

The Institute News

- IAP 20th Anniversary Family Conference held at Louisiana State University!
 - *Science Before Science* parallel conference
 - Quantum Field Theory conference
 - On-site quantum mechanics and gravity experiments
 - Ball and banquet
 - Conference photos
 - Archbishop Salvatore Cordileone of San Francisco address
- New Associate Members: Christian Captain, Kateri Robson, Isaac Vaughn
New Associate Humanities Member: Chris Hoffman
- *The Interstitium: Keeping You One Substance!*
- IAP community news: Quantum mechanics study group, *College Science Before Science* study group, IAP members awarded PhDs, Computer upgrade in IAP office
- *Love and Friendship Updates*: Audio article completed, YouTube shorts published, upcoming Live TV show, related article published

IAP 20th Anniversary Family Conference held at LSU!

photos courtesy of Maikel Garcia, IAP Associate Member



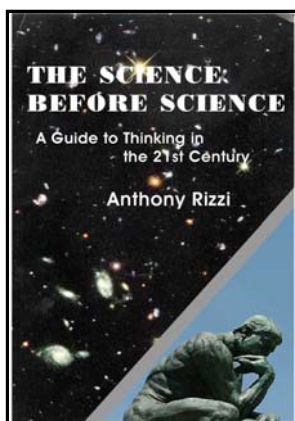
This year's conference was a spectacular event! There was much growth in truth and in friendship with each other. It was a joy-filled event celebrating IAP's tremendous success over the last 21 years. In particular, the conference consisted of two parallel tracks: A "Quantum Field Theory" (QFT) track and a Science Before Science (SBS) Track. The latter was for Certified and Associate members' wives and older children as well as volunteer members. It was the Twenty-second Annual Institute for Advanced Physics (IAP) Conference and was held at Louisiana State University (LSU) in Baton Rouge on July 16 to July 20, 2024.

IAP Celebrates 20 Years with Special SBS Parallel Conference!

by Anthony DiCarlo, IAP Associate Member and Membership Director
photos courtesy of participants



The annual Institute for Advanced Physics (IAP) Conference was held on Louisiana State University's (LSU) campus in Baton Rouge from July 16 through July 20. This year's conference was a special one devoted to celebrating IAP's 20th anniversary but a year after the actual 20th anniversary. On March 21st, 2024, IAP celebrated its 21st birthday, so the celebration technically occurred during the 22nd year of IAP's existence. The celebration was delayed for a variety of reasons, one of which was to allow the IAP 20th Anniversary celebration to coincide with the 20th Anniversary of the publication of Dr. Rizzi's monumental book *The Science Before Science*

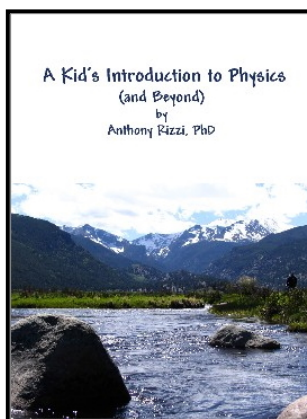


Science Before Science (SBS) (published June 24, 2004). Dr. Rizzi's writing of this book sparked all the deep research and discoveries that IAP alone has done and made and is currently doing and making.

And so, it was fitting that the conference this year included a

Science Before Science track for volunteer members, family members of IAP members, and a few special guests, as well, which ran parallel to the Quantum Field Theory (QFT) track that certified and associate members attended. The Quantum Field Theory track met in room 424 of Hodges Hall (see article on QFT track), but here we focus on the SBS track.

The SBS track was led by IAP associate members **Anthony DiCarlo**, **Ethan Robson**, and **Brendan D'Amato**. They were assisted by IAP associate member **Brian Lane**, IAP associate member candidates **Christian Captain** and **Kateri Robson**, and IAP volunteer members **Nicolo Rizzi** and **Michael Rutland**.



The SBS Conference, which was held at the LSU Cook Hotel and Conference Center, began on Wednesday afternoon with an informal lunch followed by a primer on Dr. Rizzi's book *A Kid's Introduction to Physics*

(and Beyond) led by **Nicolo Rizzi**. Following the primer, SBS Conference participants watched "Return to Wisdom", an IAP



production in which Dr. Rizzi analyzes various examples of the "equation-alone" physics mindset and its impact on our culture. Then they enjoyed pizza and enjoyed each others' company before turning in for the evening to get ready for the full days that lay ahead.

On Thursday morning, **Fr. Brent Maher**, a priest of the Archdiocese of Baton Rouge, offered Mass in the Cook Conference Center for SBS Conference participants. During Mass, Fr. Maher preached on the importance of truth and study for all of us, using passages taken from *The Intellectual Life* by A.G. Sertillanges, O.P.

