South Dakota Chapter

American Association of Physics Teachers

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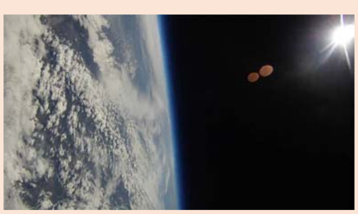
Teaching Innovation Spotlight…

Flying High with Science

Watertown middle school science teacher Mark Iverson has taken his students to new heights by launching weather balloons. This year's goal is a virtual fieldtrip at 110,000 feet above the Earth's surface which students will achieve by attaching a 360-degree camera to the weather balloon and viewing through VR glasses. The activity is more than observational, however, as sensors attached to the balloon allow students to collect and analyze temperature, pressure and humidity data. Mark's 8th grade students have used their video footage and data to also work with 5th grade students in their school, inspiring an even younger generation of budding scientists. For more information on the project, contact Mark.A.Iverson@k12.sd.us.



Related: http://www.projecttraveler.org

President's Message

Greetings,

It is both a challenging and exciting time to be a science teacher. While new standards and testing create additional work and stress in the classroom, support and funding for STEM education has continued to grow. Scientific discoveries and explorations continue to engage and create wonder, from the discovery of gravitational waves to Curiosity Rover's exploration of Mars and the fly-by of Pluto by the Horizon spacecraft. Science has become more woven into popular culture as well, from the TV series, The Big Bang Theory, to several recent movies – "Interstellar", "Gravity", "Hidden Figures". It seems we, as science teachers, have so much working in our favor except, perhaps, distance.

Living in a rural state has many challenges (and perks!) not least of which is being an isolated science teacher looking for help with content, ideas for labs, or just a general morale boost. Organizations such are the SD Science Teachers Association and the SD Chapter of AAPT are here to help shorten the distance between us. I encourage all physics and physical science teachers in SD to join these organizations not only for professional development but also for professional support. You are not alone.

Judy Vondruska, SDSU
2016-17 President

Upcoming Events

February 3-4
- SD Science and Math Teachers' Conference

February 18-21
- National AAPT Winter Meeting in Atlanta

February 19-25
- National Engineers Week (check with local universities for activities)

March 30 – April 1
- SD Academy of Science at DWU in Mitchell

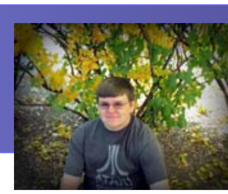
March 30 – April 2
- National NSTA Convention in Los Angeles

April 23-25
- TIE Conference in Rapid City

July 22-26
- National AAPT Summer Meeting in Cincinnati

August 21
- The Great American Eclipse Event

Meet the Future: *Ben Deneui*



Ben Deneui is a graduate of Roosevelt High School in Sioux Falls and is currently completing coursework at South Dakota State University to become a physics teacher. Ben plans to graduate in December 2017.

When did you know you wanted to be a physics teacher? *I never really thought about going into teaching, or for that matter a STEM field, until my third year of high school. I took accelerated physics with a great teacher and ever since then I have had a passion for physics. I knew around this time that helping other students learn how cool physics was could be my profession and I just kind of ran with it.*

Why physics and not some other science subject? *In truth I am a rather average physics student, but no other area of science has captured my attention like physics has. Biology and chemistry are alright, but I never found them as interesting as I found physics. It also does not hurt that we get all the cool toys as a physics teacher.*

What are your most significant concerns in becoming a teacher/physics teacher? *I think that my major concern about being a teacher is that I won't be able to match my teaching style to my students. I know that I have to adapt to meet the needs of every class that I teach, it is just makes me anxious thinking about it because I do not know how I will need to adapt until I reach that point.*

What are you most looking forward to in becoming a teacher/physics teacher? *The one thing I am most looking forward to is being able to show students that even though physics might seem tough and exhausting, it is also rewarding and quite fun.*

Where would you like to be employed after graduation? *I've only given a little thought to this, which seems odd since I will be student teaching next semester. I think I would rather like to become a part of the Brookings school system for a while, after attending college here I have found that I really like the community. The Sioux Falls school system would also be a good fit for me I think.*

Curriculum Resource: Sanford Lab

The Sanford Underground Research Facility offers free curriculum materials and presentations suitable for an assembly or individual classrooms.

Elementary Presentations

“A Day in the Life of a Sanford Lab Scientist”
“Particle Accelerators-Smashing Science”

Middle School Presentations

“Discover Exciting Career Opportunities”
“Dark Matter-It's a Matter of Gravity!”

High School Presentations

“Neutrinos-Just Passing Through”
“What Can We Learn From A Borehole?”

