

THE INSTITUTE FOR ADVANCED PHYSICS

The Institute News



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Seventeenth Annual IAP Members Conference

by Ken Klenk, Ph.D., IAP Certified Member
photos courtesy of Maikel Garcia and Ken Klenk



IAP faculty and members (*standing, left to right*) Maikel Garcia, Dr. Ken Klenk, Anthony Coniglio (member candidate), Giuseppe Rizzi (member candidate), Dr. Anthony Rizzi, Dr. Murray Daw, Dr. Dan Lejeune, Frank Camacho, Fletcher Williams, Anthony DiCarlo, Fr. Neal Nichols, Dr. Dan Welch, Dr. Stephen Strickland, Randy Nichols, Dr. David Liberto, (*kneeling, left to right*) Brian Lane (member candidate), David Giroir, James Louviere, John Baker, and *participating by Skype* Dr. David Welch, Dr. Kevin Hix, and Dr. Ted Dickel

The 17th annual summer conference was held on July 24 – 27, 2019 at the Louisiana State University in Baton Rouge, LA. As is the usual custom, the conference began with a primer session led by IAP Faculty member, Dr. Murray Daw. This year the focus was on the first two books of IAP’s *Physics for Realists* (PFR) series – *PFR Mechanics* and *PFR Electricity & Magnetism* (E&M).

Participant fellowship and discussion continued at an informal pizza dinner. [Continued on page 2](#)

Annual conference story continued from page 1...



Dr. Murray Daw gives primer on Physics for Realists Mechanics and PFR Electricity & Magnetism

Evening topics included bringing out and addressing the errors made by several popular Catholic authors and speakers, which allowed each participant to uncover those same errors within his own thinking. One major insight that all of us need to keep in mind is that grace is not a substitute for nature. Grace presupposes nature and grace can help us think if we ask for it. And, appeals to faith and acts of piety are not substitutes for understanding nature.

Thursday's morning sessions addressed some of the research topics that are fundamental to the fourth textbook *PFR Quantum Field Theory* (QFT). **Dr. Anthony Rizzi** discussed the Lagrangian, D'Alembert's principle, Action, and Hamilton's Principle of Least Action. He commented that currently QFT is in the first state (of three states) of empiriometric theory that he has dubbed the "raw empiriometric." We have already begun to move parts of QFT into the 2nd and 3rd stages and a few bits partially into the physical understanding stage.



Associate Member candidate **Giuseppe Rizzi** discussed the *Science before Science* study groups he ran at his school: Texas A&M University. Among the tools he employed were the **EWTN Live** video interview of Dr. Rizzi and the *Science Before*

Science series featuring Dr. Rizzi and Marcus Grodi available at the ewtn.com store.

Before ending the morning session, Director **Dr. Rizzi** (*photo left*) presented **Dr. David Liberto** (*photo right*) with his Associate Membership certificate representing his 2017 achievement.



The afternoon session returned to the QFT book and discussion of several topics of interest including –Path Integrals and Brownian Motion and QM, the non-relativistic limit of the Klein-Gordon equation and the Dirac equation, Fourier nature of QM and QFT, and the AB effect's importance. Rizzi also showed in a very clear manner how to go back and forth from the Schrödinger equation to the path integral.



IAP assistant professor **Dr. Ted Dickel** gave a talk on measurement in quantum mechanics as revealed by the third textbook in the *Physics for Realists* series – *PFR Quantum Mechanics* (QM). As quantum mechanics is fundamentally a statistical theory of ensembles, a measurement of an observable of a quantum mechanical system gives one the value of one member of the ensemble in a given quantum state (described by the wave function). Also, the measurement changes the system through the interaction between the system and the measurement device. And, the observer knows the result. Staying confusedly in the empiriometric mindset has led to the nearly universally believed idea that the wave function somehow collapses as a result of a measurement. There were **Continued on page 3**

Annual conference story continued from page 2...

two breakout sessions that addressed: (1) problems for the QFT text and (2) QM problems that relate to things observed in nature.

