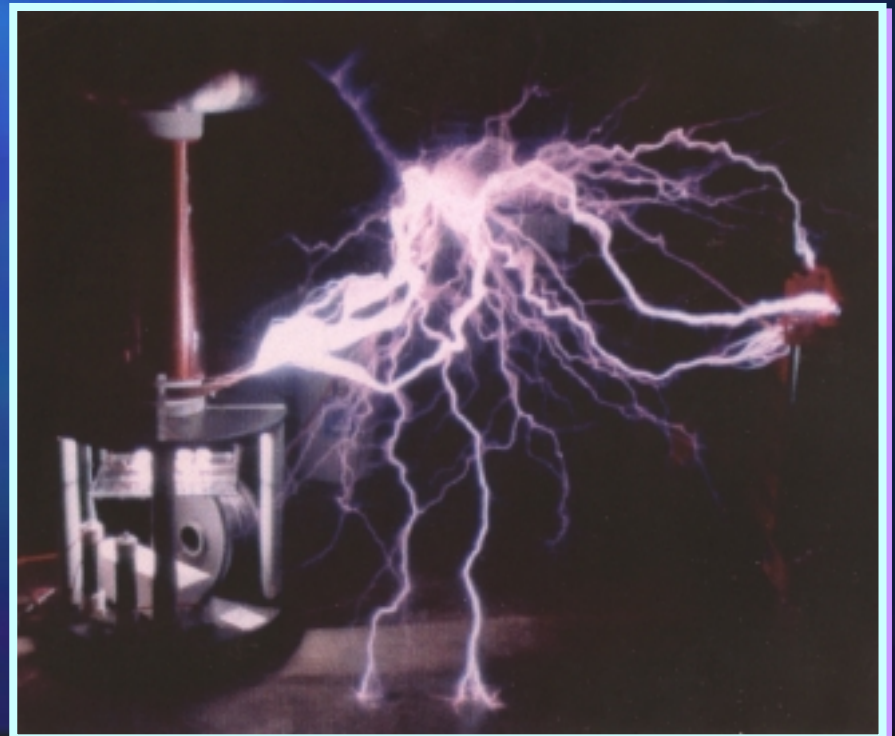




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Santa Cruz Institute for Particle Physics SCIPP

- Professors Hartmut Sadrozinski, Terry Schalk

UC Santa Cruz Department of Physics

- Brian Keeney

Science Teacher Volunteer:

- Mr. S. Briber (Independence H.S., San Jose)
- Dr. J. Dann (St. Ignatius Prep. H.S., San Fran)

Thanks to our hosts

- Lowell Physics Students
- Richard Shapiro (Physics Teacher)
- Lowell Science Dept.
- Gabriel Hanover (Tech)
- Paul Cheng (Principal)



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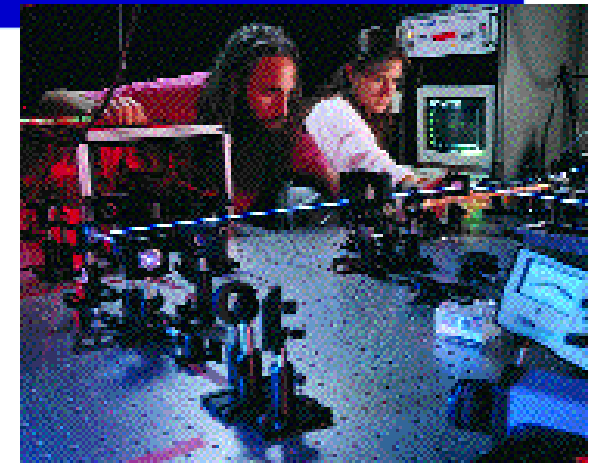
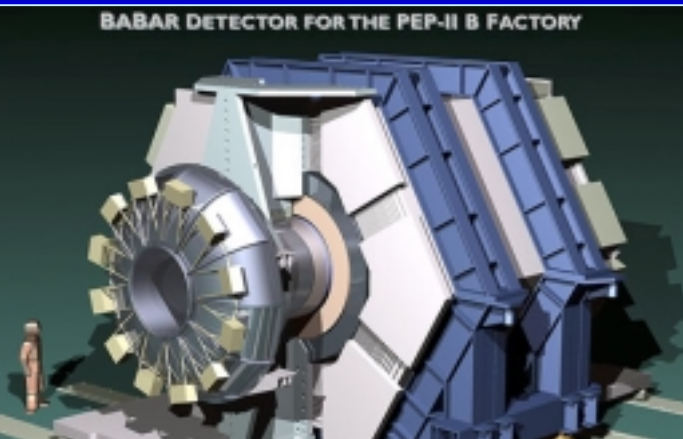
UCSC Physics