Mass was followed by breakfast at "the Lodge" in the Cook Hotel. Thursday's SBS Conference sessions began in the Cook Conference Center after breakfast with the praying of the St. Thomas Aquinas Study Prayer, an opening song (John Denver's *Singing Skies and Dancing Waters*), and introductions. **Anthony DiCarlo** gave a brief presentation on the four steps to learning (see Dr. Rizzi's article *How to Learn in Four Steps* available at IAPweb.org/iapmagazine.htm#vol1) and the IAP Central Theorem (see IAPweb.org/mission) which proves the need for the work of the IAP and the *essential* importance of the education that the conference participants had come to receive. After this, presentations on Chapters 1-6 of SBS began, with **Ethan Robson**

presenting Chapters 1-4 and **Brendan D'Amato** presenting Chapters 5-6.



The presentations on the chapters of SBS were broken up by small and large group discussions on the material, which gave SBS Conference participants an opportunity to better digest the content of SBS and its impact



on our day-to-day lives, as well as to ask questions. Following each lecture, small groups were formed and group leaders asked questions

to each member of his group to probe for understanding and to prompt conversations. After this, the small groups came back together to form a large group, and helpful insights were shared and questions were addressed. Meal times provided additional opportunities to extend conversations and deepen understanding. Many thought-provoking and enlightening conversations were had during these times.

Before lunch on Thursday, SBS Conference participants took a group picture, and then, while eating lunch, enjoyed watching the *Holy Gassers* skit starring IAP associate member **Dr. Ronald Heisser** which highlights in a funny but thoughtful way the need for us to use the grace God gives us to grow in truth and the living of that truth. It does this by emphasizing the need to avoid the ridiculous, but real, temptation to misuse that grace to justify our lives as they already are. After lunch the group prayed the Angelus together before resuming presentations and discussions on SBS.

At the end of Thursday's lectures, **Anthony DiCarlo** gave a brief presentation that



addressed how IAP alone is doing the work of grounding modern empirical science in the basic physics, the simple truths that we get directly through our senses, and that highlighted the urgency of this work. Following this presentation, the group prayed together for the IAP and the success of its mission.

After the SBS lectures on Thursday, SBS Conference participants enjoyed dinner together at the Cook Conference Center. This

was followed by a cloud chamber experiment led by **Ethan Robson, Nicolo Rizzi, and Alonso Vela**. The experiment was a big hit! It



connected the two tracks of the conference together because this experiment reveals the paths of particles coming from outer space. And, these particles are described by Quantum Field Theory, the topic of the other track.

After the experiment, SBS Conference participants had social time and walked to Insomnia Cookie and Highland Coffee to get some fresh air and some exercise, as well as a treat. Conversations and fellowship continued late into the evening.

Like Thursday, Friday began with Mass offered by **Fr. Brent Maher**, whose sermon further discussed the importance of study, at the Cook Conference Center followed by breakfast at "the Lodge". Presentations on the chapters of SBS resumed after breakfast with the praying of the St. Thomas Aquinas Study

prayer. Friday's presentations were led by **Anthony DiCarlo** and covered Chapters 7-10 of SBS. As on Thursday, the presentations were broken up by small and large group discussions, prayer, and lunch. On Friday afternoon, Anthony DiCarlo led a review of the IAP Central Theorem and the four steps of learning to conclude the SBS Conference presentations. Everyone commented on how much they learned and how important it all is.

Following this, the SBS Conference participants and the QFT Conference participants came together at the Cook Conference Center for a special treat: a Q&A session with **Dr. Rizzi!** This session included

especially the foundational truths on which all others depend. Thank you, IAP, for 22 years of giving us these truths, that our joy may be full!



many good questions from conference participants and powerful insights from Dr. Rizzi. SBS Conference participants also got to show off some of what they had learned during the conference. The Q&A session ended with Dr. Rizzi leading the group in praying the IAP Prayer.

Following the Q&A session, the participants from each conference got an opportunity to visit with each other while enjoying soda and coffee before going off to change into their formal attire for the Ball and Banquet. This wonderful climax of the conference is discussed in a following article. It was indeed wonderful!

The 20th anniversary SBS Conference was a powerful event, full of learning, fellowship, and the joy that comes from living the truth,



Quantum Field Theory Conference

by Ken Klenk, Ph.D., IAP Certified Member and
Fletcher Williams, IAP Associate Member and Assistant Professor of Practice



(left to right)(standing) Fr. Neal Nichols, Benjamin Luna, Giuseppe Rizzi, Dr. Ken Klenk, Capt. James Scheuer USSF, Casey Izard, Dr. Anthony Rizzi, Dr. Ronald Heisser, Fletcher Williams, Dr. Stephen Strickland, Michael Rust, Maikel Garcia, *(front row, kneeling)* David Giroir, Dr. Murray Daw, Frank Camacho, Isaac Vaughn, Anthony Coniglio, *(front row left, tablet)* Randy Nichols

The Institute for Advanced Physics (IAP) 22nd annual summer conference, Physics for Realists XXI: Quantum Field Theory (QFT) VI, was held on July 16-20, 2024 on the campus of Louisiana State University. As mentioned in the previous article, this was a special 20 Year Anniversary Celebration that included a parallel Science Before Science Conference (see SBS Conference article), concluding in a ball and banquet on the last night! As already stated, on March 21st, 2024, IAP celebrated its 21st birthday, so the celebration technically occurred during the 22nd year of IAP's existence.

