Coulomb

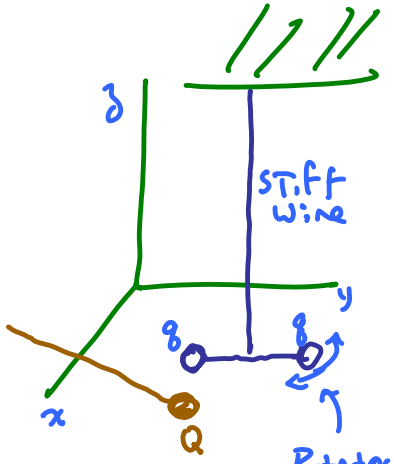
(1736 – 1806)

Coulomb's Law ~1785

French Military engineer



Torsion Balance



Rotates in x-y plane

$F \propto \frac{q_1 q_2}{r^2}$

Period of oscillation depends on force