Spring 2018

THE INSTITUTE FOR ADVANCED PHYSICS

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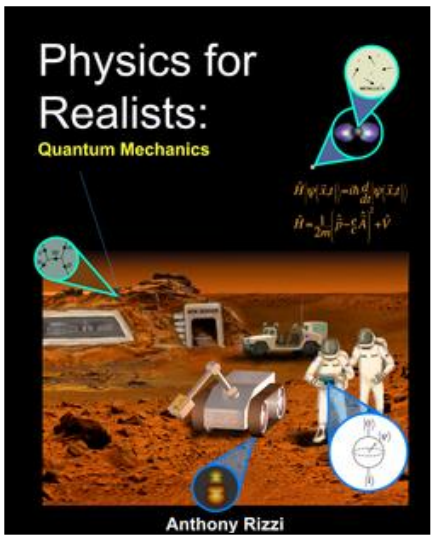
Physics for Realists: Quantum Mechanics NEW

This is an historic book. The problem of scientism has suffered a severe blow. One can see the foundation of our knowledge begin to solidify in a breathtaking way now. With this textbook, modern physics is understood in a fully physical way all the way up to about 1930 (the outlines of general relativity have been understood but not been published --a full treatment of general relativity is underway).



This *third* volume in the *Physics for Realists* series grounds quantum mechanics in common sense! Quantum mechanics (QM) is perhaps the most distant subject from our senses, as it deals with the atomic-level parts of physical things. As such, it has generated some of the most widely known deviations from common sense, including the idea that things are not anything till we measure them, which caused Erwin Schrödinger to produce the paradox of the cat that is neither dead nor alive to reveal and ridicule such craziness. Through the grounded approach, **Dr. Anthony Rizzi** leads the student to a deep understanding of the best in modern theory. Each chapter builds on the previous one to a discussion of Bell's EPR experiment that brings out how first principles shed light on this central arena of the foundations of QM. New understanding and insights permeate the book; these arise from years of research thinking from those first principles we get through the senses. Very new subjects, such as the latest ground breaking discoveries (for which Dr. Rizzi and Dr. Pearle are responsible) about that quintessential quantum effect, the Aharonov-Bohm Effect, are discussed. The profound unity of principle of the text is complemented by a unity of

practice through the challenge of understanding an x-ray based mineral composition analyzer for use on Mars. The overarching practical theme of the manned mission to Mars initiated in the first two volumes is thus continued. With this text, no longer does one have to think poor Schrodinger's cat is both dead and alive! **ORDER the book online at:** www.iapweb.org/store/

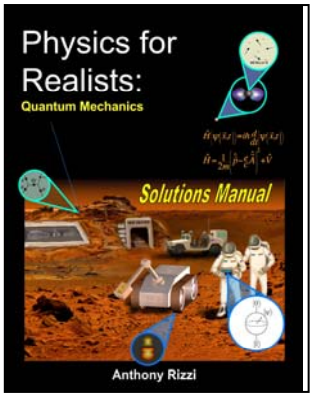
New

Physics for Realists:

Quantum Mechanics - *Solutions Manual*

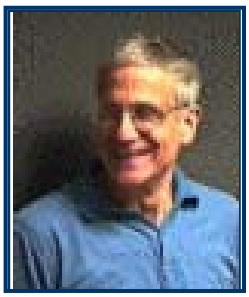
Available only to physics teachers

BEFORE ORDERING you must receive IAP staff approval of evidence of teacher status. Send evidence to info@iapweb.org. *No refunds for those who order without prior approval.* www.iapweb.org/store/



Uncovering one of the Seven Wonders of the World

Anthony Rizzi



Philip Pearle

Quantizing the Vector Potential Reveals Alternative Views of the Magnetic Aharonov-Bohm Phase Shift, accepted May 2017 and **published in Physical Review A, May 25, 2017** is the second paper on the Aharonov–Bohm effect published by **Anthony Rizzi**, Institute for Advanced Physics, and **Philip Pearle**, **Hamilton College** (retired), Clinton, NY. These papers are a major breakthrough in this area of physics. The first paper, *Quantum-mechanical inclusion of the source in the Aharonov-Bohm effects,* which was accepted in 2016, was also published in this May 25, 2017 issue of PRA.