After enjoying lunch at Chipotle restaurant nearby, the QFT participants got started on Wednesday afternoon with a Primer session



led by **Dr. Murray Daw**, who reviewed the deep groundbreaking insights that are contained in two of the textbooks published by the Institute – *Physics for Realists: Electricity and Magnetism* and *Physics for Realists: Quantum Mechanics*. These insights are the fruit of many years of

hard work and careful IAP research to understand the rich new information given to us by modern physics in light of the first principles that we get through the senses. On Wednesday evening, in addition to enjoying pizza, soda, and good conversation, the group took part in a discussion led by **Fletcher Williams**. He covered the IAP Central Theorem and presented examples of some of the errors



in the culture that are proven to arise by the Central Theorem.

After offering morning Mass at the chapel, **Fr. Neal Nichols**, FSSP, led opening prayers at the lecture hall. Then, **Dr. Anthony Rizzi**, IAP founder and director, formally welcomed the participants. He gave a status report on the *Quantum Field Theory* (QFT) textbook which is next to be released in the series of *Physics for Realists* textbooks. Before lunch, **Frank Camacho** gave a review of the high-level quantum mechanics content contained in *A Kid's Introduction to Physics II*.

In the afternoon, there were talks on the content being developed for the textbook on



Quantum Field Theory, given by **Dr. Rizzi**,

including the use of path integrals to understand Brownian motion and QM as well as how to arrive at the Schrödinger Equation from the path integral formalism and vice versa. **Fletcher Williams** gave a presentation entitled, "How Modern Physics Radically Changes Us" showing how specific examples of errors in modern physics propagate up to our on-the-ground thinking and living. **Dr. Rizzi** continued the discussion of QFT topics addressing Feynman Rules and a detailed exposition of Bremsstrahlung. **Fletcher Williams** presented "Living What You've Learned, Step 3ing IAP", (created with the help of **Anthony Coniglio**), which, building on the principles contained in the article "How to Learn in Four Steps," fleshes out the need to act on the principles being learned through IAP and gave concrete approaches to doing so. **Dr. Rizzi** gave a presentation entitled, "Finally, What is a photon?" which is a fruit of IAP's QFT research. **Dr. Daw** reviewed the Standard Model as part of the QFT textbook material, which helped the participant's appreciate the work still before us



in wrangling with the "raw empiriometric" information that needs to be refined. **Giuseppe Rizzi** presented "ChatGPT and AI II" following up on his previous update on the status of AI in the world and what implications are unfolding. **Frank Camacho** and **Maikel Garcia** reviewed the IAP Virtues and discussed the virtues app which is in development and which many members got

beta versions of on their phones. The afternoon session ended with a closing prayer and the singing of the Salve Regina led by **Fr. Nichols**.

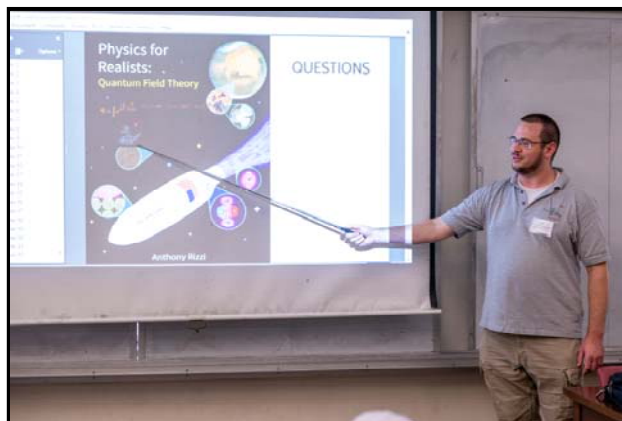
The Thursday evening session consisted of several experimental demonstrations by **Dr. Stephen Strickland** (see next article). This was followed by a discussion of topics of interest to the IAP. **Fletcher Williams** led a discussion on the life of Walt Disney based on the book *Walt Disney: An American Original*, inspiring the group to emulate the virtues embodied by Disney throughout his life's work. This revealed the amazing character of Walt Disney and his important and excellent contribution to American culture.



