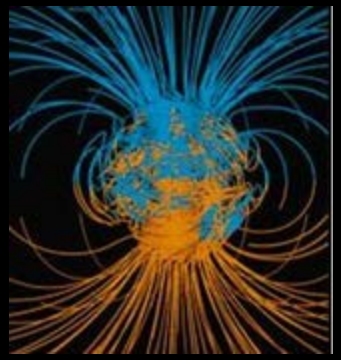


# PHY2005 Applied Physics 2

**Instructor:**
**Prof. Peter Hirschfeld**
**Tentative Office Hours: Tues. 4th, Wed. 8th, + 1 TBA**
**Office: NPB #2156**

**I expect you to know:**

**trigonometry, vector (addition, subtraction, decomposition)**
**how to solve linear coupled equations, quadratic equations, ..**
**physics from PHY2004 (Newton's law, motion in 2-Dimension, potential energy, energy conservation,..)**

**Goal of the Course:** **Conceptual understanding of** E & M
**Should be able to solve physics problems involving simple application of physics and simple calculations**
**Do not expect you to solve twisted problems involving lengthy calculations.**

**Please visit my course webpage regularly!!**
**E-mails under subject PHY2005 (not a spam, do not filter).**

# How to get to the course webpage:

1) Navigate directly to http://www.phys.ufl.edu/~pjh/teaching/phy2005/

2) Navigate to Physics > Academics > Current Courses > PHY2005

Note: Canvas will not be used for this course EXCEPT to post grades

# GRADE

Two in-class exams: 2 x 24% = 48%
Final exam: 32%
Qui: 20%.

| Grade | A | B+ | B | C+ | C | D+ | D | E |
|---|---|---|---|---|---|---|---|---|
| Total Score | 100 -85 | 84- 75 | 74- 65 | 64- 55 | 54- 45 | 44- 40 | 39- 35 | 34-0 |

**Student 1:** **EX1** = 10/12 **EX2** = 9/12 **Ex3** = 8/12
**Final** = 14/16
**Quiz** = 17

**Total Score** = 10x2 + 8x2 + 14x2 + 17 = 81 **B+**

# What did ancients know about electricity, magnetism and light?

## 1. Manifestations of electricity in the natural world

a. Lightning
b. Static electricity (amber, when rubbed, attracts light objects)
c. Electric fish and eels

Reported by Thales, 6th cent. BC

No underlying theory of what electricity was or how the phenomena were connected (that we know of)

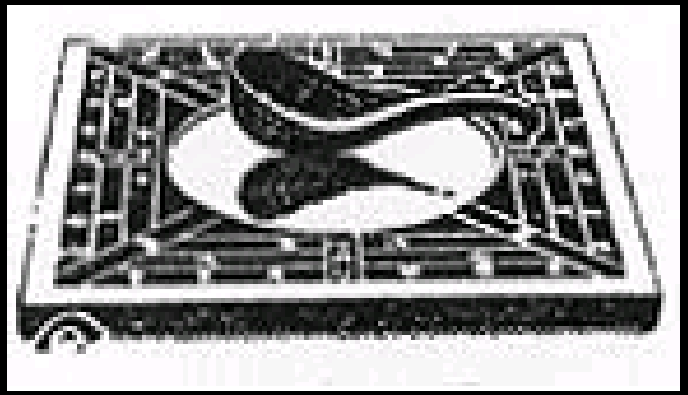
# What did ancients know about electricity, magnetism and light?

## 2. Manifestations of magnetism in the natural world

Lodestone (naturally occurring magnetic iron oxide, could attract small bits of iron)

Also reported by Thales, 6th cent. BC

Compass needles from magnetized iron: (games, fortune telling) China ~200 BC



magnetized spoon on plate

# Many theories of magnetism!

**<u>800 B.C.</u> - 0 A.D. Early theories of magnetism:**

1) magnet "feeds on" iron;
2) magnet emits "effluvia"-invisible objects or fluid.
3) Diogenes of Apollonia (460 B.C.): Iron contains humidity which dryness of magnet feeds upon

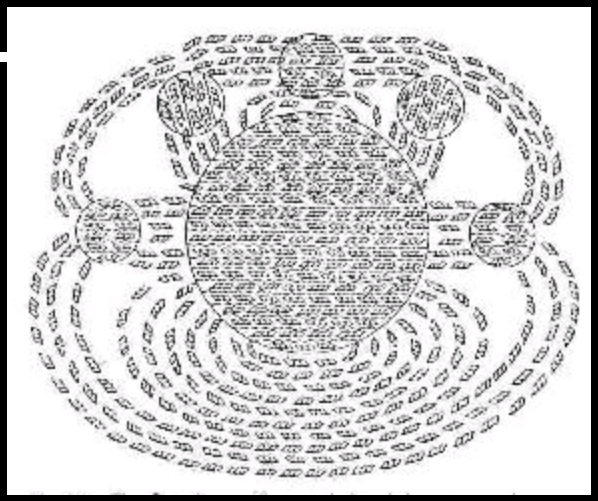
Lucretius Carus (Roman Poet) [example of 2)]:

"First, from the magnet num'rous Parts arise.
And swiftly move; the Stone gives vast supplies;
Which, springing still in Constant Stream, displace
The Neighb'ring air and make an empty Space;
So when the Steel comes there, some Parts begin
To leap on through the void and enter in...
The Steel will move to seek the Stone' s embrace,
Or up or down, or t'any other place
Which way soever lies the empty Space. “

**1000, 1200 AD** **1st use of compass for navigation (China, Europe)**

## 1269 A.D. Poles of magnet discovered.

Petrus Peregrinus - wrote first treatise on exp'tl magnetism. Put iron filings in various places around spherical lodestone, mapped out orientations and noticed streamlines converged at N and S poles.



## 1600 Publication of *de Magnete* by William Gilbert

- Repeated Peregrinus' experiments, great exponent of experimental method.
- Disproved superstitions saying garlic, onion, and diamonds could rob magnets of their power.
- Recognized that earth itself was a magnet, and that magnetic poles did not quite coincide with real poles.

# What did ancients know about electricity, magnetism and light?

## 3. Manifestations of light in the natural world: sun, stars, etc

Aristotle, in the 4th century BC, said everything was composed of 4 elements; fire, air, earth and water. Stated that the human eye made out of all four including fire in the eye which shone out from the eye making sight possible.

Dissenting views: Roman Lucretius (*On the nature of the Universe* (55 BC)):-

*The light and heat of the sun; these are composed of minute atoms which, when they are shoved off, lose no time in shooting right across the interspace of air in the direction imparted by the shove.*

But the eye “emitting” vision theory dominated well into the middle ages.

At no point did anyone connect light with electricity and magnetism!!!

# WHY are there so few natural manifestations of electricity, magnetism?

Gravity is much weaker than electromagnetism, yet we see gravitational effects all around us; not so for electrical ones – why?

Fact that there are positive and negative charges means that Electrons and protons bind together to make neutral objects. To see electrical effects, You need to separate charges to make ions – takes huge amount of energy!