- Particle Astrophysics & Cosmology

- Teaching, Research, Outreach

BABAR DETECTOR FOR THE PEP-II B FACTORY

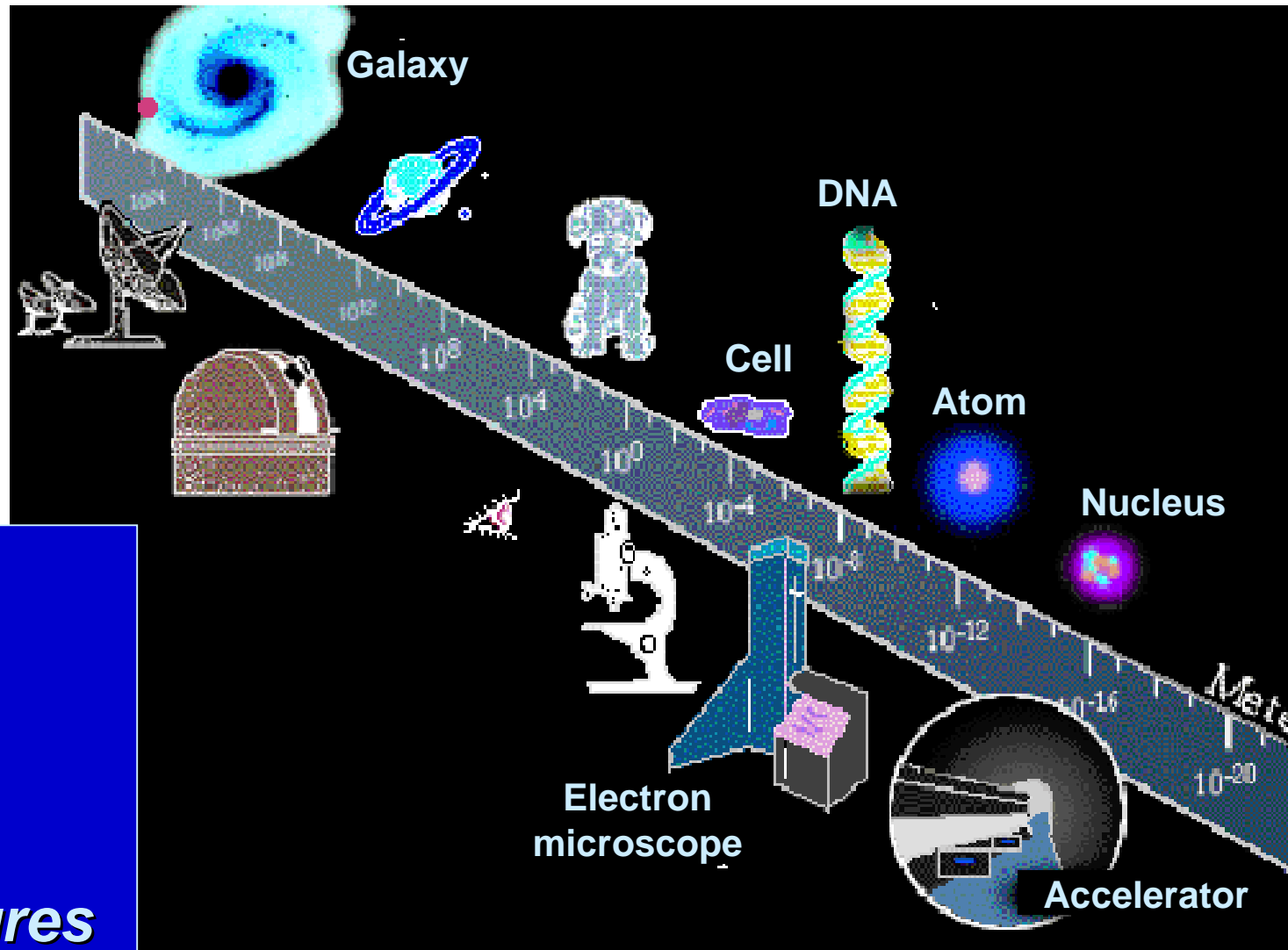


- Elementary Particle Physics

- Condensed Matter Physics & Wave Propagation



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SCIPP's Research extends from the smallest particles to the largest structures in the Universe