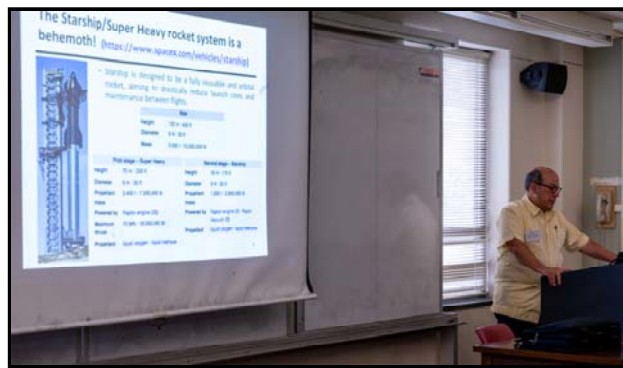
On Friday morning, after Mass offered by **Fr. Nichols** and breakfast in common with fraternal conversation, the sessions resumed. The updated table of contents for the QFT textbook was reviewed by **Dr. Rizzi** and discussed by the group. **Fletcher Williams** gave a presentation called – “Step 3ing IAP: Setting Goals”, which followed up on the previous day's presentation, giving more concrete advice about how to practically achieve what had been discussed the day before.

Dr. Rizzi presented a principled and chronological overview of the growth of scientism in his talk entitled, “The Scientism after Science”, showing, including current examples, how scientism has crept into our culture and now is universal at all levels of society and not just those in academia.

Following the Angelus and group photos, the participants enjoyed lunch together.

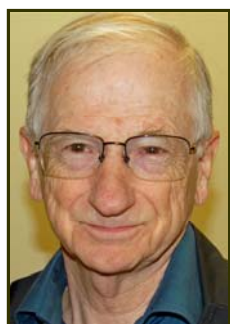


After lunch the group prayed the rosary. **Dr. Strickland** discussed the concept for the design of the QFT textbook cover. **Mr. Camacho** gave a status report on the status of manned space missions. The group then discussed assignments and deadlines for various efforts which surfaced during the conference.



At this point, the QFT and SBS parallel conference merged together Friday mid-afternoon. **Dr. Rizzi** hosted a Q&A session for the SBS Conference attendees that the QFT participants also attended. Afterwards, despite the deluge of rain that made cross-campus walking impossible for a time (and got several members soaking wet, but they “renormalized” with the use of many paper towels!), both sets of conference attendees changed into formal attire and assembled at the Cook Conference Center for the ball and banquet to celebrate the 20th Anniversary of the Institute (see Ball and Banquet article). After watching and discussing the “Holy Gassers” skit, attendees enjoyed a

special address (text is reproduced in a later article) given by **Archbishop Salvatore Cordileone** lauding the tremendous accomplishments of IAP, concluded by his apostolic blessing. Archbishop Cordileone was not able to attend in-person because of the National Eucharistic Conference that was unfortunately at the exact same time. However, he very much wanted to be present in spirit, so he sent his remarks in a video format. Following this was a special address given by **Dr. Rizzi** and a presentation of awards. The evening was capped off with a delicious banquet, dancing, and even a concert given by several musically-talented IAP members, including world-class pianist **Anthony Coniglio** who played several selections on the piano, **Steven Strickland** who joined in on one on the violin, as well as **Fletcher Williams, Benjamin Luna, and Michael Rutland** who sang “Battle Hymn of the Republic.” Conversations continued well into the night, long after the ballroom closed down. There is nothing like fellowship grounded in truth and the pursuit of it!



Article contributor Dr. Ken Klenk has been an IAP Certified Member since 2006. Before retiring, he worked as a scientist on several NASA ozone programs and managed several large science contracts supporting science and data management projects at NASA Goddard Space Flight Center, Jet Propulsion Laboratory and the U.S. Geological Survey.



Fletcher Williams has been an IAP associate member since 2017. He is a high school math and physics teacher at Knoxville Catholic High School in Knoxville, TN. He is also a physics PhD student at the University of Tennessee at Knoxville, as well as IAP Assistant Professor of Practice.

20th Anniversary Conference QFT and Gravity Experiments

by Stephen Strickland, Ph.D., IAP Certified Member
and Fletcher Williams, IAP Associate Member and Assistant Professor of Practice



On Thursday evening, July 18th, at the Institute for Advanced Physics (IAP) Annual Conference, Dr. Stephen Strickland conducted a series of experiments demonstrating fundamental physical principles for discussion among the IAP members.

(1) The Cavendish Experiment - The Gravitational Torsion Balance

Dr. Strickland opened with an experiment originally performed by Henry Cavendish in 1798 (see "Experiments to Determine the Density of the Earth" by Henry Cavendish). The experiment demonstrates that two bodies of ordinary masses are able to exert gravitational forces upon each other, and when measured with due care, one can measure the gravitational constant G used in Newton's Universal Law of Gravitation.

