

### March Club Meeting

**Date:** Friday, March 25, 2005.

**Time:** Socializing at 7 pm, Meeting at 7:30

**Place:** Covington School, 205 Covington Road, Los Altos

**Special note:**

The meeting will be in Room 32, not the multi room

**Speaker:** Dru Anderson, KG6LAD

**Topic:** After the Big One!...Amateur Radio's role in providing communications for disaster relief efforts.

### February Meeting Report

At the February meeting, Dr. Keith Snyder spoke about antenna modeling using FEKO. He demonstrated how the electromagnetic fields are shown for a variety of situations, including an antenna on a Humvee. It was a fun and fascinating demonstration.



**Dr. Keith Snyder**

Arv Hamer, WA6UUT, carried away the raffle prize, a Garmin GPS unit. Congratulations to Arv.



**Arv Hamer, WA6UUT**

### Upcoming Events

Mar 25 7:00 PM, Club meeting, Covington School  
 Apr 2 8 AM to 9 PM, [AM-Tech day](#), SLAC  
 Apr 3 7:30 AM to 11 AM, [Livermore Flea Market](#)  
 Apr 7 7:30 PM, Board Mtg at the Los Altos Town Crier  
 Apr 9 6 AM to noon, [Electronics Flea Market](#)  
 Apr 22 7:00 PM, Club meeting, Covington School  
 Apr 22 7:00 PM, Club meeting, Covington School  
 Apr 23 8 AM to 1 PM, [VOMARC Hamfest](#)  
 Thursdays 8:00 PM, FARS net, 145.230(-), 100 Hz PL  
 See more events, [FARS Calendar](#)  
<http://www.fars.k6ya.org/events/calendar.shtml>

### 9 AM Talk Net

This is an informal net which meets at 9:00 AM weekdays on the [N6NFI repeater](#), 145.23-. More details at [9amtalk.net](#).

### Presidents Corner

**Am-Tech DAY.** April 2 is our next Am-Tech Day at SLAC, check the FARS web site ([www.fars.k6ya.org/](http://www.fars.k6ya.org/)) for details on the location or subscribe to the FARS Announcement list ([www.fars.k6ya.org/mail/](http://www.fars.k6ya.org/mail/)) to make sure you get an email notice.

**11am-12pm. Finding Interference.** Cortland Richmond, KA5S will talk about how to track down and counter Electro-Magnetic Interference (EMI).

**2pm-3pm. Finding Hidden Transmitters.** Rich Harrington, KN6FW will talk about T-hunting.

**Flea Market.** The Electronics Flea Market is moving to a new location in on Saturday April 9. Check [www.asvaro.org](http://www.asvaro.org) for an announcement soon and details on the new location.

- de Mikel, KN6QI

### Dr. Know-It-All

**Question:** Some books on electromagnetics speak of a paradox whereby energy appears to flow in a d-c circuit even when the voltage source is switched off and no current is flowing. Can you explain this paradoxical phenomenon? From Andy, KR6DD, and Michael, N6EMR.

**Answer:** The paradox is an old one that electromagnetics professors still use to test their students. Let the symbol **E** represent an electric field and **H** represent a magnetic field. **E** and **H** are vector fields, i.e., they each have magnitude and direction that varies with position in space. It was discovered in the 19<sup>th</sup> century that another vector, the cross-product **E**×**H**, represents the flow of energy through space. The modern units for **E** are volts/meter, and for **H** are amperes/meter, and for **E**×**H** are watts/square-meter. Since the electric field inside a perfectly conducting wire is zero, the energy flow or power in a circuit, isn't in the wires of the circuit, rather, it's in the space that surrounds the wires. Discovered independently in 1884 by Scots electrical engineer Oliver Heaviside and English physicist John Henry Poynting, these curious facts were considered to be the greatest discovery in physics after James Clerk Maxwell's discovery of radiation in 1873.

