



# THE INSTITUTE FOR ADVANCED PHYSICS

# The Institute News

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## Fifteenth Annual IAP Conference

### Physics for Realists Boot Camp for Quantum

by Ken Klenk, Ph.D., IAP Certified Member

photos courtesy of Ken Klenk, James Louviere, Murray Daw and Kevin Hix

The fifteenth annual conference of the **Institute for Advanced Physics (IAP)** was held at the **Louisiana State University (LSU)** campus in Baton Rouge from July 26 to 30, 2017. The title of the conference was “PFR Boot Camp for Quantum”. As the IAP is approaching the time of publication of the third volume of *Physics for Realists (PFR)* which addresses quantum mechanics, this conference reviewed the principles and concepts that are fundamental to the PFR series of textbooks (mechanics and electricity & magnetism--E&M) and to a realistic understanding of modern physics. **Dr. Murray Daw**, R.A. Bowen Professor of Physics, Department of Physics & Astronomy *Story continues on page 2*



IAP faculty and members (left to right) Dr. Ken Klenk, David Giroir, Don Caffery, Fr. Neal Nichols, James Louviere, Dr. David Welch, Dr. Dan Lejeune, Maikel Garcia, Randy Nichols, Dr. Kevin Hix, Anthony DiCarlo, Dr. Anthony Rizzi, Dr. Dan Welch, Dr. Stephen Strickland, Dr. Murray Daw, Giuseppe Rizzi, Frank Camacho (front), and Dr. Ted Dickel (back)



Algebra Guide developers meet with Dr. Rizzi (from left counter clockwise) Dr. Rizzi, Giuseppe Rizzi (volunteer member, not a developer), Frank Camacho, Maikel Garcia, Randy Nichols, and Anthony DiCarlo

*Annual conference story continued from page 1...*

**Clemson University** and also Professor of the Institute for Advanced Physics, led the participants through the key concepts of PFR. He stressed that we need to have the proper attitude toward the texts that have been written with a continuity that properly guide students in their understanding of physics in a way that incorporates the underlying fundamental principles. It is these principles that unveil the meaning of the modern (empiriometric) physics, which is equation centered. He offered the following list of guidelines:

Dr. Murray Daw's guidelines for teachers:

- Use PFR**
- Trust PFR**
- Be positive**
- Trust PFR**
- Keep it simple**
- Trust PFR**

(PFR is the *Physics for Realists* textbook)

**Dr. Daw emphasized that IAP members should keep in mind that physics is the base of all our knowing and thinking as they are learning from and teaching from *Physics for Realists* (PFR).**

The **Algebra Guide group** arrived early to the conference and spent time Tuesday evening and the majority of the day on Wednesday working

on the first draft of the Algebra Guide (AG) for the *Physics for Realists: Mechanics* textbook. The group met on Tuesday evening with **Dr. Anthony Rizzi**, IAP Director, to get a better understanding of certain topics to be included in the AG, including angular momentum, E&M, optics, and the basics of quantum mechanics. The latter three topics are being included as supplemental topics. On Wednesday, the group revised the AG, writing sections based on the understandings that they had gained from Dr. Rizzi. In particular, **Maikel Garcia**, IAP Associate Member, spent time re-writing portions of the angular momentum section of the AG, while **Frank Camacho**, IAP Associate Member, worked on revising the thermodynamics supplement. **Anthony DiCarlo**, IAP Associate Member and AG group leader, worked on revising the table of contents for the AG, as well as vetting the portions of the thermodynamics supplement that were already written. **Randy Nichols**, IAP Associate Member, worked on the figures for Chapter 8 of the AG, which covers gravity and several supplemental topics. The group left the 2017 conference inspired to get the AG completed and out in the schools!

