UBC Physics 102 Lecture 16

Rik Blok



Outline

- ▷ Electric and magnetic fields
- ▷ Gauss's law for magnetism
- Maxwell's equations
- Electromagnetic waves
- \triangleright End



Discussion: Ampère's law



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• So changing electric flux Φ_E produces *B*.



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Discussion: Gauss's law for magnetism

Recall Gauss's law (for electricity),

$$\sum E_{\perp} A = \frac{Q}{\epsilon_0}.$$

Turns out there is a similar law for magnetism,

$$\sum B_{\perp}A = 0.$$



Definition: Maxwell's equations



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 Maxwell recognized you only need four equations to explain <u>all</u> electricity and magnetism,

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- So E and B not separate but "two sides of the same coin".
- (Even true for special relativity so more general then Newton's laws.)





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 If monopoles existed could (in principle) swap all magnetism with electricity and laws of nature would be essentially unchanged.



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Interactive Quiz: PRS 16a



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 E and B are solutions to Maxwell's equations if the speed of the wave is

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- So waves of E and B travelling at the speed of light will continue in a straight line.
- Now known that electromagnetic waves <u>are</u> light!



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- Interactive Quiz: PRS 16b



End

Practice Problems:

- Ch. 32: Q. 5, 7, 9, 11.
- Ch. 32: Pr. 13, 15, 17, 35, 37, 39, 45.



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- Tutorial Question: tut16