The torsion balance, which is at the heart of the apparatus shown in the picture at the end of the article and sketched in Figure 1 is comprised of two small

lead spheres mounted to a thin cross bar which is suspended in the middle by a very fine torsion wire from the top of the apparatus. The torsion balance is housed inside a small box with transparent

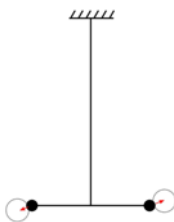


Figure 1

walls so that no wind currents affect it, and at equilibrium, the torsion balance is parallel with the sides of the box. To perturb the balance, two large lead spheres are introduced and placed very near to (but not touching) their respective small lead spheres. The gravitational forces of the large lead spheres acting upon their respective small lead spheres impart impetus in the two small lead spheres. Although the impetus in each small sphere is oppositely directed, because it is imparted to the spheres at the ends of the cross bar, as they begin to move in straight-line motion, the cross bar, which holds them together, exerts centripetal forces on each sphere. Thus the impetus is changed in such a way as to move the spheres in circular motion (captured empirically by angular momentum). As the torsion wire twists, it acts upon the cross beam like a spring trying to restore its equilibrium, it applies forces (captured empirically by torque) proportional to the angle of twist. The result of this interplay between the angular momentum of the torsion beam and the torques from the gravitational forces, the torsion wire, and drag is a damped oscillation whose period is roughly 8 minutes and whose exponential decay time constant is about 32 minutes. After a considerable span of time, the beam comes to rest displaced from its original orientation. This displacement is

indicative of the strength of the gravitational forces as it comes from the balancing of the torques due to the gravitational forces and due to the torsion wire. To assist the eye in seeing the displacement of the torsion beam, a mirror is mounted to the center of the beam, and a laser is shone off the mirror onto a screen placed far away. As the torsion beam turns through an angle, the laser dot moves across the screen at twice the angle due to the law of reflection.

With this apparatus, one can measure the angle of displacement along with the torsion constant (from the period of oscillation), and then determine the magnitude of the gravitational forces acting upon the small lead sphere. Then using Newton's Universal Law of Gravitation, the gravitational constant G can be calculated. Cavendish went on to use G to determine the mass of the Earth, hence the title of his publication "Experiments to Determine the Density of the Earth". Since Cavendish's time, we have used G along with Kepler's third law to determine the masses of other astronomical bodies (e.g. the mass of the sun, of Jupiter, etc.).

The essential point that the demonstration illustrates is that bodies of ordinary mass (a few kilograms) are able to act upon each other gravitationally without being in direct contact. More precisely, they act upon the plane between them, activating in the plane the gravitational field, which the plane propagates out from those parts in contact with the bodies to those parts further away. This gravitational field (a power of the plane) then acts upon the small massive spheres imparting the impetus to turn the torsion balance.

(2) The Millikan Oil Drop Experiment

The second experiment Dr. Strickland presented was the Millikan Oil Drop Experiment which was originally used to show that charge is discrete and to measure the quanta of charge. The experiment

demonstrates that a charged oil droplet can be suspended and manipulated by the phi-field (thru the electric field described by $\text{grad}(\phi)$) force produced by a parallel plate capacitor.

The oil drops were produced by a spray nozzle wherein a swift flow of air draws oil out of a reservoir and up a straw into the air stream (the Bernoulli effect), and then the turbulence of the air flow breaks apart the oil into fine droplets. Even though the oil is electrically neutral, having equal numbers of protons and electrons, during the turbulent process, droplets form that have a net charge, either having more or less electrons than protons. The nozzle was directed into a walled chamber so that no external air currents could disturb the droplets once the experiment begins. The ceiling and floor of the chamber were made of conductive brass, which were charged by a power supply, and a switch controlled which of the plates were charged positively or negatively.

In the original experiment, each droplet was examined in two ways: (1) falling at terminal velocity, (2) rising at terminal velocity under the power of an electric field opposite the forces of gravity and drag. By the first examination and by knowing other measurements (e.g. density of the oil, viscosity of the air, etc.), one can determine the radius of the droplet and thereby its mass. By the second examination, one can determine the charge of the droplet.

Millikan repeated this experiments for many such droplets. Because of the violent way that the oil droplets are prepared, each oil droplet not only has a different mass but also a different amount of charge (e.g. some droplets might have 2 or 3 electrons more than protons while others many 2 or 3 too few). Millikan noted that the charge of each droplet was very nearly an integer multiple of a constant, thereby showing that charge is discrete and measuring the fundamental charge.