**Dr. Rizzi** addressed the conference and discussed the big picture of what the IAP's goals are. He said that the current trend in the culture

is to, at heart, ignore and deny the physical world. The incomplete physics (study of the physical world) at the base of our culture leads to a machine view of the world, substituting mental constructs for reality. He went on to point out that a common trivial analysis of the problem of science focuses on the conveniences as the major good of modern science. Instead, the key good of science is all the truth it brings. But, because it is packed in an equational structure that, until IAP, has been left unpacked, its truth is largely lost and indeed it has led to the fundamental confusions and the increasingly anti-truth culture we see. He reminded the participants of the central IAP theorem, which is, in a nutshell:

#### Central IAP Theorem

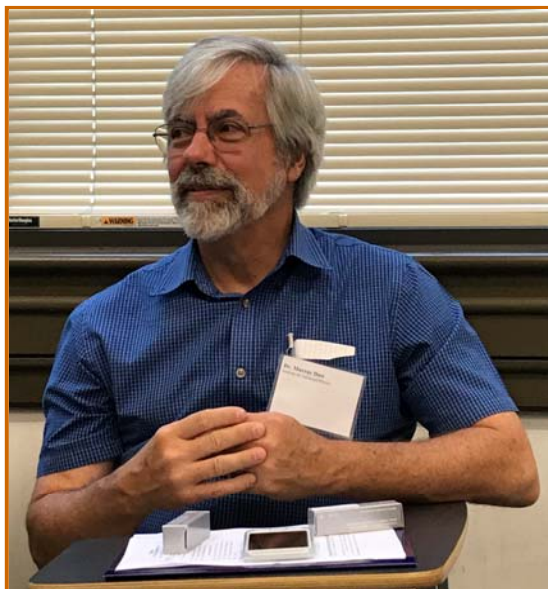
- (1) Everything we know comes through what we know through the senses, i.e., physical things.
- (2) This study is called physics.
- (3) To the degree our physics is wrong, everything we know and do is wrong!
- (4) Our physics currently ends in equations which are symbols, which only exist in the mind.
- (5) Therefore, our physics is inadvertently mind-centered and not understood in terms of first principles given through the senses.
- (6) Therefore, the thinking of our culture is not properly grounded and, hence, the confusions and deep errors about reality in our culture.

**Dr. Rizzi further pointed out that it is very important that the pursuit of truth be primary for each one of us. It is the primal modern sin to neglect truth and the pursuit of the truth for any reason, such as not having enough time.**

The more good something is, the more something can go wrong with it, and, therefore, the profound good that is modern science, which is the core source of our problems, has huge potential to give us great truths and make us more who we are meant to be.



On Thursday, Dr. Rizzi presented a certificate for Certified Membership to **Dr. David Welch** who completed the requisite course material, which includes study of *The Science Before Science: A Guide to Thinking in the 21<sup>st</sup> Century* earlier in the year. Dr. Welch is a senior scientist in Condensed Matter physics at **Brookhaven National Laboratory**. He holds a Ph.D. from the **University of Pennsylvania**.



On Friday, **Dr. Daw** continued the Boot Camp on PFR with a discussion of special relativity (SR). He stated that PFR offers a fully physical understanding of what is contained in the equations, so that the student can develop a fully integrated understanding of the discoveries of modern physics. An important principle in truly understanding special relativity is that rest and motion are not the same. This is lost in all standard treatments, which are empiriometric.

In fact, Impetus is responsible for the unique status accorded inertial frames. In the world as it is, a maximum (measurable) speed is necessary to avoid confusing, apparently acausal actions. Empiriometric special relativity treats time as another length in a logical system in which its distinctness only shows up as a minus sign! The empiriometric core of SR is the Lorentz transformation, a series of equations. The plana is not explicitly referred to in the Lorentz transformation, nor is time as a duration of change, which leads, in current modern physics, to the idea that they don't exist! All these things are carefully and fully discussed, revealing the full physical reality captured by the equations of special relativity (but unknown outside IAP). As pointed out in *The Science Before Science*, the profound equations of modern physics are not the end of physics, but, when properly understood, building from the first principles given through the senses, they reveal the deep physical realities that they encapsulate.