For information about curriculum units or to arrange a tour, visit

http://sanfordlab.org/education/updates

Looking for resources? Check out ComPADRE, a network of free online resources for all grade levels, **http://compadre.org**

Did you know you can order a classroom Radiation Instrument Kit from the **North Central Chapter of the Health Physics Society**?

The kit contains a classroom set of 6 digital Vernier Radiation Monitors with LabPro interfaces, a copy of Vernier Logger Pro software, a copy of Nuclear Radiation with Computers lab manual, and 6 each beta and gamma radiation sources. Shielding materials and a minigenerator for a half-life experiment are also available.

The kit is available for classroom use for periods of time of up to 1 week. For more details go to http://hps1.org/chapters/ncc/ and click on the Teachers and Students link at the top of the page. You can also contact Robert.McTaggart@sdstate.edu.

From the World of Physics Education Research – *Effective Demonstrations*

by Judy Vondruska, SDSU

Simply doing a demonstration in front of students and discussing the results with them has little impact on their learning. Consider first the timing of the demonstration. Students are more likely to predict the correct outcome and remember the demonstration if they have the requisite conceptual understanding of the underlying principles of the demonstration (Miller, Lasry, Chu, Mazur, 2013). This aligns with the constructivist idea of posing problems of emerging relevance to the learner. To help the student learn new information, it is important to link the new learning to prior knowledge (scaffolding). If students have the requisite knowledge underlying a demonstration, they are more likely to be able to apply the correct physics concepts to the demonstration.

What you do in conjunction with the demonstration matters. Crouch, Fagen, Callan, and Mazur (2004) compared three different modes of demonstration: (1) students just observing the demonstration and then listening to the instructor's explanation of the results; (2) having students predict what they thought would happen and entering their responses on a multiple-choice clickers question; and (3) having students write down their predictions, discuss them with classmates, and then enter their prediction on a multiple-choice clicker question. When evaluated at the end of the semester, students who only observed the demonstration were less likely to be able to predict the correct outcome or provide a correct explanation for the outcome than students who had first made a prediction or those who first discussed their predictions with classmates. Students who first discussed the question with classmates had the largest learning gains in predicting the outcome of a demonstration when they were assessed at the end of the semester but there was little difference in this group and the group who only did the prediction in terms of the ability to correctly explain the concepts behind the demonstrations.

Miller, et.al (2013) found nearly one in five students incorrectly described the outcome of a demonstration even after they had observed it being done. The means we cannot assume students see the same things as we do when they observe the demonstration. So often students do not attend to the key features within a demonstration (Baddock and Bucat, 2008). Effective demonstrations follow a four-step process (Miller, 2013):

1. Choose a demonstration with a clearly observable event.
2. Provide conceptual scaffolding for the demonstration by making sure students have the prerequisite knowledge to understand it.
3. Ask students to predict the outcome of the demonstration before doing it.
4. Reinforce the outcome by having the students discuss what they have observed and by you explicitly discussing the outcome of the demonstration.

Physics Discoveries

by Dr. Joel Rauber, SDSU

An extraordinary event was announced in 2016. The LIGO (Laser Interferometry Gravitational Wave Observatory) officially announced on February 11, 2016 that the experimental collaboration had verified detection of gravitational that occurred on September 14, 2015. The laser interferometer detectors located in Hanford, Washington and Livingston, Louisiana made the detections.

The September 14th event was indicative of the black hole merger of at 36 solar mass black hole with a 29 solar mass black hole forming a 62 solar mass black hole. This was followed by the detection of another merging of two black holes (a 14.2 solar mass black hole and a 7.5 solar mass black hole creating a final object of 20.8 solar masses) on December 26, 2015. These events represent the first direct evidence of the existence of gravitation waves; by directly detecting the waves propagating through detectors located on the earth.

Direct detection of the gravitational waves has been the most resistant to verification until now. In 1974, Russell Hulse and Joseph Taylor used precise frequency data from measurements of a binary star system with a nearby neutron star (forming a peculiar pulsar). Their analysis of the rate of loss of energy in the system are consistent with explaining the loss of energy in the pulsar system as being radiated away by gravitational waves. This is viewed in the scientific community as indirect evidence for the existent of gravitational waves. Hulse and Taylor were awarded the 1993 for this interpretation. While somewhat a matter of opinion, direct evidence is usually considered to be the clincher ("particularly for scientists from Missouri"); and we now have that direct evidence. All basic predictions of Einsteinian gravity can now be viewed as having been experimentally verified.

The detection also is of significant astronomical significance. It is impossible observe black hole mergers by any traditional astronomy approaches (detection of electro-magnetic waves; whether through optical telescopes or other telescopes capable of detecting various regions of the electro-magnetic spectrum beyond the visible). "Telescopes" sensitive to gravitational waves are capable of the task. We now have an entirely new tool for observing the Universe.

LIGO - https://www.ligo.caltech.edu/