Associate Member **Anthony DiCarlo** presented the near final manuscript of the *PFR-M Algebra Guide*. On behalf of the group he is leading with Associate Members **Frank Camacho, Maikel Garcia, Randy Nichols, and Fletcher Williams**, he announced that the manuscript is almost ready to go to Dr. Rizzi for his final vetting, and that it should be published in the near future.



PFRM Algebra Guide meeting: clockwise around the table starting with empty chair/photographer Garcia, Williams (red shirt), Camacho, Nichols, Baker, and DiCarlo

Associate Members **Mr. Williams** and **Dr. Liberto** presented a progress report on the IAP University efforts. There was a spirited and enthusiastic discussion of the mission statement of the university among the IAP members.



Certified members **Dr. Dan Welch** (*standing right*) and **Dr. Dan Lejeune** (*seated*) provided experiments analogically related to QFT for the participants to interact and discuss in the evening session (*assisting in photo is Williams standing left and Strickland standing center*). Later, the members continued their discussion of

the errors that are made outside of the Institute due to there being a lack of understanding of the foundational physics – an understanding that outside of the Institute is not known. **Mr. Williams** provided interesting quotes that the group used to sharpen their awareness of how these errors are presented.



On Friday, Dr. Rizzi presented a suggestive draft table of contents for the QFT text. The general theme of the text, speaking in a fully physical manner, is to show how the plana interacts with particles, including how it can, in certain states, create particles. The outline is quite impressive in its breadth and scope. Among the topics to be eventually addressed are QED, Path Integrals, Renormalization, Standard Model, Weak and Strong forces, Gravity, Grand Unified Theory, and Theory of Everything.

Mr. DiCarlo gave a talk on how IAP is the soup kitchen for the soul feeding our minds with the healthy physics it needs. **Dr. Rizzi** then gave a talk entitled the *Scientism after Science – Our Path toward the Brave New World*. He stressed how quickly the culture is declining by showing the stark contrast of music between just the 1960’s and today. He showed that this decline has been in progress for a very long time – since the scientific revolution and the mis-digestion of the wonderful scientific method discovered then. This decline is still threatening us and the only way to change things is to fix our physics.

Frank Camacho, Associate Member, gave a talk on IAP’s new publication – *A Kid’s Introduction to Physics and Beyond – Volume II (KIP2)*. The book, which has a baseball theme, is a continuation of the first volume and is packed full of the



Continued on page 4

Annual conference story continued from page 3...

common sense understandings which the first three physics texts have provided, i.e. *PFR-Mechanics*, *PFR-E&M* and *PFR-QM*, but focused on the last two (the *PFR-M* being treated also in *KIP 1*). His well-done talk showed how interesting and accessible the book really is.

The afternoon session began with a showing of the video *Return to Wisdom*. This video, produced by the Institute in 2005, shows the impact of empiriological thinking on the many professionals from journalists, to lawyers, to theologians, and physicists.

Dr. Rizzi continued his discussion on the QFT text and discussed gravity waves acting on a quantum mechanical particle. Meanwhile, separate groups broke out to discuss how to address (1) integrating the basic physics into the field of Biology and (2) the Algebra Guide. Dr. Daw gave a review of the standard model of particle physics. Dr. Rizzi then addressed the de Broglie-Bohm formalism and the quantum field theory case of massive bosons. In QED, the quantum field has multiple analogical meanings related to the A-field of E&M.



The session ended with a presentation by **Anthony DiCarlo** on methods of promoting *KIP* and *PFR-M* Algebra Guide into schools and his experience this past year in attending a home-school conference and getting an announcement on Catholic radio about *KIP*; a

presentation by Certified Member **Dr. Stephen Strickland** on the hydrodynamic-QM analogy; and, finally, a video of the US 1969 moon landing featuring the activity on the lander and ground control in the last minutes leading up to the successful landing on the moon. IAP celebrated the 50th Anniversary (July 20, 2019) of this important event. Dr. Rizzi pointed out that only the United States, even at this date, has accomplished this feat.