**Dr. Daw** reviewed the key features of *PFR: Electricity and Magnetism*. Charge, a property of certain bodies (a quality in subcategory of power), causes the  $\phi$ -field; and, impetus-activated charge (which causes a current) causes the  $A$ -field. These fields are both properties (qualities of the plana) and are fundamental to understanding E&M. Using PFR for an

“Vacuum is **not** air *and* it is not nothing (of course, nothing is no-thing!). It is what you have left after you get rid of all the air. Since the word “vacuum” tends to make people think of nothing, let’s give it a different name. We will call it **plana** (which is the Latin word for field).”

*A Kid’s Introduction to Physics (and Beyond)* by Anthony Rizzi

introduction to electricity and magnetism gives the student a background that prepares him for more advanced courses, e.g. quantum mechanics, advanced E&M and also the quantization of the field called QFT. PFR leads us also to a correct understanding of what Maxwell calls the displacement current as well as

radiation. Radiation occurs when the impetus of a charged body is changed.

**Drs. Ted Dickel** and **Stephen Strickland**, Certified Members, presented updated information on their investigations into the quantum analogical phenomenon in hydrodynamics - the bouncing silicon oil drops. Dr. Strickland also presented his latest investigations into Quantum Computing.



In the evening **Dr. Dan Lejeune**, Certified Member, presented experiments on induction and statics. The participants were able to experiment on their own with the apparatus.

We were blessed again this year to have our chaplain, **Fr. Neal Nichols**, to offer Mass each day, give reflective homilies and to hear



confessions. He blessed the members' pocket knives and the prizes that were given for the ongoing contest to see who can correctly answer questions on the new content IAP has discovered. Fr. Nichols also led the group with prayers to open and close each session, led the group in saying the rosary on Friday, and led the group in its beautiful rendition of the *Salve Regina* (plain chant).



Also participating this year were Certified Members **Dr. Ken Klenk** and **Dr. Dan Welch**; Associate Members **Don Caffery**, **David Giroir**, **James Louviere**, and **Dr. Kevin Hix**; and Volunteer Member **Giuseppe Rizzi**.



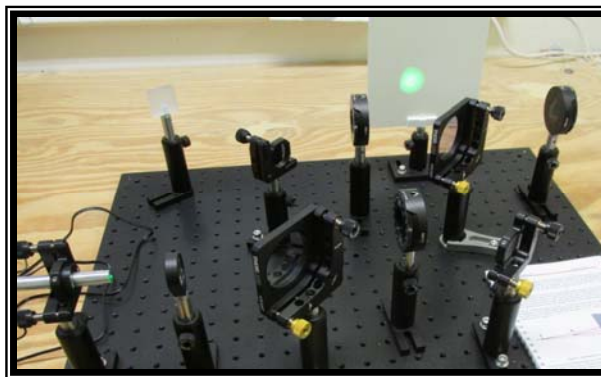
**Swiss Army pocket knives** were given out to the members in anticipation of the 15<sup>th</sup> anniversary of the Institute for Advanced Physics. The pocket knives have the IAP logo and also the individual member's name.



