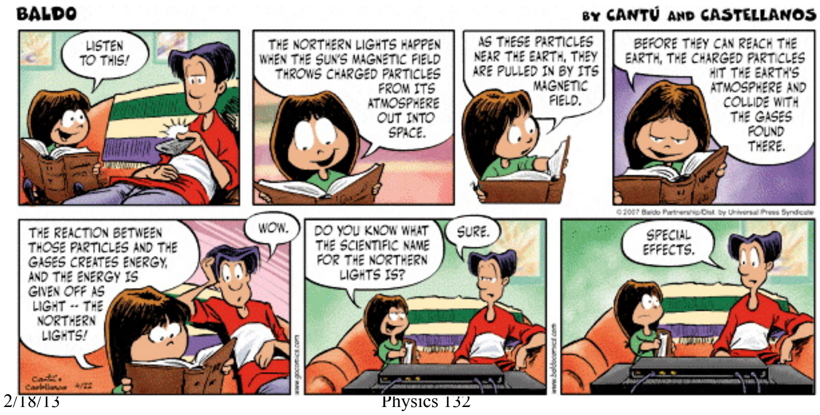
February 18, 2013 Physics 132 Prof. E. F. Redish

- **<u>Theme Music:</u> Charley Pride**

  Field of Dreams

- **<u>Cartoon:</u> Cantu and Castellanos – *Baldo***



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Foothold idea: Fields

- *Test particle*
  - We pay attention to what force it feels. We assume it does not have any affect on the source particles.
- *Source particles*
  - We pay attention to the forces they exert and assume they do not move.
- *Physical field*
  - We consider what force a test particle would feel if it were at a particular point in space and divide by its coupling strength to the force. This gives a vector at each point in space.

$$\vec{g} = \frac{1}{m}\vec{W}_{E\to m} \qquad \vec{E} = \frac{1}{q}\vec{F}_{\text{all charges}\to q} \qquad V = \frac{1}{q}U^{elec}_{\text{all charges}\to q}$$

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Units

- Gravitational field
  units of g = Newtons/kg
- Electric field
  units of E = Newtons/C
- Electric potential
  units of V = Joules/C = Volts
- Energy = qV so $e\Delta V$ = the energy gained by an electron (charge $e = 1.6 \times 10^{-19}$ C) in moving through a change of ΔV volts.
  1 eV = 1.6×10^{-19} J

Reading question

- I'm still confused on the idea of determining fields and the fact that it is a function that is defined on a range of space? and how it would cause confusion if the field is negligibly small so we decide to identify it as a region of space?
- The next part made the least sense for me: when it warned to not identify the field with a region of space when the field was 0 or negligibly small. I did not understand this part at all or what to do if you should not do this.
- Can you clarify what you mean by, "A field does not refer to a restricted region of space, but rather it is the function that is defined on a range of space?"
- "Field… refers to THE FUNCTION THAT IS DEFINED ON A RANGE OF SPACE." What is mean by this (the wording is confusing to me)?

Reading question

Are electric fields and gravitational fields the same regarding the acceleration that results from them? For example, in free fall all objects accelerate toward the center of Earth with the same magnitude regardless of mass. In an electric field, do source charges accelerate toward test charges with the same magnitude regardless of charge?