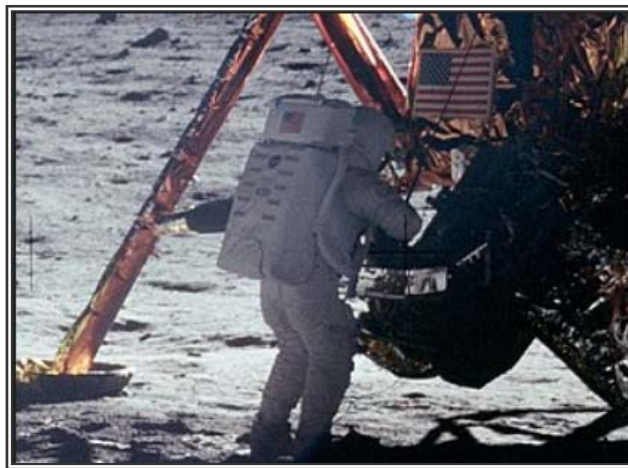


That evening **Dr. Welch** and **Dr. Lejeune** provided further experiments including an impressively sensitive cloud chamber (which detects cosmic ray radiation) as well as other interesting experiments. **Dr. Strickland** gave an update of his investigations into Quantum Computing.

Fr. Neal Nichols, FSSP, IAP Spiritual Director, was once again present to provide Mass and confession each day of the conference as well as



leading participants in prayer at the beginning and end of our conference sessions. The IAP is indebted to him for his participation and his powerful prayerful intercession on behalf of the Institute for Advanced Physics.



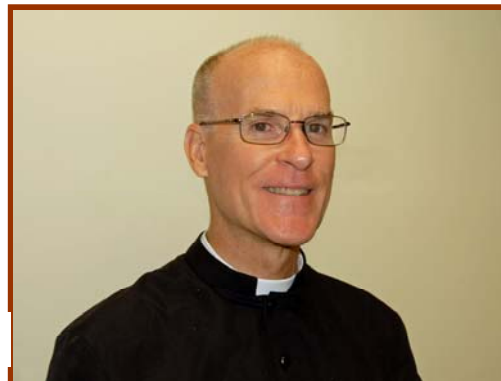
Apollo 11 Moon Landing

The crowning achievement for the Saturn V rocket came when it launched Apollo 11 astronauts (Neil Armstrong, Edwin (Buzz) Aldrin, and Michael Collins) to the Moon in July 1969. In this photograph, astronaut Aldrin takes his first step onto the surface of the Moon.

Image credit: NASA



Above: Giroir
Conference logistics



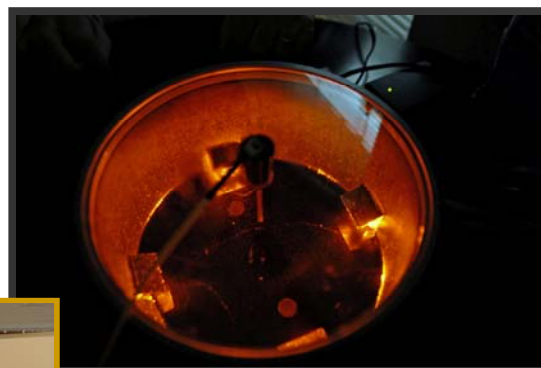
Conference photos *Top left (right to left):* Lane, Liberto, Baker, and Williams; *Top right:* Fr. Neal Nichols, FSSP; *Middle left:* G. Rizzi, Coniglio; *Middle right (right to left):* A. Rizzi, DiCarlo, R. Nichols, Lane, Williams, and Strickland



Bottom left: Dan Welch experiment demonstration

Bottom middle: Stephen Strickland presentation

Right: photo of the IAP cloud chamber (close eye will observe a heavy particle and a light particle)



Right: Klenk photographer, conference secretary



Above: Garcia photographer, Louviere A/V

Chesterton Academy Teacher Training and Volunteer Training

Phase one: A Kid's Introduction to Physics (and Beyond)

by Anthony DiCarlo, Associate Member



In June, IAP Associate Members **Anthony DiCarlo** and **Fletcher Williams** conducted a teacher training workshop for Chesterton

Academy teachers. The aim of the workshop was to begin the IAP education of the **Chesterton Schools Network**; teachers from the following locations participated: Annapolis, Maryland; Detroit, Michigan; Hopkins, Minnesota; Milwaukee, Wisconsin; and also Martin Saints Classical High School of Oreland, Pennsylvania.