The Aharonov–Bohm effect has been called one of the Seven Wonders of the Scientific World because it appears to imply a cause acting instantly over a distance. "Our Quantum Mechanics research continues with great success," says Rizzi. Dr. Rizzi also has additional papers in the final stages. That work includes answers to deep questions posed by the great discoveries of the 20th century.

New

Quantum Field Theory lectures

(empiriometic only)

by **Antony Valentini**, theoretical physicist and professor at Clemson University

Available on the Institute for Advanced Physics web site: www.iapweb.org/resources.htm

Is Water Wet?

IAP unravels a national media controversy

by John Sudnick, Associate Member

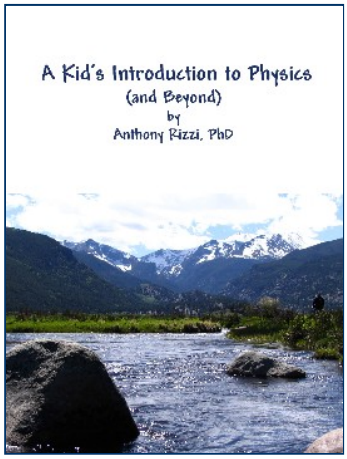
An interesting controversy arose between many of the nation's high school and college students around the 2017 Christmas break. Although not a focus of the national media, it was fairly prominent on social media including YouTube. The halls of schools across America rang with the question: "Is water wet?" It was said that some places nearly came to blows over the question.

The students were divided into two camps. There appeared to be differing opinions on what the definition of wetness is and whether or not the water is wet or the thing that the water is on is wet? There was also a secondary question related to where the notion of wetness comes from. Many students wanted to know if "wetness" is real or just the name given to an idea in our minds.

Parents and teachers who witnessed these arguments were surprised by how impassioned the students became in debating these questions. While it is tempting to just pass these off as silly arguments over dumb questions, this current event should cause us all to stop and reflect on the dire need for the work of the Institute for Advanced Physics. Our culture is losing its hold on basic physical truths more and more with each passing day. The scientism *(explained on page 5)* robs us of our common sense and our ability to defend basic realities; now we have come to the point where we don't even know whether or not water is wet!

In many ways, the passion of the kids in debating these questions is a healthy sign. They still care about basic physical truths enough to get angry about it when one is called into question. Do we respond the same way? Could we answer the questions that they were debating?

To do so, we need the basic physics presented in *A Kid's Introduction to Physics (and Beyond)* by Dr. Anthony Rizzi. Without an explicit understanding of the content of this book, the best



we will be able to do is respond to questions like the ones above with a confused gut-level response; at worst, we will fall into the philosophical idealism that we inherit from our culture which asserts that all we can really know are our own thoughts not physical things themselves.

All that we know comes through our senses. As young children we explore the world around us, touching, tasting, and smelling everything we can get our hands on. We learn that water is wet, rocks are hard, and fire is hot through our senses. These properties (wetness, hardness, hot) cannot exist on their own and make no sense on their own. They must exist in a thing. Wetness is a *proper* accident (property) of water. It is a property whose existence is necessarily (formally) caused by the substance, in this case water. When water is on another substance, say for instance a piece of wood, the "wetness" of the wood is a *mere* accident of the wood since it does not spring from the essence of the thing, in this case the wood. The water acts on a second substance, say wood; each substance receives that action according to its own nature. There are two different meanings of "wet;" the primary one which we get from watery fluids, and the secondary one which we get from their action on other substances. We can summarize with the following simple statement: if water wasn't wet, it could never make anything else wet! This should be obvious, but no one involved in the before-mentioned arguments was able to articulate it with any kind of clarity. Let us allow this incident and others like it to shake us out of our sleep-walking state and begin studying the basic physics!