In the experiment presented at the conference, a Raspberry PI powered camera was mounted to a microscope that gazed into the clear side-wall of the chamber. The images

collected by the camera were projected onto a wall for everyone to see. The droplets were illuminated from the side with a white LED light. On injecting the droplets, a stream of fine particles shone on the screen, each particle looking like a tiny star in a dark background. At first, we let the droplets begin to settle, the heavy droplets falling quickly at a fast terminal velocity while the lighter droplets settled slower. The lighter droplets also jiggled back and forth upon the screen, an effect called Brownian motion. These lighter droplets are so tiny that rather than being collided with air molecules from all directions (and thus having an average net zero transfer of impetus), they regularly have a side-to-side imbalance of collisions with air molecules. This imbalance leads to the activation of impetus in one direction which, followed by imbalances in the other direction, leads to the activation of impetus in other direction, etc. The smallness of these droplets led Millikan to republish his work examined under a modification to the viscosity of air to account for the apparent viscosity such tiny spherical bodies would see.

On turning the switch, the plates charged, and the droplets moved quickly under the action of the electric field. In charging the plates (say top plate positive and bottom plate negative), these plates activate in the plana a phi field whose disposition reflects the type of charge on each plate. The plana propagates the phi field from these parts near the plates to the parts further away from the plates, and in so propagating, the phi field develops a gradient between the plates as depicted in Figure 2. The plana causes an electric force proportional to the gradient of the phi field which activates impetus in the oil droplets. The positively charged droplets receive impetus towards the negative plate and the negatively charged droplets receive impetus towards the positive plate.

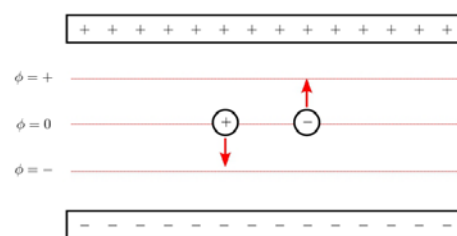


Figure 2

The essential point that this demonstration reveals is that the plana has the power to cause impetus in charged bodies, and that by careful measurement, we can show the discrete nature of charge.

(3) LC oscillator circuits

In the third experiment, Dr. Strickland demonstrated the operations of an LC oscillator circuit (a.k.a. a tank circuit). This circuit is comprised of a capacitor (initially charged) connected to a solenoid via an adjustable resistor as sketched in Figure 3 and shown in the picture at the end of the article.

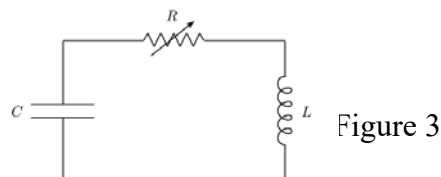


Figure 3

The capacitor was initially charged and the resistor's resistance was initially set to its minimal value (which we will consider for now to be negligible). The capacitor is allowed to discharge through the solenoid. What forces are at play in the circuit?

First, we have the phi-field (electric) force, which, as we said above, is proportional to the strength of the gradient of the phi field which gives impetus to the mobile electrons in the wire and solenoid. Once mobile electrons gain impetus and move off the capacitor plates the charge on the plates will decrease. This gradient is strongest when the capacitor is fully charged and will weaken to nothing as the net charge on each plate goes to zero.

As the electrons begin to move, they will activate an A field in the surrounding plana, with

a much stronger A field in and around the solenoid due to having several loops of wire stacked next to each other, all with electrons moving (on average) in the same direction throughout.

That leads us to the second, which is the A-dot force. That is, the plasma will try to maintain the A field in its given state by causing a force on nearby charged bodies with a strength proportional to the time rate of change of the A field (see *PFR: Electricity and Magnetism* and *A Kid's Introduction to Physics (and Beyond) Vol. II*). Since, immediately before the capacitor began to discharge, there were no moving electrons and therefore no A field, the plasma attempts to keep the A field zero by causing a force opposite the direction of the phi-field force. So, the next moment later, the mobile electrons have a small amount of average impetus activated in them, and thus cause an A-field in the plasma. At this time, the A-dot force kicks in to activate an opposing force on these electrons. Initially, the A-dot force is the largest it will be because the current increase is the largest, because the capacitor voltage (and thus the phi-gradient) is its largest (to fully understand this see *PFR-EM*, especially pages 183 and 410, as well as a "Knowledge Bite" to come at iapweb.org/magazine, which properly explains how the current and A-dot effect it causes interplay with each other under the action of the phi-field force of the capacitor). This means there is a tiny, but steadily increasing current, and thus the charge on each plate decreases.

However, as the current flows, causing the charge of each plate to decrease towards zero, the gradient in phi decreases, meaning the phi-field (electric) force decreases, and thus the flow rate of electrons increases, but at a decreasing rate. This continues until the plates have no charge and the rate of increase of current goes to zero, at which point the A-dot force momentarily goes to zero. The current having hit its maximum value now begins to

decrease. Why? Because of the direction of that current, each plate begins to accumulate charge opposite the types of which it started, leading to phi-force directed opposite the flow.