Now for the paradox: Consider a simple experiment. A battery (or a charged capacitor) and a bar magnet are placed side-by-side on a table. The battery creates an electric field **E**, and the bar magnet creates a magnetic field **H** in the surrounding space. Both fields are static, i.e. not functions of time, and no conduction current flows, as there are neither wires nor circuit. The situation may be termed static (or d-c with zero current). Because the fields **E** and **H** are generally nonzero everywhere, the vector cross-product **E**×**H** is also nonzero everywhere. However, in this static experiment, no power is dissipated; no energy is expended. So why isn't the Poynting vector **E**×**H** zero? How can energy be flowing in space in the static experiment? From where does this energy come, and to where does it go? That is the paradox.

The answer is technical but illuminates the relationship between mathematics and physics. First we introduce and define a mathematical property that a vector field can possess. A vector field is said to be "solenoidal" if its divergence is zero

everywhere. Solenoidal field lines form closed loops in space, i.e. they neither originate from nor terminate on any place in space. So they cannot convey energy from a source to a sink.

The Poynting vector  $\mathbf{E} \times \mathbf{H}$  is not a mathematically unique entity; it is unique only up to the addition of an arbitrary solenoidal vector field. Only the *non-solenoidal* part of  $\mathbf{E} \times \mathbf{H}$  can be interpreted as energy flow, however, because only this part can represent power delivery from a source to a sink.

The paradox may be explained by noticing that in the static case, the Poynting vector is a solenoidal vector field, i.e. its divergence is zero. For readers who understand vector notation, here's a simple four-line proof.

$$\begin{aligned} \nabla \cdot (\mathbf{E} \times \mathbf{H}) &= \mathbf{H} \cdot (\nabla \times \mathbf{E}) - \mathbf{E} \cdot (\nabla \times \mathbf{H}) \\ &= \mathbf{H} \cdot \left(-\frac{d\mathbf{B}}{dt}\right) - \mathbf{E} \cdot \left(\mathbf{J} + \frac{d\mathbf{D}}{dt}\right) \\ &= \mathbf{H} \cdot \mathbf{0} - \mathbf{E} \cdot \mathbf{0} \\ &= 0 \end{aligned}$$

where we've made use of the facts that in the static case, the fields don't vary with time, and no current flows so the current density  $\mathbf{J}$  is zero.

Now, consider an imaginary sphere  $S$  enclosing a ball of volume  $V$ . The net power entering or leaving the sphere across its boundary is zero by Gauss's divergence theorem.

$$\begin{aligned} \oiint_S (\mathbf{E} \times \mathbf{H}) \cdot d\mathbf{S} &= \iiint_V \nabla \cdot (\mathbf{E} \times \mathbf{H}) dV \\ &= \iiint_V 0 dV \\ &= 0 \end{aligned}$$

The sphere can be arbitrarily small, and its location is arbitrary. Hence, there can be no energy sources or sinks anywhere. The power that apparently exists in space carries energy from nowhere to nowhere.

It follows that a Poynting vector field is unique only up to the addition of an arbitrary solenoidal vector field. Only the non-solenoidal part of a Poynting vector field has physical meaning. This is the part of the Poynting vector field that does work. The remainder, the solenoidal part, does no work. An immediate but surprising conclusion is that it is impossible to measure the solenoidal part of the Poynting vector with instruments. The solenoidal part cannot affect any sensor. It is unobservable, and its presence or absence is a subject for philosophers, not physicists or engineers or radio amateurs.

That's it for this month. You can send your comments or questions about any aspect of Amateur Radio to Dr. Know-It-All. Written comments and questions are accepted at the monthly meetings of the Foothills Amateur Radio Society, by email to FARS officers and board members, or through the FARS web site at <http://www.fars.k6ya.org>.

## CLUB INFORMATION

President: Mikel Lechner, KN6QI  
 Vice President: Steve Stearns, K6OIK  
 Treasurer: David Cooper KE6PFF  
 Secretary: Ruth Lacey, KG6RZG  
 Radio Officer: Phil Hawkins, KA6MZE  
 Training Officer: Mike Zensius, KG6GUE  
 Relay Editor: Mark Hardy, KG6GRR  
 FARS Board: Dick Baldwinson N6ATD, Howard Takaoka KG6GRO, Robert Flemate KE6TFU, Rob Goodson N2RAG, Steve Leander KV6O, Ron Green KG6RLG.