Order the Kid's book at:

www.iapweb.org/store/

Murray Daw teaching IAP member candidates since 2006

Murray Daw, R.A. Bowen Professor of Physics, Department of Physics & Astronomy **Clemson University,** is, and has been for many years, a Professor of the Institute for Advanced Physics. This role includes teaching top-level member candidate courses. Murray became an IAP Certified Member in 2005 and was appointed an IAP faculty member in 2006.

Murray Daw is the R. A. Bowen Professor of Physics in the Department of Physics and Astronomy at Clemson University in Clemson, SC. He received his B.S. degree in Physics from the **University of Florida** in 1976 and Ph.D. in Physics from **California Institute of Technology** in 1981. Following his Ph.D., he joined the Materials Group at **Sandia National Laboratory, California**, where he originated the **Embedded Atom Method**, which has become the workhorse for atomic-scale investigations of the mechanical properties of structural materials. During his 13 years at Sandia, he helped establish an active group in computational materials science, and was promoted to Distinguished Member of Technical Staff. He joined the faculty of the Physics Department at Clemson in 1994, where he has participated in the rapid growth and development of their materials physics group.

From 1998-2000, he was on leave from Clemson to work at **Motorola's Semiconductor Product Sector** in Austin, TX, where he was Senior Scientist and Section Leader in the Computational Materials Group, and participated in joint projects between Motorola and the **Los Alamos National Laboratory** in New Mexico. He returned to Clemson in 2000. He has carried out research in many areas of materials physics, including semiconductors, surface physics, and mechanical properties of metals. His main research interests currently include work in mechanical properties and in new materials for thermoelectric applications. Prof. Daw is author or co-author of over 100 publications and is on the ISI's list of Most-Cited Physicists. He also works with Dr. Rizzi on IAP quantum mechanics and quantum field theory research.

He has won a number of awards for his research, including the **DOE award** for Sustained Outstanding Research in Metallurgy and Ceramics and the **Sandia Award for Excellence**. He was elected Fellow of the **American Physical Society** in 2000, and Fellow of the **American Academy of Arts and Sciences** in 2004.

IAP Associate Member **John Kevin Hix, MD**, has been assisting Dr. Daw with the associate member courses. Dr. Hix earned his undergraduate degree in Psychology as a Natural Science at the **University of Michigan** and then earned his medical degree at the **Ohio State University**. He completed his residency training in internal medicine and a subsequent fellowship in nephrology at **The Cleveland Clinic Foundation**. He is board certified in internal medicine and nephrology and currently serves as the medical director for patient dialysis services at **Rochester General Hospital** as well as the director for its outpatient Baycreek unit.

Find out how to apply for IAP Certified or Associate Membership at:
www.iapweb.org/membership.htm

John Sudnick, Associate Member

John J. Sudnick earned his Bachelor of Science Degree in Mechanical Engineering at **Drexel University** in 1975. He began his career as a system's test engineer at **Rocketdyne** in Canoga Park, California, the primary NASA contractor on the **Space Shuttle Program**. In 1979, family situations required him to move back to Philadelphia, Pennsylvania. He became an application engineer for the **T-Thermal Company** designing combustion systems for industrial applications. His career advanced through several technical and management positions in engineering companies in the northeastern and southeastern areas of the United States. Currently he is a part owner of a professional engineering company in Spartanburg, South Carolina. He is a registered professional engineer in seven states.

John first learned about the Institute for Advanced Physics when a Catholic men's group he belongs to decided to read and discuss Dr. Rizzi's book *The Science Before Science A Guide to Thinking in the 21st Century*. **Anthony DiCarlo**, an IAP member who led the group discussions, recognized John's interest to more fully understand the fundamental truths outlined and explained in the book. John lives in South Carolina with his lovely wife, **Mary Ann**. He is excited and honored to be an IAP member. He completed the course (level I) on April 22, 2018.