Now that we have a decreasing current, the A-dot force steps in to try and maintain it, to keep the A-field from changing. Again, the A-dot force only partially slows down the change. Meanwhile, the phi-field (electric) force grows stronger with increasing charge on the plates while the A-dot force increases as the rate of current change increases (again see *PFR-EM* pages 183 and 410), and the current decreases as the average impetus of the electrons goes to zero. At this point, we have the inverse of the situation we started with (oppositely charged plates and zero current), and thus we will have the opposite progression play out until the plates are reset to their original charge state, forming a complete cycle.

This LC circuit changes analogously to the way that a spring-mass oscillator moves back and forth. For more detailed analysis, see *PFR: Mechanics* and *PFR: Electricity and Magnetism*. With the experiment presented at the conference, an oscilloscope measured the voltage across the capacitor plate as a function of time. The voltage is proportional to the charge on the capacitor which was analogous to the displacement of the spring in the mass-spring oscillator, and through the oscilloscope, we could clearly measure the oscillations (and the decay, as there is resistive force in the wires, analogous to a damping force for the spring-mass oscillator). In order to charge the capacitor between experiments, a function generator was set to produce a very low frequency square wave. The experiment began when the function generator fell to zero volts so that the generator became as a conducting wire in the circuit diagram.

(4) Electron Spin Resonance

In the final experiment, Dr. Strickland demonstrated the operations of an Electron

Spin Resonance Spectrometer. The experiment demonstrated the quantization of electron spin states as they align either parallel or anti-parallel to an externally generated B-field.

Certain substances* when placed in a uniform B field will magnetize (a bit like iron but not as strongly). For ferromagnetic materials, this magnetization is due to the alignment of the electron spins with the B field. Due to the actions of the guiding wave structure (as empiriometrically captured by the Pauli Hamiltonian), there are two eigenstates for the electrons' spins, either parallel with the B field or anti-parallel with the B field. The parallel state has a lower energy, and the energy difference between the two levels is proportional to the B field and to the electron's spin: $\Delta E = g_e \mu_B B$.

The electron's spin state can be changed from the lower-energy parallel state to the higher-energy anti-parallel state by applying a smaller intensity and rapidly oscillating (radio frequency) B field perpendicular to the original B field that magnetized the substance. Classically, the net B field (now being slightly misaligned with the spin) applies a torque to the electron's spin which begins a process of precession (Larmor Precession) around the net B field as shown in Figure 4.

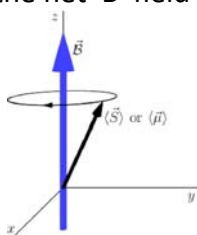


Figure 4

If the frequency of the perturbing B field is equal to the Larmor Precession frequency, then as the electron precesses half-way around, the net B field will be perturbed in the other direction resulting in a greater misalignment and thereby a larger precession. As the precession continues another half rotation, the B field again changes direction, again increasing the misalignment gaining an

even larger precession, etc. The result is that the originally aligned electron's spin is gradually torqued away from the original magnetizing B field in a spiralling fashion as shown in Figure 5. Quantum mechanically, this process of Resonant Larmor Precession puts the electron's guiding wave structure into a state of superposition, and if applied for enough time, into a pure state of the higher-energy anti-aligned state. Since the experiment is run at room temperature, the excited anti-parallel state is not stable, and thermal effects quickly return the electrons to their lower-energy parallel state.