Station Trustee: Stan Kuhl, K6MA  
 FARS Web Page: <http://www.fars.k6ya.org>  
 Download Relay: <http://www.fars.k6ya.org/relay>

Club members and non-members are encouraged to subscribe to the FARS Announcement list by browsing [www.fars.k6ya.org/mail](http://www.fars.k6ya.org/mail), clicking on Subscribe/Unsubscribe and following the instructions under "Subscribing to fars-announce."

You may also submit an announcement to the FARS Announcement at [fars-announce@svpal.org](mailto:fars-announce@svpal.org). The list is moderated and messages will be posted as approved by the list moderator.

The FARS board of directors may be reached at [fars-board@svpal.org](mailto:fars-board@svpal.org)

Club meetings are held at 7 PM on the fourth Friday of each month except January (Winter Banquet); and sometimes there are changes for June (for field day) and Nov. & Dec (for holidays).

Annual club membership is \$20. Club badges are \$6. Visitors are always welcome! Directions in this newsletter. Talk-in: N6NFI (145.23-, 100 Hz) or W6ASH repeater (145.27-, 100 Hz).

The FARS *Relay* is the official monthly newsletter of the Foothills Amateur Radio Society. Contributions to the newsletter from members, family, and guests are earnestly solicited! Contributions subject to editing and/or compression. ASCII files via Internet or diskettes preferred; but all readable forms welcome.

Here is how to reach the editor:  
 Mark Hardy, KG6GRR  
 Mail: 2998 Jerald Avenue  
 Santa Clara, CA 95051  
 Voice: 408-243-0701 (Before 9 PM, preferred)  
 Fax: 408-243-0701  
 Email: [kg6grr@arrl.net](mailto:kg6grr@arrl.net), At FARS meetings.



Scenes of Am Tech Day – February 2005



## FARS Membership Form

PLEASE fill out the form for all new/renewal memberships.

**FARS 2005 MEMBERSHIP RENEWAL FORM** Date: \_\_\_\_\_

Name(s) & Callsign(s) & Class (E-A-G-T-N-None): \_\_\_\_\_

Mailing Address: \_\_\_\_\_

Home phone: \_\_\_\_\_ Work phone: \_\_\_\_\_

Fax (H or W?) \_\_\_\_\_ Packet BBS Address: \_\_\_\_\_

E-mail: \_\_\_\_\_ ARRL Member(s)? \_\_\_\_\_

Preferred modes: (e.g. HF-SSB/VHF/QRP/Other): \_\_\_\_\_

I'm willing to Elmer new hams with: \_\_\_\_\_

Special topics of interest / suggestions for club meeting speakers: \_\_\_\_\_

Dues: \$20 per year, new members add \$6 for badge fee. Please write one check for both banquet and membership.

**Please note:** Membership runs from January 1 to December 31.

Send your check payable to FARS, to:

David A. Cooper, KE6PFF  
270 Redwood Shores Parkway  
PMB 41  
Redwood City, CA 94065-1173



### **How to get to regular meetings: (Visitors always welcome)**

Our meetings are held at the Covington Elementary School (directions below) on the fourth Friday. Socializing at 7 PM with the regular meeting at 7:30 PM. There may be changes in the meeting dates for January, June, November, and December.

#### **DIRECTIONS:**

**From Interstate 280.** take the El Monte exit Northeast. Cross Foothill Expressway. (A) At the first traffic light turn right on Covington. (B) Immediately at the fork take the left street (Covington). Go about 1/10th of a mile. Turn left into the parking lot. The gym is the tall building to your right with red and white stripes.

**From Foothill Expwy.** From Foothill Expressway, take the El Monte exit and go Northeast; then follow directions as above at point (A).

**From US101 or El Camino:** take San Antonio Road west (to Foothill Expressway). Then follow directions as above at point (A).

**TALK-IN** via the N6NFI (145.230-; 100Hz PL) repeater or the W6ASH 145.27- (100Hz PL) repeater