Ronald Heisser, Associate Member

Ronald Heisser is currently a Ph.D. student, having just finished his first year in Theoretical and Applied Mechanics at **Cornell University** in Ithaca, NY. There he has joined the **Organic Robotics Laboratory**, where new materials and technologies are being developed to make innovations in robotics manufacturing, energy storage, and sensing. Prior to this position, Ronald studied Mechanical Engineering and Philosophy at **MIT**, earning his SB in 2016. While there he investigated novel fracture properties of thin brittle materials.

Between finishing his undergraduate studies and beginning graduate school, he spent a "gap year" doing design and engineering work for two companies. First, he worked as a product designer for **MMID in Delft, Netherlands**, where he developed functional design specifications and produced a working prototype of a new consumer product. Later, he worked as a mechanical engineer for **Aerofarms in Newark, NJ**, a company which aims to grow and sell affordable, sustainable food on an industrial scale. He helped develop processes to eliminate error in the manufacturing and formulated solutions to allow for the feasible scaling of vegetable production.

Ronald read *The Science Before Science* as a freshman at MIT and so has waited with great anticipation to have the opportunity to join the Institute. He completed the course on April 18, 2018.

Gerardo Vazquez, Associate Member

Gerardo Vazquez is currently a 2nd year Theology Seminarian studying for the **Archdiocese of San Francisco at St. Patrick's Seminary and University in Menlo Park, CA**. He has a strong interest in how the truth, the good, and the beautiful can help bring others to know God and to establish a deep and personal relationship with Him. He found out about IAP during the series of talks given by IAP at the seminary.

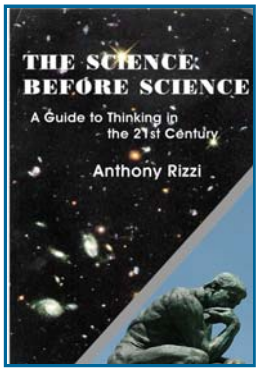
Gerardo joins the Institute for Advanced Physics with 12 years of aerospace industry experience in Human Spaceflight, Strategic Missile Defense, Satellite Space Systems, and Next Generation Military Jet Aircraft Engine programs supporting international (JAXA, ESA, UK) and domestic (NASA, DoD, U.S. Military) customers.

Three months before graduating **San Jose State University** with a B.S. in Aerospace Engineering in 2004, he joined **Lockheed Martin** at the **NASA Ames Research Center** working on the **Space Station Biological Research Project**. He continued his M.S. studies in Aerospace Engineering through the **Lockheed Martin and SJSU Cohort Program**. As a graduate of Lockheed Martin's Engineering Leadership Development Program, he had the opportunity to rotate within the company supporting various defense programs. It was in 2014 when he discerned his call to join the seminary. He is expected to be ordained in 2022, please keep him in your prayers. He is happy to have completed the course and to now be an associate member. He completed the course (level I) on April 19, 2018.

Science Before Science Study Group in Texas

Giuseppe Rizzi, IAP Volunteer Member, is leading a group study of *The Science Before Science: a Guide to the Thinking in the 21st Century* (SBS) by Dr. Anthony Rizzi. The group meets in College Station, Texas on Saturday evenings to view the SBS DVD series and discuss the reading and its application in their daily lives. The participants, primarily college students, are very excited to have the fundamental truths found in SBS explained to them for the first time. Dr. Rizzi made a personal appearance in April to answer questions. **Anthony Coniglio** is assisting Giuseppe via internet participation. Coniglio is a junior studying mathematics, physics, astronomy, and music at **Indiana University Bloomington**.