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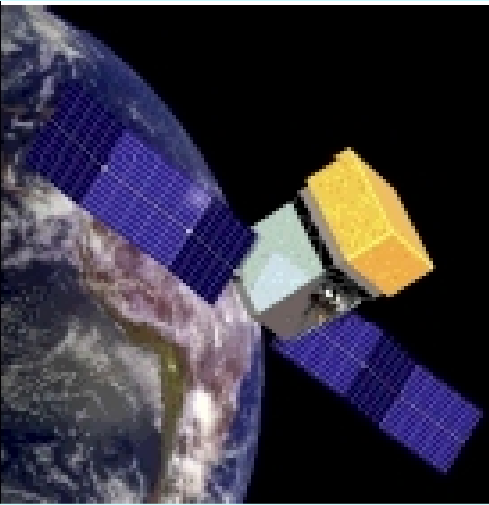
**Graduate and Undergraduate Students
conduct research in the SCIPP Laboratories**



<http://scipp.ucsc.edu>



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Program

- Introduction & Jacob's Ladder
- Corona & Lights without Cords
- Zorro's Revenge
- Mystery Knight in Armor
 - Fighting Lightning
 - Bolt to the face
- Facts on Tesla Coil
- Mystery Knight in Armor
 - Sparks from the feet





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SAFETY FIRST!

- Distance at least 20 ft.
 - Computers, Gameboys, CD players, telephones to the back of the room – unplugged, switched off!
 - Hearing aids off, pacemakers out of room
-
- Normally you can't see, hear or smell electricity, but the Tesla Coil makes
 - Bright sparks
 - Loud crackling noise
 - The air smell bad (Ozone)



***1 Million
Volts!
DANGER***

BRACE YOURSELF!



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Zorro



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Lightning

Jacob's Ladder

Corona

Tesla Sparks

are all related.

Principle: Air becomes ionized, and
therefore conducts electricity.

Lot's of it, so the current heats up the air,
excites the atoms/molecules which emit light.



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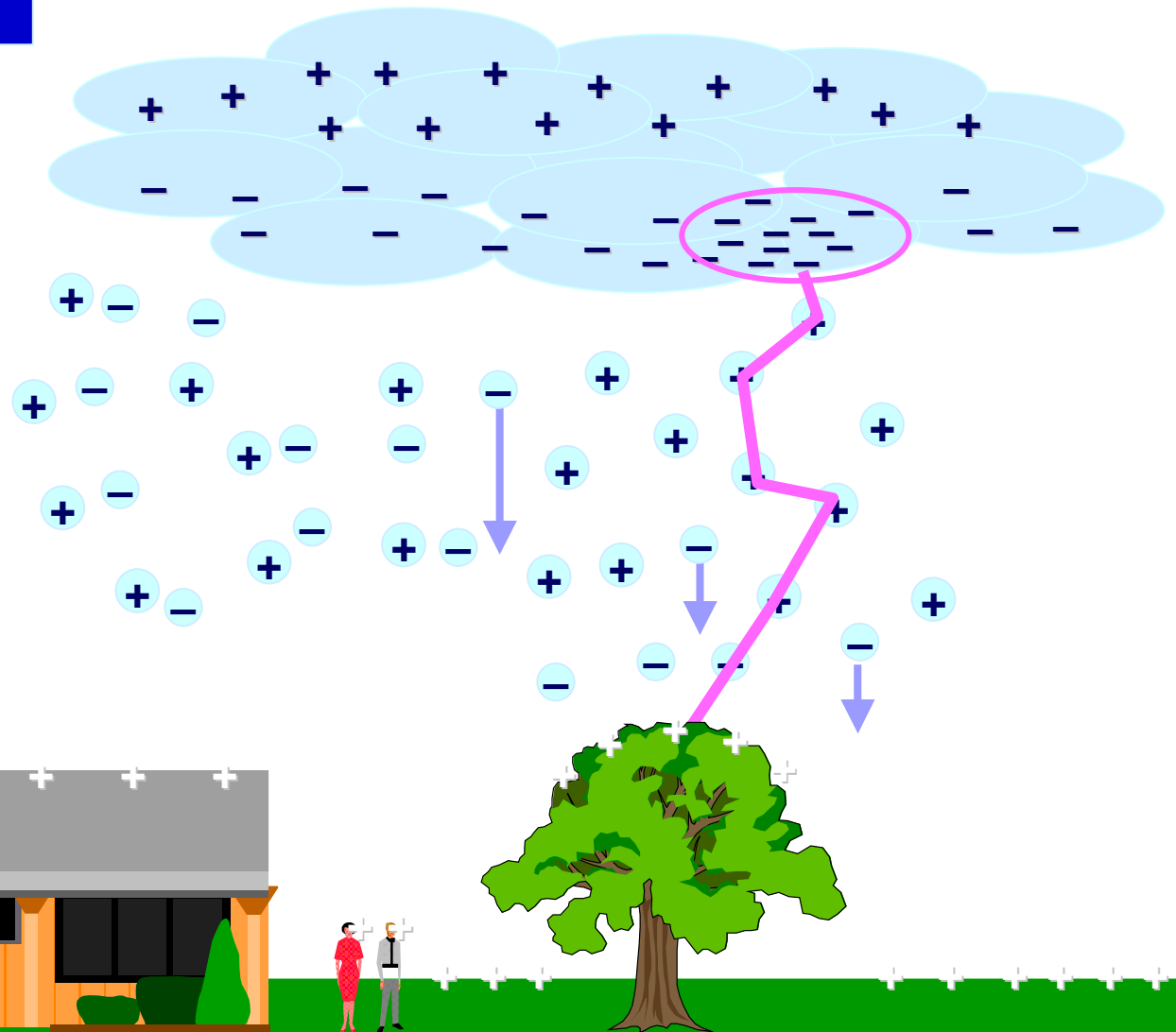
Two important concepts:

- **Lightning**
- **The Faraday Cage**



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How lightning works



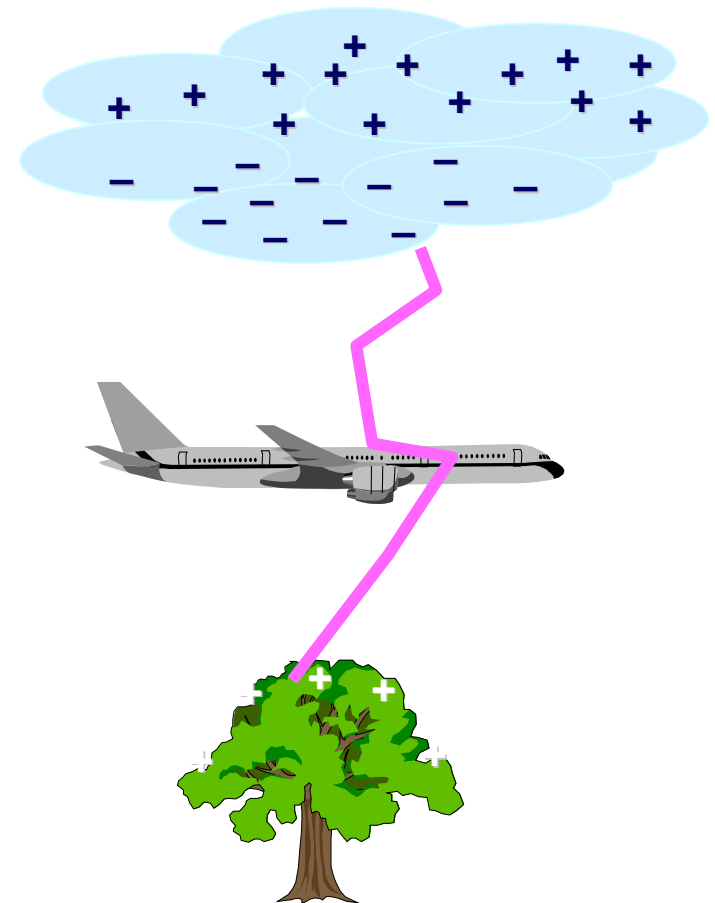


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The Faraday Cage

Why aren't air planes in grave danger being so close to the clouds and all?