## Quantum Eraser Educational Demonstration Kit

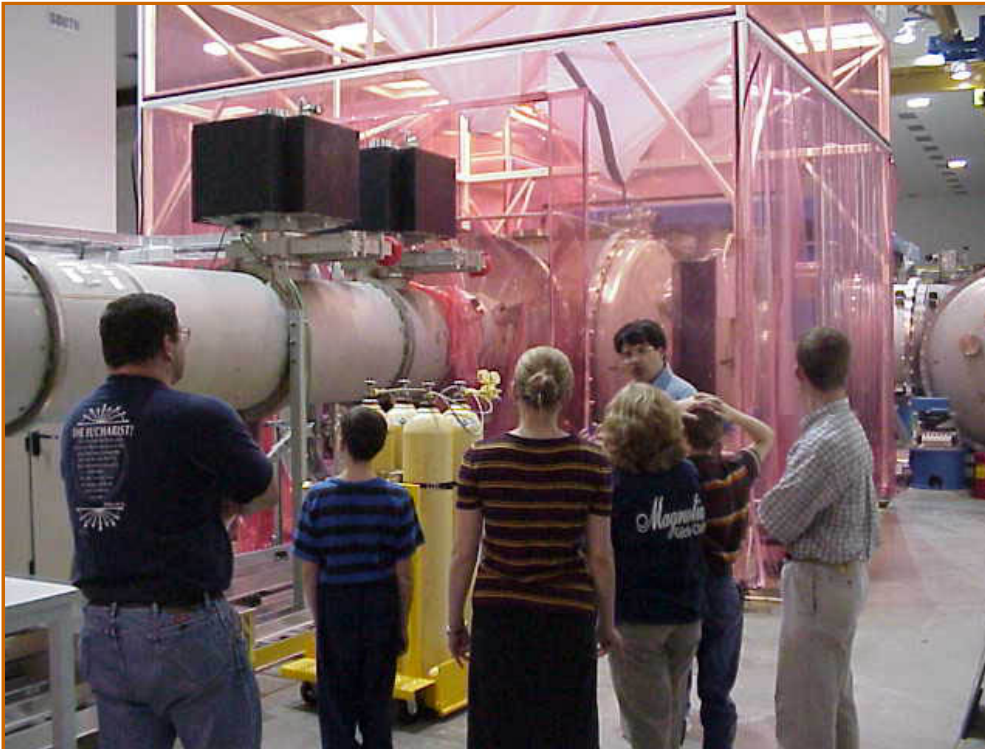


A Quantum Eraser Educational Demonstration Kit was donated to the Institute for Advanced Physics by Associate Member **Frank Camacho**. This Thorlabs experiment shows through analogy the quantum-mechanical principle of complementarity using the erasure of path information. It can be used to illustrate the fundamental principles of quantum physics and displays how nature is often counterintuitive on the quantum scale. The experiment was received at the 2017 annual conference. Dr. Dan Welch and Dr. Dan Lejeune also used the experiment for undergraduate physics courses at Wofford College, Spartanburg, South Carolina.



See IAP's 2018 newsletter for an announcement about the publication of groundbreaking quantum mechanics papers.

## LIGO Researchers Awarded Nobel Prize



*Dr. Ricci was a Senior Scientist at LIGO. Pictured here, he leads a tour of the Laser Interferometer Gravity Wave Observatory in Livingston, Louisiana*

The discoveries by the Laser Interferometer Gravitational-Wave Observatory (LIGO), which our director **Dr. Ricci** was a part of, have been awarded a Nobel Prize! The Royal Swedish Academy called it “a discovery that shook the world.” The fruits of LIGO represent the combined efforts of hundreds of scientists and engineers world-wide. Dr. Ricci has been involved in the theoretical and/or experimental work on gravity waves for 37 years, being active at the beginning stages of LIGO, his first physics research.

The Nobel Prize splits between three men who represent the large number of scientists who contributed to the project. One of the recipients, **Dr. Kip Thorne**, says “The prize rightfully belongs to the hundreds of LIGO scientists and engineers who built and perfected our complex gravitational-wave interferometers, and the hundreds of LIGO and Virgo scientists who found the gravitational-wave signals in LIGO's noisy data and extracted the waves' information.” Caltech press release, 2017

In addition to Thorne, **Dr. Rainer Weiss** and **Dr. Barry Barish** were named recipients.

The discovery is ground breaking; for the first time ever, man has directly detected these ripples of gravity and opened up one of the most penetrating views of the universe. Gravity waves can “see” through things much



better than X-rays, thus, enabling us to look very far back toward the beginning of the universe. Using this penetrating view, we, for the first time ever, saw two black holes spiral into each other to make a larger black hole.

*Some people, in order to discover God,  
read books.*

*But there is a great book:  
the very appearance of created things.*

*Look above you! Look below you!*

*Note it. Read it.*

*God, whom you want to discover,  
never wrote that book with ink.*

*Instead He set before your eyes  
the things that He had made.*

**St. Augustine**

Learning about God's physical world is the first way we learn about Him. The more we know of the "book of nature" the more we know of Him. Catholics especially should be excited about this discovery that reveals more of the wonders of God. It brings up the primal importance of physics, which is the first thing we know because everything we know comes through what we see and hear. And, we see and hear only physical things.