SBS groups have been and are now occurring around the country. We encourage you to form your own group in your local area. Order your copy at smile.amazon.com/ and choose the Institute for Advanced Physics as your charity! *Photo: Giuseppe, second from left, pictured with some of the group members.*



American Maritain Association Conference

by Ken Klenk, Certified Member

The annual meeting of the **American Maritain Association** (AMA) was held on March 1 to 3, 2018 at **St. Charles Borromeo Seminary** in Philadelphia, PA. **Dr. Anthony Rizzi**, Director of the Institute for Advanced Physics (IAP), was an invited plenary speaker at this top level Thomist conference. He gave a provocative talk entitled, *The Real Conflict between Science, Morality, and the Faith: Why are we losing on every front? We have found the enemy and he is us!*. Dr. Rizzi spoke about how all of us are affected by scientism and the habits of thinking that it creates in us. He revealed the eye-opening point that the 1960's was the time when the thinking of the scientism hit the popular culture for the first time. The scientism springs from having a physics that is solely equational. He pointed to the deep principle shift that occurred at that point in the core thinking of our popular culture (a step 1 shift -- see *How to Learn in Four Steps* by Anthony Rizzi[1]). The results of this shift (step 3) was clearly seen in the profound changes in the moral and spiritual elements in music and film that was clearly visible beginning in the early 80's and increasingly obvious since then. This problem can be traced to our knowledge, i.e., our science. How we think is how we act and live. He talked about the thinking and habits that began with Descartes profound revolution in math (the advent of quantiological math, the use of symbols and systems of thought to encapsulate the first property of physical things--quantity--this can be simply described as the discovery of algebra properly speaking!) This discovery led very soon afterward to the development of modern physics, (i.e. empiriometric method, roughly said equational physics). He explained that the misdigestion of this new method, the modern scientific method, led to an increasing predominance of philosophical idealist thinking in the culture. This new base to our cultural thinking affects everyone.

Dr. Anthony Rizzi *(center)* with AMA participants and IAP Advisory Board Members Dr. John Hittinger *(left)*, professor of philosophy University of St. Thomas, Houston, and Dr. Jude Dougherty *(right),* Dean Emeritus School of Philosophy, The Catholic University of America.

In particular, through inculturation of the fruits of the thin base physics, the principles of the popular culture finally were robustly affected starting in the 60's.

Now, one of the results is that most people, though they are not scientists, still think they know things but it is, in fact, just a faith based on authority. Often times these beliefs go against things they actually see! Everyone, Christians included, is scientized; there are different levels. Some operate within the scientism with a more complete acceptance; others operate within it rejecting some of its most virulent conclusions, but not its principles. Dr. Rizzi emphasized that philosophy and science are the same thing, that man is made for the truth, and that the work of the Institute for Advanced Physics is directed to the reintegration of science. Dr. Rizzi's talk was very well received.

In fact, near the end of his talk the President of the AMA interrupted to announce that **Archbishop Charles J. Chaput** of Philadelphia,

[1] Institute for Advanced Physics, *Physics and Culture* magazine at www.iapweb.org/iapmagazine.htm

the next speaker, was on the phone saying he would not be able to make it because of the snowstorm in the area. The President went on to say that the Archbishop would like Dr. Rizzi to take his time. Dr. Rizzi used this extra time to respond to the questions from the very-interested audience.

Also, attending the conference was **Dr. Ken Klenk**, a Certified Member of the IAP since 2006. His talk was a submitted paper entitled, *On Uniting the Sciences of the First Order of Abstraction: Physica and Modern Physics*. He talked about the history of restoring the teaching of St. Thomas Aquinas. The call came

Dr. Ken Klenk and session chairman Dr. J. Raymond Zimmer

from Leo XIII in the late 1800s at which time Thomism was almost gone. Jacques Maritain responded to this call making significant first steps in understanding the nature of modern science. And, in the early 1950's, on a parallel track, for the *first time in the modern world*, a small group learned the Thomistic teaching that physics is the first science. This group was the Albertus Magnus Lyceum at River Forest, Illinois. Their efforts, however, failed. Dr. Klenk pointed out that IAP is the first and only institution that is actually answering the call at the fundamental level by grounding modern science in the first science of physics. He stressed how the IAP has been working successfully on this problem for the past 15 years and has made amazing progress in integrating the foundational principles into modern physics and beyond.