Answer: They form a Faraday Cage i.e., they are surrounded by metal; if you are surrounded by metal you are safe the electricity flows around the outside



Safest place during a lightning storm is in a plane or car because it is a Faraday Cage



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Mystery Knight

Lowell Physics Student
in Armor
Fighting Lightning

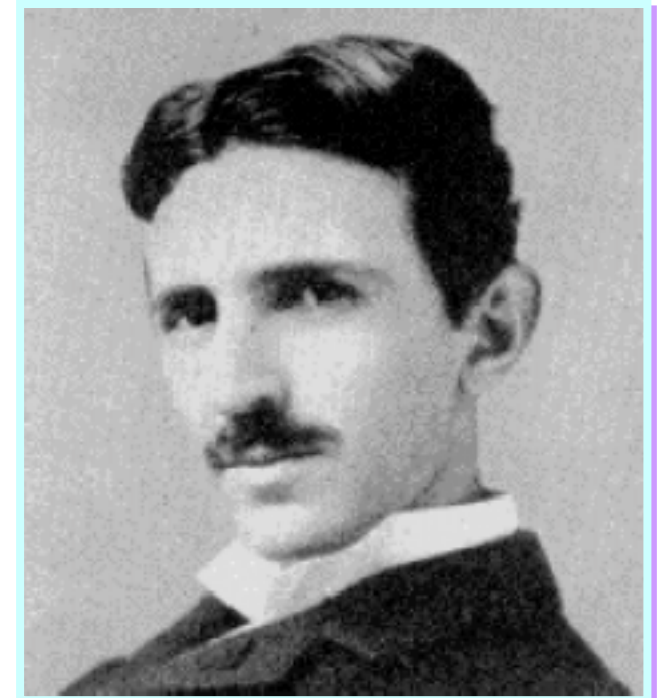


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Thomas "DC" Edison

VS.