**Dr. Rizzi** was part of the first small group of people working in this area beginning around

1980, where he made a significant contribution in understanding how a LIGO instrument might be built. In 1997 while at Princeton University, Dr. Rizzi made a discovery in Einstein's theory of general relativity that solved an 80-year old problem that Einstein had left unsolved. This problem intrinsically involved gravitational waves and helped better understand them.

Dr. Rizzi was hired as a senior scientist at the LIGO Livingston, LA site by the California Institute of Technology (Caltech). There, he was the first research scientist and worked as part of the team to get the experiment built at that site as well as to further understand how to do and implement the data analysis. He is a premier expert in the field.

Dr. Rizzi is the founder and Director of the Institute for Advanced Physics.

Listen to an interview of Dr. Rizzi on LIGO at:

<https://avemariaradio.net/audio-archive/kresta-afternoon-october-11-2017-hour-2/>

## **Dr. Rizzi on Kresta in the Afternoon**



### **LIGO Discovery**

<https://avemariaradio.net/audio-archive/kresta-afternoon-october-11-2017-hour-2/>

On September 14, 2015 the universe's gravitational waves were observed for the very first time. The waves, which were predicted by Albert Einstein a hundred years ago, came from a collision between two black holes. It took 1.3 billion years for the waves to arrive at the LIGO detector in the USA. LIGO stands for Laser Interferometer Gravitational-Wave Observatory and is a collaborative project with many researchers. Researchers Rainer Weiss, Barry Barish and Kip Thorne were just awarded the Nobel Prize in Physics for their LIGO research. Dr. Anthony Rizzi is an expert in the field, and contributed significantly to LIGO, and he joins radio host Al Kresta to explain it.

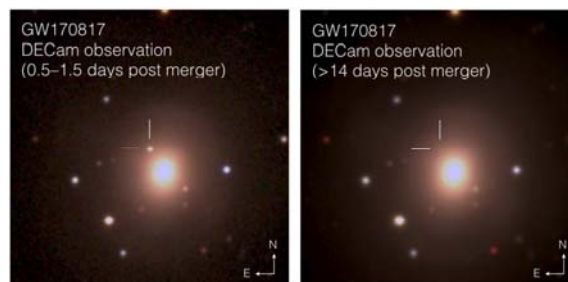
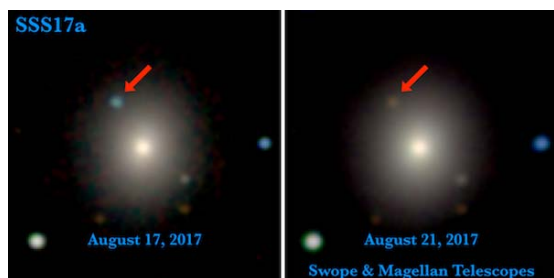
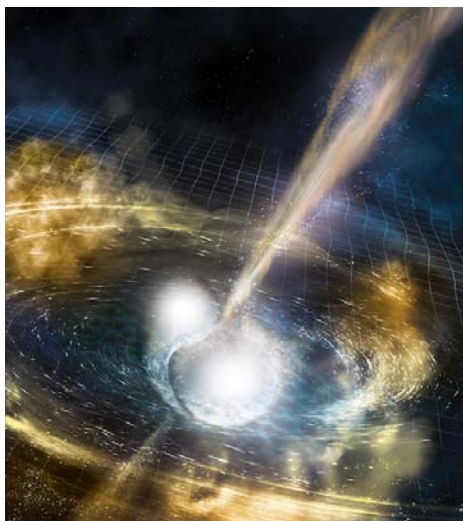
### **Thinking clearly about the world as a Catholic**

<https://avemariaradio.net/audio-archive/kresta-afternoon-october-25-2017-hour-1/>

Many Christians try to understand their lives *solely* through the lens of Scripture or other Church teaching. But, this is not possible, for everyone must start with what he gets through his senses. We need to return to a respect for creation, and, in that way, we can truly understand revelation. Everything, including our politics, will be truly reformed only when we do this. Dr. Anthony Rizzi joins radio host Al Kresta with more.