Frank Camacho, an IAP Associate Member, also attended and provided information to the attendees about the various publications of the IAP and discussed with philosophers the work of the Institute, helping them to understand the many advances of the IAP.

Frank Camacho, IAP Associate Member

The Institute for Advanced Physics presents its 16th annual conference

Quantum Field Theory

for IAP members

and a special parallel session

Science Before Science

for volunteers and family members

The sessions conclude with a special 15 year anniversary celebration banquet and blessing of the members by Archbishop Salvatore Cordileone of San Francisco, CA (video appearance)

July 25 – July 28, 2018
Louisiana State University

Science Before Science Study Group in Georgia

Science Before Science study groups are meeting at schools, homes, and churches around the country. We encourage you to start a group and contact our office if you have questions info@iapweb.org . Read about what one group is doing in Duluth, Georgia.

A group formed to discuss *The Science Before Science: A Guide to Thinking in the 21st Century* and began meeting at **St. Monica Catholic Church in Duluth, Georgia** in February. The group was formed after a providential meeting between **IAP Associate Members Anthony DiCarlo and Fletcher Williams** *(see photo)* and St. Monica parishioners Nicholas DiCarlo (Anthony's brother) and Brian Lane. Participants at St. Monica for the opening discussion were the **Reverend Augustine Tran** (St. Monica Priest-in-Residence and former masters candidate in aerospace engineering at **Georgia Tech**), **Nicholas DiCarlo**, **Brian Lane**, **Michael Nappi**, **David Rodriguez, Phillip Sharp, Casey D'Amato**, and **Adam Slide**, and participating by means of video conference were **Brendan D'Amato** in North Carolina, and **Krish Ramanathan** in Greenville. Also participating are **Robert Lane**, a high school sophomore, and **Eric Adjei-Danquah** and **Dan Brndjar**, fellow teachers with Fletcher in the **University of Notre Dame Alliance for Catholic Education** teaching fellows program.

The discussion group meets two Saturdays each month and it is being led by **Fletcher Williams** *(see photo)*. The group is discussing both the *Science Before Science* and *A Kid's Introduction to Physics (and Beyond)* and each meeting focuses on one chapter of SBS and the related chapters of KIP. Fletcher guides preparation for each meeting by sending vocabulary to learn and study questions in advance of the meeting. Each meeting begins with prayer followed by a review of vocabulary, and by the most recent meeting, most participants had learned the nine categories of accidents using the pneumonic QQRARePOET. Participants brought a rich diversity of backgrounds and experience to the group, and there was lively discussion at each meeting, often continuing well after closing. Fletcher closed each meeting with a clear, concise, and informative summary of the chapter, which was followed by a closing prayer. All meetings were recorded so that members who were absent could still benefit from the discussion. At our next meeting, we will discuss the final chapter, and already, members have discussed starting another cycle of discussion with new participants.

Institute for Advanced Physics library privileges at ***Louisiana State University*** *were extended for two years thanks to our sponsor* ***Dr. James P. Stoner****, Professor and Director of the Eric Voegelin Institute in the Department of Political Science at LSU.*

Check out IAP's

NEW online magazine

Journal of Physics and Math

What is Math Really?

Read this article and more at:
www.iapweb.org/iap_journal_math_phys.html

This article also published on the archive.
https://arxiv.org/abs/1804.05955

In order to continue our important research and education outreach, we need your help. **Please support our work with a $2 donation for each article you read** in our online magazines *Physics and Culture* and *Journal of Physics and Math*. Here is the link to donate: Donate

Please consider a larger donation to facilitate our many activities. Thank you

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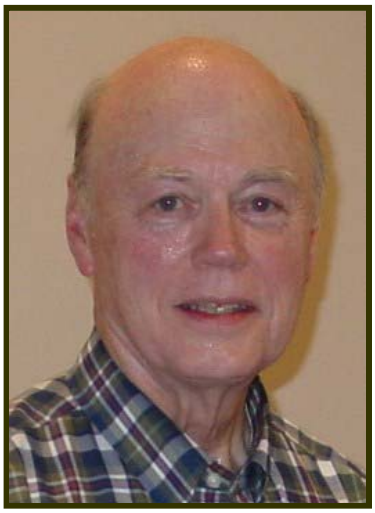
South Carolina Members' Meeting