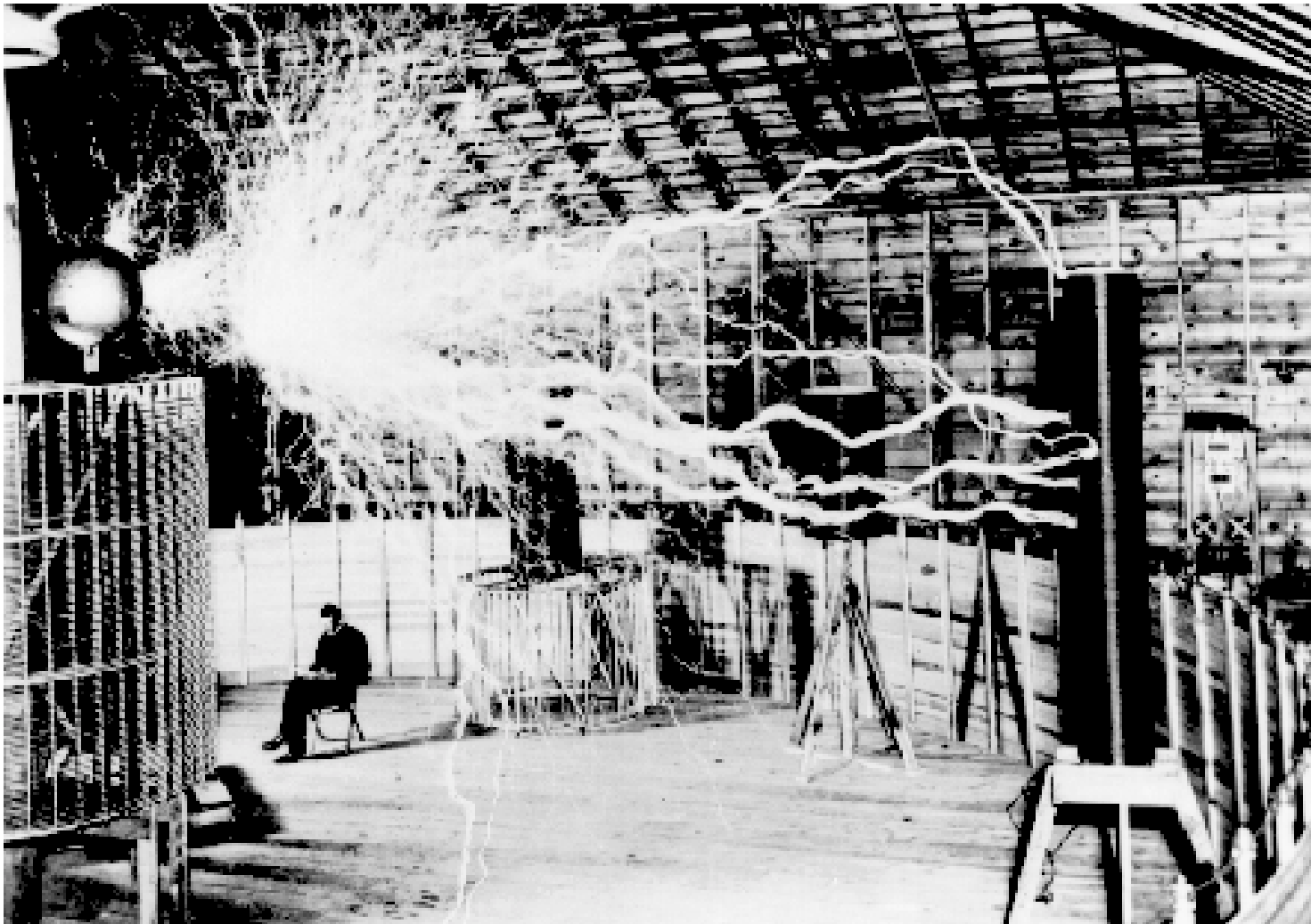
Nicola "AC" Tesla

- Tesla Revival
- 271 web sites are dedicated to Nicola Tesla
- Join the "Tesla Coil Web Ring"
<http://nav.webring.yahoo.com/hub?ring=teslaring&list>



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- Nicola Tesla as a Daredevil?



- Double Exposure makes it safe!

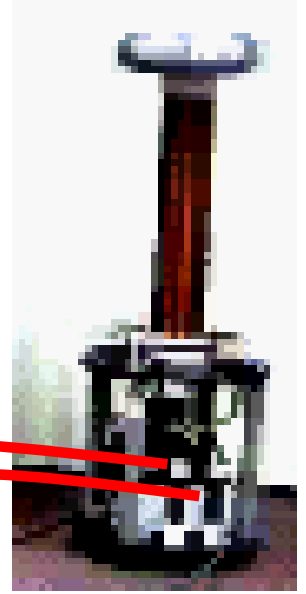
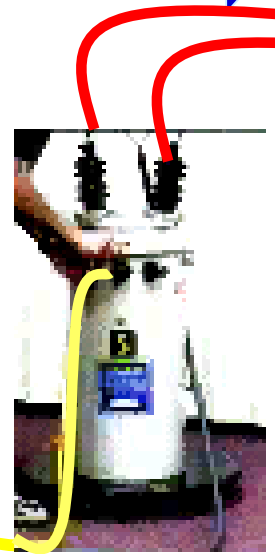
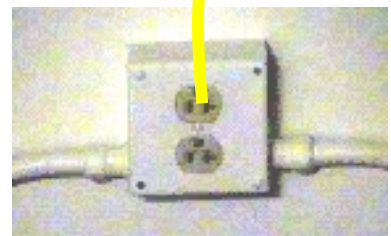


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Principle of the Tesla Coil

Ask your teachers about details!


Voltage starts at 120 ends up at 1 million!