During the workshop, Mr. Williams and Mr. DiCarlo took the participants through the content of *A Kid's Introduction to Physics (and Beyond)* by Anthony Rizzi and showed them how to integrate that content into their various curriculums. Participants participated in lectures via Skype and completed homework assignments between lecture sessions. The workshop, which usually lasts five days, was extended to six due to an unexpected bonus: a question and answer

session with Dr. Rizzi on day four of the workshop.

Workshop participants expressed gratitude for all that they had learned during the workshop, as well as a desire to continue deepening their understanding of the Institute for Advanced Physics' material. Mr. Williams and Mr. DiCarlo will be following up with participants throughout the school year to help them as they begin to implement what they have learned. More workshops with the Chesterton Academy Schools are expected in the summer of 2020.

This was a particularly intensive month for DiCarlo and Williams as the week before this workshop for the Chesterton Academy teachers they gave a workshop on *A Kid's Introduction to Physics (and Beyond)* for non-IAP members with **Dr. Stephen Strickland** (IAP Certified Member) and **Dr. Kevin Hix** (IAP Associate Member) helping as well. The participants of this workshop also expressed appreciation for the opportunity to learn the basic physics that outside IAP no one knows.

Please consider a donation to IAP

Donate any amount by credit card online at <http://www.iapweb.org/store/#donate> or mail your check to: Institute for Advanced Physics, PO Box 15030, Baton Rouge, LA 70895

Donate \$35 online (plus \$6 for shipping) using our web site store at www.iapweb.org/store/kids.html#video and receive IAP's *Physics for First Communion* nine-episode DVD series as our gift to you.

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Thank you for your financial support.

Dr. Rizzi invited for lectures at Clemson University

by Frank Camacho, Associate Member
photos courtesy of Ken Klenk, Certified Member

In the two days preceding the *Physics for Realists: Quantum Mechanics (PFR-QM)* teacher workshop, **Dr. Anthony Rizzi** had a full schedule at Clemson University. On Thursday, October 17th, Dr. Rizzi met with multiple faculty and visited the condensed matter laboratories. At 4:00pm, he gave a colloquium titled "A New Quantum Paradox and its Resolution." In this talk, Dr. Rizzi described his recent collaboration with **Dr. Philip Pearle**, Prof. of Physics Emeritus **Hamilton College**, in which they made a groundbreaking discovery relative to the Aharonov-Bohm effect, which has been described as one of the seven wonders of the quantum world. Refreshments and interesting discussion with faculty and students followed the colloquium. Clemson faculty then took Dr. Rizzi to dinner.

On Friday, October 18th, following morning meetings with other Clemson faculty, Dr. Rizzi gave a formal talk to multiple Clemson classes: the sophomore quantum mechanics (QM) class, the senior QM class and a graduate QM class. Invited faculty also attended the lecture, which covered the measurement problem in QM, the central problem in understanding QM, which Dr. Rizzi's new quantum book has resolved. Topics in the talk included: the Copenhagen interpretation of QM, the false idea of wave function "collapse," the ensemble approach to QM, and his easy to understand resolution of the "Schrödinger's cat" paradox. At the end, Dr. Rizzi addressed the interesting questions of

students and faculty. Next, was a pizza party for all Clemson students that have or are taking a class using Dr. Rizzi's *Physics for Realists Series* at Clemson. Dr. Rizzi and students especially enjoyed an entertaining discussion on the guiding wave structure. Students were excited about the guiding wave structure so much so that one student, **Shane Blade**, came to the Halloween party a week or so later dressed as a particle with its guiding wave structure (*see photo on page 8*). The day ended with a relaxing BBQ dinner for faculty and families at the home of the chairman of the physics department.