Several IAP members near the Upstate of South Carolina have been getting together regularly to eat breakfast and discuss things going on in the culture. The most recent IAP breakfast was on January 27, 2018 in Greenville, SC. The IAP members in attendance were **Dr. Murray Daw**, **Dr. Dan Welch**, **Anthony DiCarlo**, and **Fletcher Williams**. **John Sudnick**, a member candidate (going through associate member program) at the time, also joined. The group discussed a recent "controversy" on social media that centered on the question "is water wet?" (*see* article on page 3). Mr. Fletcher and Mr. DiCarlo shared what they had seen and heard from their students at the high schools where they teach regarding this "controversy". The group discussed how this is another example of the loss of an understanding of basic physical truths and the urgent need to get IAP's materials into more schools. The group also discussed the challenge of educating those close to us in our increasingly anti-truth culture, where one is seen as being an extremist or a radical of some kind if one insists on the existence of fundamental truths.



Dr. Dan Welch, IAP Certified Member since 2008, is a professor of physics at Wofford University using Physics for Realists. He participates in the South Carolina members' meetings.

What is Math Really?

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), IAP magazine and now IAP Journal of Physics and Math have been initiated.

In this article (complete article located on the IAP web site at the below link), Dr. Rizzi shows us how the basic physics teaches us the meaning of something that we probably think we already know, but actually don't!

Abstract: Modern mathematics is known for its rigorous proofs and tight analysis. Math is the paradigm of objectivity for most. We identify the source of that objectivity as our knowledge of the physical world given through our senses. We show in detail, for the core of modern mathematics, how modern mathematical formalism encapsulates deep realities about extension into a system of symbols and axiomatic rules. In particular, we proceed from the foundations in our senses to the natural numbers through integers, rational numbers, and real numbers, including introducing the concept of a field. An appendix shows how the formalism of complex numbers arises.

Introduction

We are all taught math from a young age, but, practically none of us is ever told what math is truly all about. We learned how to do it, what worked and what did not, but not usually why, and seldom where any of it came from. As we moved from arithmetic to fractions to algebra, any thoughts we had of where math came from became more and more hazy. Sets, axioms and proofs begin to take center stage. Classrooms around the country in middle and high school years ring with "What will I ever use this for?" and "What does this have to do with life?" To most, math is now simply a tool for certain technical professions, not something of any real interest or relevance. Such professions are considered to be extremely important, but very hard and best reserved for those trained technicians who can do such things without hurting their brains too much. (Or, there is always a sneaking suspicion, maybe they are just more willing to do so?) They are thought to be like the acrobats at the circus who jump through hoops of fire and stand on thin wires or like the lineman fixing the high voltage equipment on telephone polls high in the air, but without any of the excitement of these activities.

By contrast, someone like myself, who grows up and does enter such a mathematical profession (I am a physicist), feels comfortable saying, as the renowned physicist Eugene Wigner did, how amazing is "the unreasonable effectiveness" of mathematics in revealing a deep understanding about the world. Those who take up mathematics for a profession will often think of math as existing out there in some realm of unchanging things, which Plato so aptly expressed. Other mathematicians will see math as it is treated in formal proofs that dominate so much of modern mathematics, that is, as simply the necessary

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Anthony Rizzi, Ph.D., *founder and Director of The Institute for Advanced Physics (a 15 year old non-profit organization with Vatican backing), gained worldwide recognition in theoretical physics by solving an 80-year old problem in Einstein's theory. He has physics degrees from MIT and Princeton University. Prior to IAP, he was senior scientist at Cal-Tech's Louisiana LIGO and taught at LSU. LIGO won the 2017 Nobel Prize in Physics.*