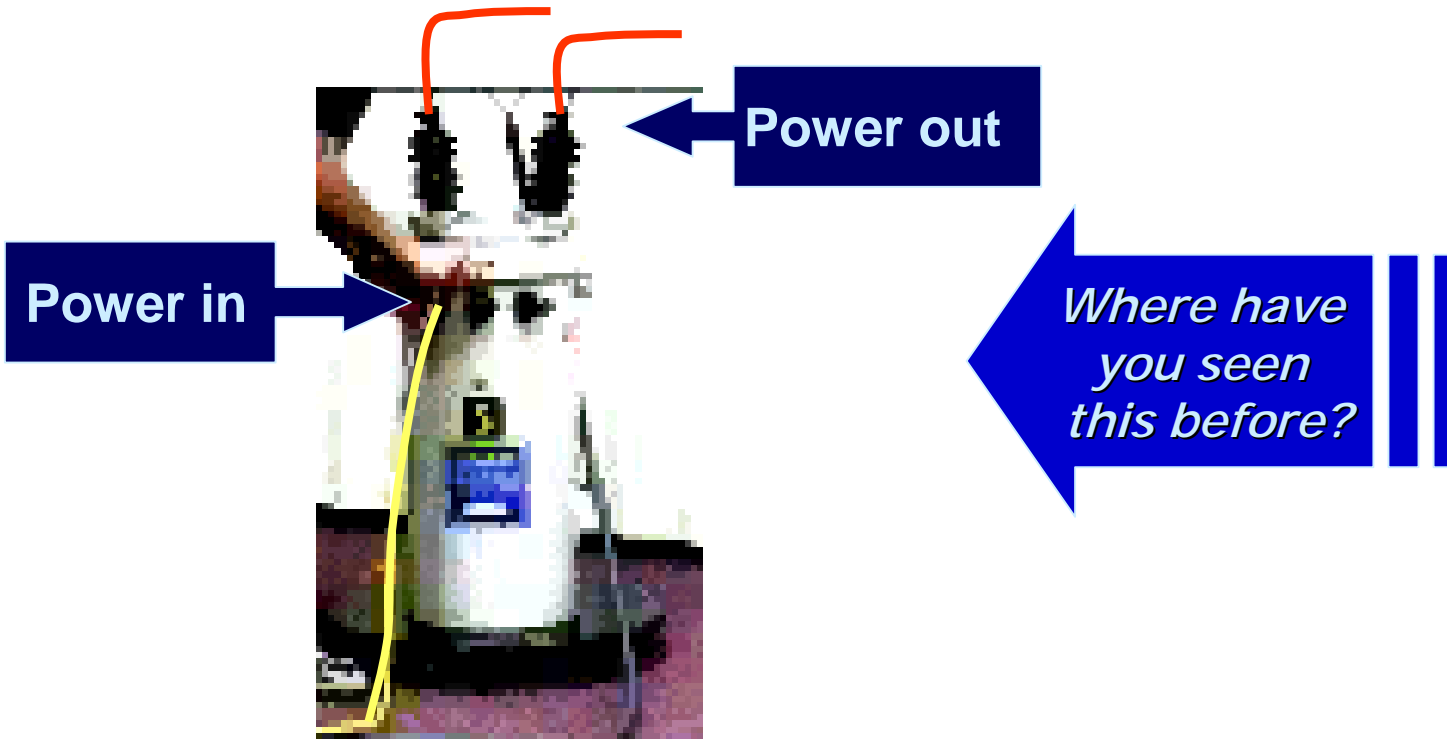




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Transformer

Power out = Power in
Power = Volt • Current

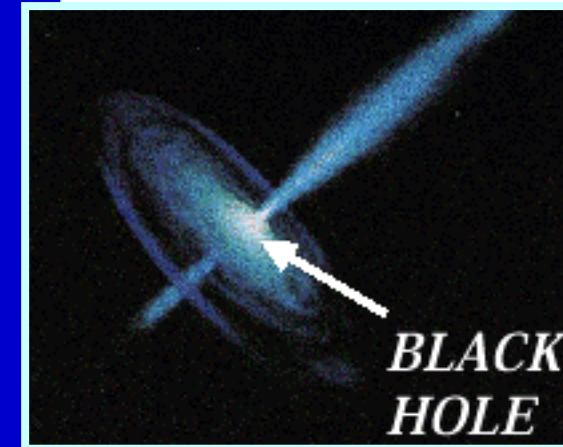
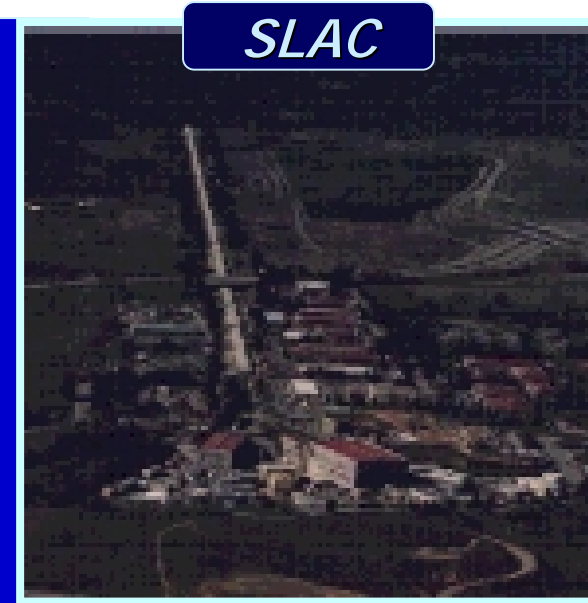