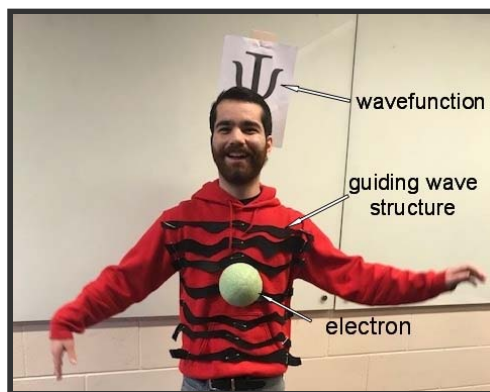
These activities coupled with IAP's workshop for physics teachers at Clemson University and the already existing Clemson *PFR-QM* course serve to underscore *PFR-QM* as a landmark textbook that can be readily incorporated into the teaching of undergraduate college physics. In this and in many other venues, the IAP advances its goal of teaching the powerful principles of modern physics *without* the powerful error of neglecting its foundation and context in the broader and more generic first physics that comes to us through the senses.

"Physics for Realists is a profound new series. It uses the things we know first as children to discover the heights of modern physics. It presents a new and fundamentally deeper understanding of physics in a way that allows the student to fully follow and digest that depth. The series is nothing short of revolutionary."

David Welch, Stony Brook University

"This textbook (Physics for Realists) does it just the right way. I think Feynman would have loved it. He always taught us (in his class) to work to understand things deeply, and that the equations were something that should follow the understanding, not the other way around."

Mike Baskes, former student of famed physicist Richard Feynman who was considered by many to be the Einstein of his day. Dr. Baskes is retired from Sandia National Labs, Los Alamos National Labs and University of California, Davis



Photos of IAP events at
Clemson University
October 17-19, 2019

PFR-QM Teacher Conference at Clemson University

by Frank Camacho, Associate Member

photos courtesy of Ken Klenk, Certified Member



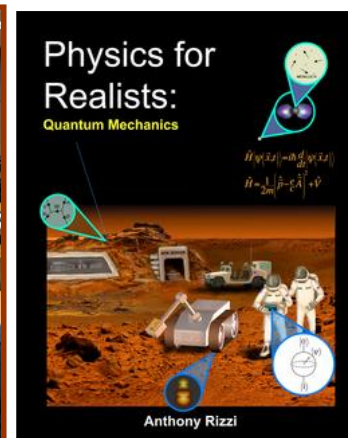
On October 19, 2019, the Institute for Advanced Physics (IAP) conducted an all-day conference for physics teachers at **Clemson University** in South Carolina. IAP provided an overview of the new textbook *Physics for Realists: Quantum Mechanics (PFR-QM)* written by **Dr. Anthony Rizzi**, the Director of the IAP. This book is the third volume in the groundbreaking series of *Physics for Realists* (PFR) texts, with the first two being *PFR: Mechanics (PFR-M)* and *PFR: Electricity & Magnetism (PFR-EM)* which are highly recommended by the **American Association of Physics Teachers'** (*The Physics Teacher*, May 2009).

Participants included physics professors from **Clemson University, Wofford College, Furman University, Wake Forest University, Auburn University, Samford University,** and **Christendom College**. Also present were advanced high school physics teachers from South Carolina, Tennessee, and Texas. These participants were well prepared for a rigorous study of *PFR-QM*. In the weeks leading up to the workshop, **Dr. Murray Daw**, IAP Adjunct Faculty and R. A. Bowen Professor of Physics and Astronomy at Clemson University, held a primer session via Skype covering *PFR-M* and *PFR-E&M*.