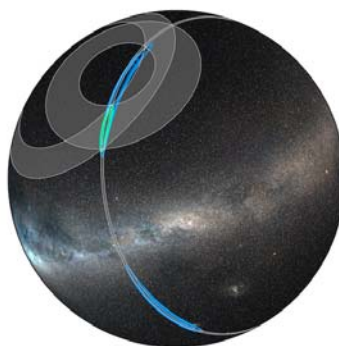
## Another First! Images explaining the historic finding

First ever gravitational wave detection of neutron star inspiral! First ever detection of gravity waves along with light waves from the same source!



These images show pictures taken by telescopes sensitive to visible and near infrared light (Swope and Magellan telescopes). They show the collision region (upper left indicated by red arrow) that generated the gravitational waves detected by LIGO and VIRGO. The source, after merging to one object, is labeled SSS17a. The left image is from August 17, 2017, 11 hours after the gravity wave detection. The right image is from four days later, when SSS17a—the aftermath of a neutron star merger—faded significantly and its color became much redder. [Image Credit: 1M2H/UC Santa Cruz and Carnegie Observatories/Ryan Foley]

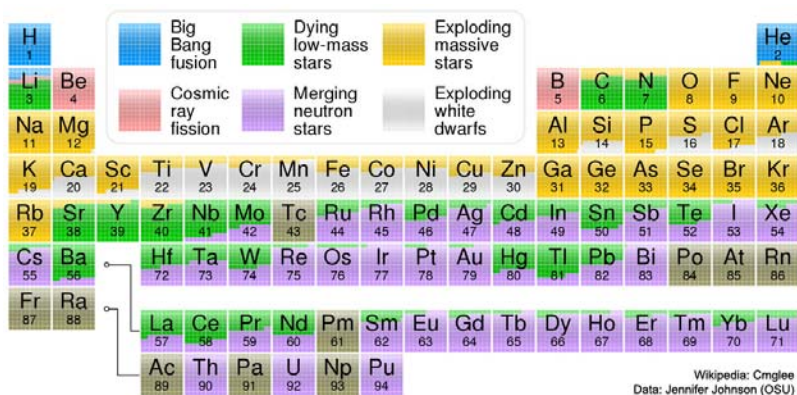
The neutrons stars detected were in the Galaxy labeled NGC 4993. The collision region is the upper left dot. The left image was taken in the infrared on 2017 August 18 and combined with images taken with green and red filters 1 day later. The right image shows the same area two weeks later. Note how much dimmer the image is after the collision has settled down. Each image is 1.5 arc-seconds on a side. [Image Credit: Soares-Santos et al. and DES Collaboration]



Credit: LIGO/Virgo/NASA/Leo Singer (Bkly Way image: Axel Mellinger)

LIGO finds the location of a source in the sky (here represented as a spherical shell) by triangulating from the three detector locations. The gray rings give an indication of the region to which each pair of detectors narrows the location of the source of the gravity waves. [Image credit: Axel Mellinger]





The elements in light purple above have been generated by neutron star mergers like the ones detected by LIGO.

## David Liberto, Associate Member

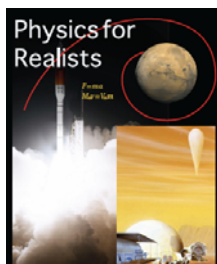


**David Liberto**, (Ph.D., Marquette University) has served as professor of Dogmatic and Historical Theology at **Notre Dame Seminary** in New Orleans since 2001. He also served as an adjunct professor for

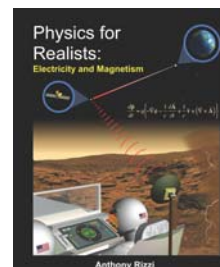
several years at nearby **Loyola University**. Besides degrees in theology, he also has a B.S. in Mathematics from the **University of New Orleans** and still has a love for things mathematical. His professional interests include Trinitarian theology (especially in its Patristic and Medieval developments), the thought of St. Thomas Aquinas, Christology, and Metaphysics.

