PHY 712 Electrodynamics
10-10:50 AM MWF Olin 107

Plan for Lecture 12:

Continue reading Chapter 5

A. Examples of magnetostatic fields

B. Magnetic dipoles

Course schedule for Spring 2014

(Preliminary schedule -- subject to frequent adjustment.) Please note that makeup lectures (indicated in red) are scheduled for Tuesdays or Thursdays at 11 AM - 12:15 PM in Olin 107.

	Lecture date	JDJ Reading	Topic	Assign.	Due date
1	Wed: 01/15/2014	Chap. 1	Introduction, units and Poisson equation	#1	01/31/2014
2	Thu: 01/16/2014	Chap. 1	Electrostatic energy calculations	#2	01/31/2014
3	Fri: 01/17/2014	Chap. 1	Poisson equation and Green's theorm	#3	01/31/2014
	Mon: 01/20/2014		MLK Holiday - no class		
4	Wed: 01/22/2014	Chap. 1	Green's functions for cartesian coordinates	#4	01/31/2014
5	Thu: 01/23/2014	Chap. 1	Brief introduction to numerical methods	#5	01/31/2014
6	Fri: 01/24/2014	Chap. 2	Method of images	#6	01/31/2014
	Mon: 01/27/2014		NAWH out of town - no class		
	Wed: 01/29/2014		NAWH out of town - no class		
7	Fri: 01/31/2014	Chap. 3	Cylindrical and spherical geometries	#7	02/05/2014
8	Mon: 02/03/2014	Chap. 4	Multipole analysis of charge distributions	#8	02/05/2014
9	Wed: 02/05/2014	Chap. 4	Dipoles and dielectrics	#9	02/07/2014
10	Fri: 02/07/2014	Chap. 4	Dipoles and dielectrics	#10	02/10/2014
11	Mon: 02/10/2014	Chap. 5	Magnetostatics	#11	02/12/2014
12	Wed: 02/12/2014	Chap. 5	Magnetostatics	#12	02/14/2014

WFU Physics Colloquium

TITLE: The Coolest Little Hot Stars You've Never Heard Of
SPEAKER: Brad N. Barlow,

Department of Physics
High Point University

TIME: Wednesday February 12, 2014 at 4:00 PM

PLACE: Room 101 Olin Physical Laboratory

Refreshments will be served at 3:30 PM in the Olin Lounge. All interested persons are cordially invited to attend.

ABSTRACT

The enigmatic hot subdwarf stars represent one of the least-understood stages of stellar evolution. Theory shows they likely formed from red giants that lost their outer hydrogen envelopes due to Roche lobe overflow and common envelope interactions with a nearby companion star. Observations support this idea as the large majority of hot subdwarfs are, in fact, in binaries. Although binary population synthesis models are generally successful at forming hot subdwarf systems, these models are relatively unconstrained and fail at predicting their orbital periods and companion masses. Here I will (i) give a brief introduction to hot subdwarf stars, (ii) describe three main techniques we use to detect binaries with varying companion masses, and (iii) discuss new systems we found that are

Various forms of Ampere's law :

$$\nabla \times \mathbf{B}(\mathbf{r}) = \mu_0 \mathbf{J}(\mathbf{r})$$

Vector potential : $\mathbf{B}(\mathbf{r}) = \nabla \times \mathbf{A}(\mathbf{r})$

For Coulomb gauge : $\nabla \cdot \mathbf{A}(\mathbf{r}) = 0$

$$\Rightarrow \nabla^2 \mathbf{A}(\mathbf{r}) = -\mu_0 \mathbf{J}(\mathbf{r})$$

For confined current density :

$$\mathbf{A}(\mathbf{r}) = \frac{\mu_0}{4\pi} \int d^3r' \frac{\mathbf{J}(\mathbf{r}')}{|\mathbf{r} - \mathbf{r}'|}$$

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Other examples of current density sources:

Quantum mechanical expression for current density

for a particle of mass M and charge e and of probability amplitude $\Psi(\mathbf{r})$:

$$\mathbf{J}(\mathbf{r}) = -\frac{e\hbar}{2Mi}\left(\Psi^*(\mathbf{r})\nabla\Psi(\mathbf{r}) - \Psi(\mathbf{r})\nabla\Psi^*(\mathbf{r})\right)$$

For an electron in a spherical potential (such as in an atom) :

$$\Psi(\mathbf{r}) \equiv \Psi_{nlm}(\mathbf{r}) = R_{nl}(r) Y_{lm}(\hat{\mathbf{r}})$$

$$\mathbf{J}(\mathbf{r}) = \frac{e\hbar}{2Mi}|R_{nl}(r)|^2 \frac{1}{r\sin\theta}\left(Y_{lm}^*(\hat{\mathbf{r}})\frac{\partial Y_{lm}(\hat{\mathbf{r}})}{\partial\phi} - Y_{lm}(\hat{\mathbf{r}})\frac{\partial Y_{lm}^*(\hat{\mathbf{r}})}{\partial\phi}\right)\hat{\boldsymbol{\varphi}}$$

$$= \frac{e\hbar}{M}\frac{m}{r\sin\theta}\left|\Psi_{nlm}(\mathbf{r})^2\right|\hat{\boldsymbol{\varphi}}$$

Note that : $\hat{\boldsymbol{\varphi}} = -\sin\phi\hat{\mathbf{x}} + \cos\phi\hat{\mathbf{y}} = \frac{\hat{\mathbf{z}} \times \mathbf{r}}{r\sin\theta}$

$$\mathbf{J}(\mathbf{r}) = \frac{e\hbar}{M}\frac{m}{r^2\sin^2\theta}|\Psi_{nlm}(\mathbf{r})|^2(\hat{\mathbf{z}} \times \mathbf{r})$$

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