After introductory remarks and a quick chapter-by-chapter overview of *PFR-QM* given by Dr. Rizzi, **Dr. Daw** briefly summarized the main concepts from *PFR-M* to establish the foundations of substance, the categories of property, impetus, force, energy, and plana, etc. upon which *PFR-QM* builds in its treatment.



Following the presentation by Dr. Daw, Dr. Rizzi then delivered a detailed exposition of the ten chapters of *PFR-QM* to instruct the professors on the new material and how to teach it to their students. After establishing in Chapter 1 that QM is about discovering the nature of the inner structure of massive bodies, especially their parts, Dr. Rizzi delved into the content of Chapters 2 to 5, covering the nature of particles and their guiding wave structure via introducing empiriometric elements such as the Schrödinger equation in one dimension, rectangular, periodic, and harmonic oscillator potentials, angular momentum and spin, and quantum formalism. He also discussed the nature of measurement in QM. He then explained how more advanced topics are developed in Chapters 6 to 9, including the understanding of the hydrogen atom, quantum causes and behaviors, the classical limit, multi-particle analysis, and methods for analyzing atomic level systems. The progression of the material from one chapter to the next



leads the student to the depth of quantum reality, such as entanglement, and to the resolution of the famous “Schrödinger’s cat” paradox, the EPR paradox, the Aharonov-Bohm effect, and more.

PFR-QM is a ground-breaking book that breaks us out of the quantum misunderstandings that have plagued us since the advent of the theory. The text explains the probabilistic nature of QM theory and how this means that part of reality is left out of its empiriometric formulation. Because of its fundamentally probabilistic nature, Dr. Rizzi explained how QM is about ensembles of similarly prepared systems and that ***the wave function does not apply to a single system (without reference to an ensemble of systems, one member of which the given system possibly is)***. This is essential in understanding what QM formalism reveals to us about the physical world.

Dr. Rizzi also discussed how the unity of principle that underpins *PFR-QM* (which allows equations and even the history of QM to be understood from a common sense grounding) leads to and is completed by an example of a practical system based on quantum principles. This is done in Chapter 10, where students are taught about the design and operation of a Mars Mineral Identification and Composition Analyzer (MICA), a device that is an actual instrument tested on the NASA Ames K-9 Mars Rover. Building upon the material learned in *PFR-QM* and the knowledge of electronics from *PFR-EM*,

this chapter brings students back to the practical theme of the manned mission to Mars initiated in *PFR-M* and then continued in *PFR-EM*.

Dr. Rizzi showed how *PFR-QM* leads us and all students to a deep understanding of the deepest and most exciting aspects of modern physics by tapping into our common sense and starting with the things we see directly while building upon the material in the first two volumes of *PFR*. Although QM pertains to a realm that is not directly accessible to the senses, a key feature of *PFR-QM* is how it shows the meaning of QM mathematical formalisms in terms of analogies to things we get directly through the senses. It reminds us that all we know comes through what we know through the senses. Finally, it reminds us that mathematics is so revealing of nature because it is the study of quantity which, in turn, is determined by the qualities, which are in turn determined by the nature of the thing under consideration.

In addition to the formal sessions, there was time for a number of informal discussions during breakfast, lunch, and dinner. These also served to establish further connections between IAP members and the teachers attending the conference so the IAP can follow up with them in the future regarding the use of *PFR-QM* in their physics curricula.

Order your copy of
Physics for Realists: Quantum Mechanics
www.iapweb.org/store/ \$150

Mars Calendar receives award



In August 2019, The Institute for Advanced Physics' Mars Calendar was awarded a special Recommendation badge by **Free Download Manager**

according to the users' reviews!

The Institute for Advanced Physics is pleased to present a calendar designed for use on the planet Mars!