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Transformation of Energy

- **Similar to the Tesla Coil, accelerators convert Energy into new forms**
 - Visit the **Stanford Linear Accelerator Center (SLAC): Electricity \Rightarrow New particles**
 - **SCIPP works on BaBar :**
why we are made out of matter
- **In Space in black holes:**
 - **Matter \Rightarrow Light, x-rays, “jets”**
 - **SCIPP works on GLAST Mission:**
discover the most powerful accelerators in the universe



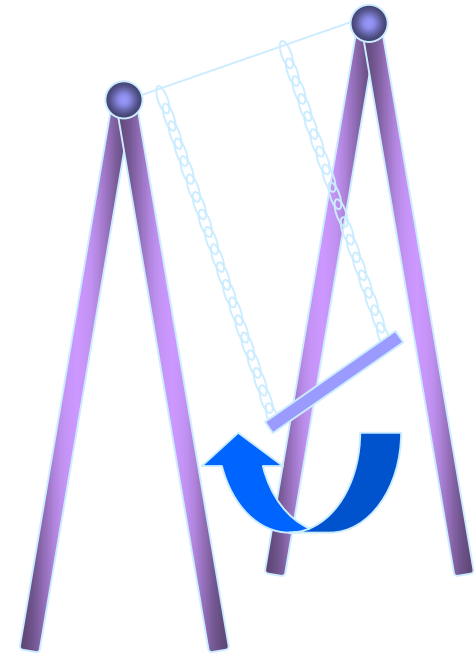


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Resonance circuit



$$\text{Amplitude} = \frac{\text{Force}}{M (f_{\text{natural}}^2 - f_{\text{force}}^2)}$$



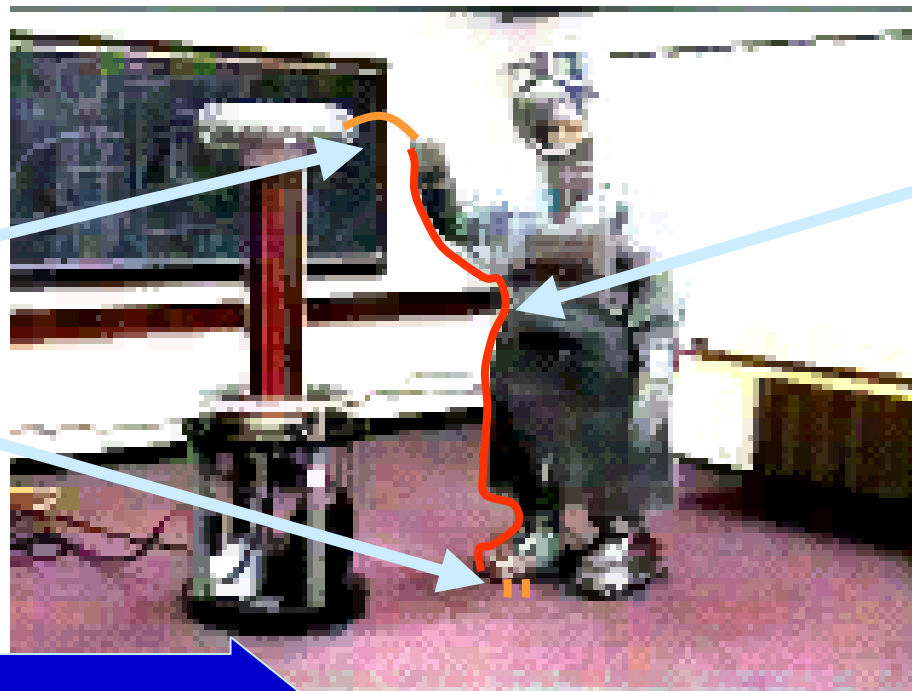
A kick at the right frequency build up and gets you sky-high!



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The armored suit is safe!

- It's a Faraday Cage – no electric field allowed inside



Visible sparks

Invisible current

Electrical current flows on the OUTSIDE of a metal!

Ground

In a thunderstorm stay in the car!



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Mystery Knight

Sparks from the feet



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**Say "Good bye" to
Daniel Greenhouse,
the brain behind the sparks
He is an undergraduate
at UCSC**