At the seminary he served as academic dean for four years (2007-2010). He instituted the

annual Aquinas Lecture Series which has hosted a virtual “who’s who” of Thomistic scholars. Dr. Liberto has published several scholarly articles including the following: “Ad Imaginem Dei. Asymptotic Assimilation in Thomas’s Understanding of Grace.” In *Divine Transcendence and Immanence in the Work of Thomas Aquinas*, (Leuven: Peeters Publishing, 2009); and “St. Thomas on the Supernatural: Christological, Eschatological, and Anthropological Insights from the Thomistic Corpus.” *Josephinum Journal of Theology* (Winter/Spring 2011). Dr. Liberto is currently working on a book-length treatment dealing with divine simplicity and the Trinity. Dr. Liberto is very involved in his parish, St. Patrick’s in New Orleans. He serves as the parish theologian and gives courses on various topics throughout the year. He will be working on IAP’s goal of forming or partnering with a university with the proper physics foundation.

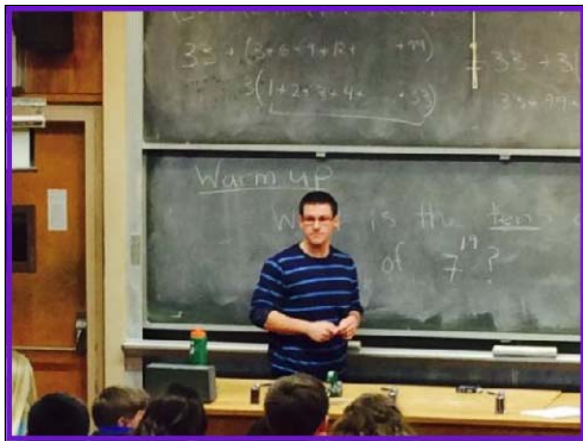


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## Introductory Physics Lab based on *Physics for Realists*

*Andrew Garmon is a graduate physics student at Clemson University*



This past year I was tasked with the responsibility of teaching the introductory physics lab dedicated for physics majors at **Clemson University**. It was my duty to not only fulfill the standard teaching requirements, but also to tailor the course to better align with the material being taught in lecture – namely, *Physics for Realists*. Throughout the year I attended the student's lectures taught by Dr. Murray Daw as I studied the textbook in detail. This gave me the ability to introduce a first-principles approach to our laboratory experiments. Instead of a lab focused solely on the empiriometric system we provided a richer context for

their learning based on a physical understanding. Highlights of the year were creating labs to illustrate the concepts of impetus and electrostatics, as well as designing an entire lab for the study of magnetic induction: three types with two causes.

### PFR lecture video conversion project



In the Fall of 2013 and Spring of 2016, lectures given by Dr. Daw using the two *Physics for Realists* textbooks were recorded in series following the introductory mechanics and electricity & magnetism courses given at Clemson University. As reported in a previous newsletter, these lectures were made available on IAP's site. The license for the Clemson video playback software will not be renewed, so access to these videos in their current format will be terminated. Fortunately, access to the raw video files for offloading to a different medium was made available to the IAP. However, the video format used by

the Clemson webplayer was not in a traditional format; so, re-encoding, along with other types of reformatting and reorganization, had to be done for each video lecture. **Nate Reed** (*pictured above*) is performing this conversion process. The conversion process is in its final stages, and the videos are being uploaded to a new IAP YouTube channel being created by IAP volunteer **Giuseppe Rizzi**.

Nate Reed decided to come to Clemson University when he learned about the work of the IAP and that he could learn IAP's material by attending Clemson; he is now an undergraduate interested in a physics major. Giuseppe Rizzi is an undergraduate electrical engineering major at Texas A&M.



### Tutoring Clemson PFR students

**Lucas McKown** (*pictured left*), an undergraduate student at Clemson University, South Carolina, is tutoring Clemson University physics students in the full physics as discovered by the Institute for Advanced Physics and presented in its textbooks series, *Physics for Realists*.

**The Institute for Advanced Physics**

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