With [two rovers](#) currently on Mars (putting those who work with them *virtually* on Mars) and President George W. Bush having set the goal for the U.S. to land a [manned mission on Mars](#) by 2030, such a calendar is needed as human history extends beyond the planet Earth. Currently, President Trump is reported as saying after a White House meeting with Australia's Prime Minister Scott Morrison: "We're going to Mars." (Sept. 22, 2019, www.space.com)

The Mars calendar aligns by setting Januaria 1 BCM as the winter solstice on Mars, thus putting the start of Martian reckoning of the year 1 ADM into alignment with January 1, 1 AD of the Earth-based Gregorian Calendar (*). This means March (*Mars* in Latin) is the beginning of the year as it was in Roman times and September, October, November, December become the 7th, 8th, 9th, and 10th months of the year as their names imply. For more information about the Mars Calendar see




the *Physics for Realists Mechanics* textbook from which it derives as part of the manned mission to Mars theme of the book. [Sign up](#) for more information on *Physics for Realists!*

Mars image courtesy Space Telescope Science Institute (www.stsci.edu)

With the Mars Calendar you can:

- Find the Martian date for any historical Earth date
- Find the historical Earth date for any Martian date
- Navigate forward or backward by year, month, day, etc. based on the Earth calendar
- Navigate forward or backward by year, month, sol, etc. based on the Martian Calendar
- Find out about *Erday*

Download the IAP's Mars Calendar from our website at: www.iapweb.org



IAP research *accepted* in Oct. for publication in
Foundations of Physics

How the Natural Interpretation of Quantum Mechanics Avoids the Recent No-go Theorem

By Anthony Rizzi

“Thank you” from Award Recipient Anthony Coniglio

Dear Institute for Advanced Physics and its members,

I am writing to express my sincerest gratitude for the award which allowed me to attend this year's IAP conference. I am truly appreciative of the generosity you have shown towards me. In attending the conference, I truly learned so much and grew in my understanding of physics, philosophy, and God. The work of the Institute has been truly life-changing for me, and I thank God for the wisdom I have gained from the members and their work through the Institute.

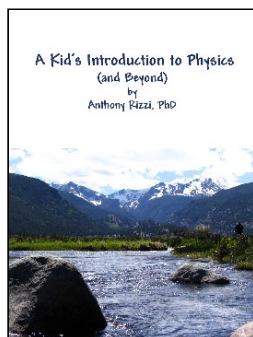
The money has been extremely helpful in making my attendance possible. I could not have financially afforded to go to the conference if it were not for this award. In

attending the conference, I grew in my understanding of truth and of the core principles of physics. It has helped equip me with the knowledge I need in order to counteract the moral decay so prevalent in today's culture. As a college student, I am especially grateful for my growth in truth as a result of the conference.



I am deeply grateful for the generosity that the Institute and its members have shown towards me. May God bless you.

With gratitude,
Anthony Coniglio



A Kid's Introduction to Physics (and Beyond)

By Anthony Rizzi

Abby is the delightful four-year-old daughter of one of the faculty members at Clemson University. She has been studying *A Kid's Introduction to Physics* with her father. He shared two stories about her genuine grasp of the principles in *A Kid's Introduction to Physics (and Beyond)* by Anthony Rizzi.

After Abby returned from a visit to India, her grandmother (still in India) called her to tell her how much she missed her. Her grandmother explained that she was glad Abby could be back in the US with her father; but, grandmother wished Abby could be in India as well. Abby responded with Kid's book physics. **“But Grandmother, that would be against the principle of non-contradiction. You cannot be here and not here. Something cannot be and not be at the same time and in the same way!”**

On another occasion, Abby was watching a television show with her several-year-older cousin, who made the comment that **“if it is really magic then you don't need a wand. It can just happen.”** Abby said (again this is *Kid's Introduction to Physics* material), **“That would be against the principle of causality. Nothing changes itself. There has to be a cause for a change.”**

Children such as Abby remind us that this is very simple material that all of us can learn if we are but open to it.

The book (6x8, 70 pages, 14 font, soft cover) may be purchased for \$12 plus s/h on the IAP web site at: <http://www.iapweb.org/store/kids.html>

Science Before Science Study Group at LSU



Study groups are occurring around the country. One example: A pre-nursing freshman student **Kateri Rizzi** led a *Science Before Science (SBS)* study group for women at Christ the King student parish at **Louisiana State University**. **Dr. Anthony Rizzi**, SBS author, made a guest appearance on November 22nd to speak to the group. In his *SBS* book, Dr. Rizzi confronts the crisis of our anti-truth culture refocusing us on the original calling of science – **to discover truth**. This purpose is critical to us now more than ever. Students discussed issues like:

1. How people can keep science *and* their common sense: There is more to life than just matter.
 2. How a fuller science naturally leads to proofs for the existence of God.
 3. Evolution and creation, properly understood, are quite compatible -- not mutually exclusive.
 4. Time travel: forward and backward -- are they possible?
 5. Are there other forms of intelligence in the universe? Are we about to produce artificial intelligence?
 6. Will scientists ever create a man? How do we objectively decide issues like cloning?
- And much, much more about how science can help us do good and avoid evil.*

Dr. Rizzi on *EWTN Live* January 29th



Dr. Anthony Rizzi and Fr. Mitch Pacwa discuss Rizzi's new book, *A Kid's Introduction to Physics (and Beyond), Volume II*. It continues on the lessons learned in volume one showing the simple connection between physics, our everyday world and God. These two volumes are an essential supplement to your

student's or child's science curriculum for 6th grade and up. They show why science (which includes modern science) inevitably leads to God, and how everything we learn about the physical world tells us something new about God. They are essential to our own and our child's education.

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What is Science?

by Anthony Rizzi

As you know, IAP is tackling the core of our deep cultural problems, which is our science not being clearly grounded in the principles that every child knows. IAP is repairing the core of our culture by grounding its core thinking, modern science, in our knowledge of the physical things that we know directly through our senses. To give people insight into this deep need (which is currently only addressed by IAP), Dr. Rizzi here addresses the topic of "What is Science."

Our science, modern science, determines what we think and, therefore, what we do and what we value! Indeed, science is the core of any culture. So, it is imperative that we know what it is and what it tells us. Science (from the Latin *scientia*) means knowledge. It is what we think we know. But, when asked: *what is science?*, most of us would immediately give, roughly, the definition we were taught: science is the process of making hypotheses and testing them. People more attuned to the modern science culture would add that they must be falsifiable. Asked about the relation between science and religion most Americans would say: *religion and science talk about two different things. Science is about how things work; religion is about morality and choices. Religion is a personal choice.* This view then ultimately amounts to the statement that religion is subjective and science is objective. This is the on-the-ground view of most Americans (and it is the more explicit view of those in first world countries outside the US). By this, I simply mean that most people actually talk and live as if this were the case, i.e., they live and talk as if this were true when not answering questions about religion directly. Another way people express their view about science and religion is by saying: *Science is about how and religion is about why.*

None of these statements about science and religion are true. As we will see, science, as defined by the way we actually think and talk about it, neither finds the how, nor the what, *nor anything about the essence of things.* Not that it cannot and not that it does not already, though in a confused way. Real science must answer all questions about a thing including: *What is it? Why does it do what it does? How does it do what it*

does? To see these things more clearly, let's look at our modern view and un-entangle it.

Looks Like We Know Nothing!

You will often see in science texts something like:

Not all hypotheses meet the criteria of science: You wouldn't be able to test the hypothesis that invisible ghosts are fooling with your desk lamp! Because science only deals with natural, testable explanations for natural phenomena, it can neither support nor contradict the invisible ghost hypothesis, nor whether spirits or elves cause storms, rainbows, or illnesses. Such supernatural explanations are simply outside the bounds of science, as are religious matters, which are issues of personal faith. Science and religion are not mutually exclusive or contradictory; they are simply concerned with different issues. (Campbell¹)

In fact, science is broader than this. Science, in the full meaning of the term, is the study of reality, in which we have various branches that focus on given areas of reality. For example, the science of psychology studies human nature. Not all science studies the physical world but all

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¹ Campbell, Urry, Cain, et al., *Campbell Biology 11th edition* (Pearson, NY, 2017), pg 18.