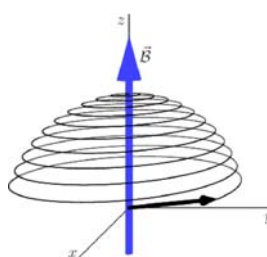


Figure 5

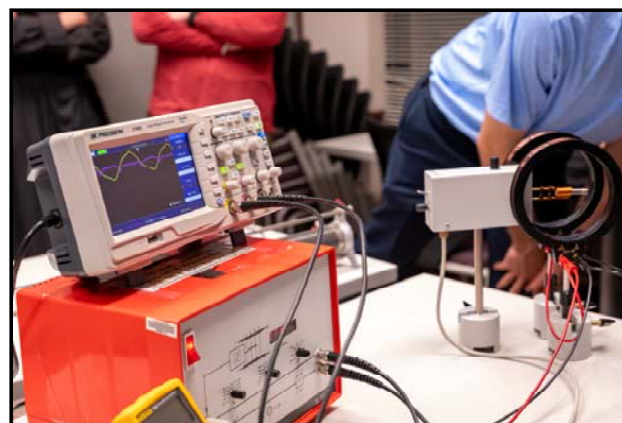
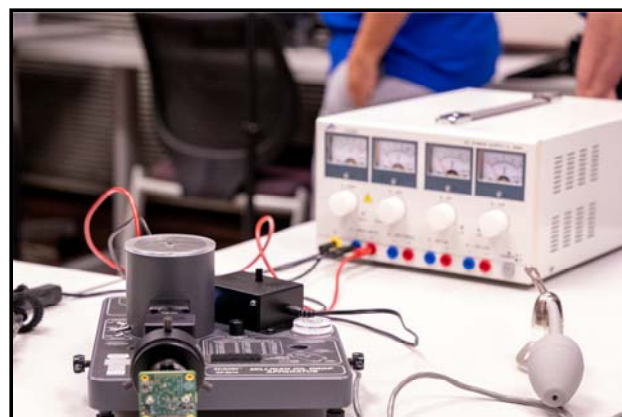
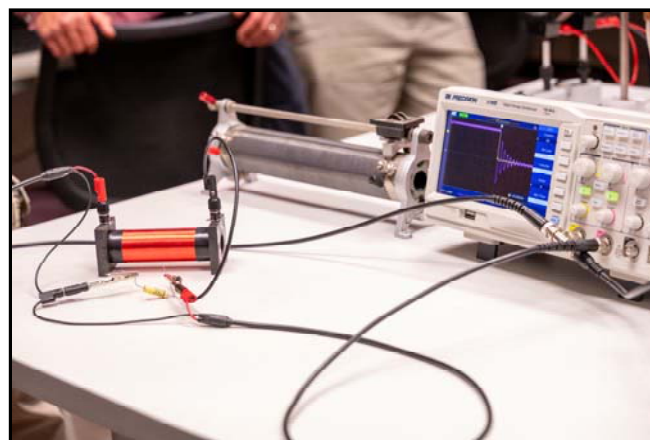
In the apparatus brought to the conference, the substance examined was a fine powder of Diphenyl-Picryl-Hydrazyl (DPPH) contained within a small vial. The DPPH was magnetized using a pair of Helmholtz coils powered by a powersupply, and the perturbing RF B field was generated with a small solenoid wired as part of an LC oscillator (as described in the third experiment). To see evidence of the magnetization of the DPPH and the change in electron spin state, an oscilloscope measured the amplitude of the oscillations of the LC oscillator. When the LC oscillator frequency matched the resonance frequency $\omega = g_e \mu_B B / \hbar$, the amplitude of the LC oscillator decreases. Since the amplitude of the LC oscillator is indicative of the energy in the oscillator, a drop in the amplitude corresponds to a drop in the energy of the oscillator. This energy taken from the LC oscillator is the energy used to change the electrons from the lower-energy parallel state to their higher-energy anti-parallel state, and the size of the amplitude dip

can be used to measure how many electrons make the transition.

A final technical point about performing Electron Spin Resonance experiments: in principle, it is clearer to hold constant the magnitude of the magnetizing B field and to change the frequency of the LC oscillator circuit (by using a variable capacitor). In practice, the LC oscillator takes several oscillations for its amplitude to build up and stabilize, and since it is the energy reservoir which the electrons draw from in order to change state, it is easier to keep the LC oscillator frequency constant for each experiment. Instead, the Helmholtz coils are made to generate a low-amplitude sinusoidal B field, with frequency 60 Hz (extremely slow compared to the MHz frequency of the LC oscillator). Maintaining constant frequency and amplitude, the mean value of the magnetizing B field is adjusted up or down until the resonance is observed through the dipping of the LC oscillator amplitude (again, occurring when $\hbar\omega = g_e\mu_B B$). Using this method of modulating the B field, we measured the electron spin resonance by generating a plot on an oscilloscope. The horizontal axis measured the magnitude of the magnetizing B field** while the vertical axis measured the amplitude of the LC oscillator. The dip in the LC oscillator amplitude corresponds precisely to the B field of the resonance frequency relation. Again, the quantum nature of electron spin is made manifest in that the LC oscillator only transfers energy when the B field hits the resonance value.

* We use Diphenyl-Picryl-Hydrazyl as the substance of our investigation which is known to have particularly nice properties for Electron Spin Resonance.

** The oscilloscope directly measures the voltage across the Helmholtz coils, but this voltage is proportional to the current of the coils which is proportional to the B field.



20th Anniversary Ball and Banquet Celebration

by Anthony DiCarlo, IAP Associate Member and Membership Director

On Friday evening, after the people in the two tracks were reunited in the Q&A with **Dr. Rizzi**, everyone dressed up for the Ball and Banquet held at the LSU Cook Hotel Conference Center. It was a grand event indeed!

It all began with a big group picture, which was a little delayed because of a monsoon of a rainstorm, including heavy waterfalls of rain falling from the rooftops. After the pictures, we all watched the *Holy Gassers* skit, a funny way to help us all pay attention to being open to the grace to think and act rightly in our lives. This was followed by an address from **San Francisco Archbishop Salvatore Cordileone**, who spoke about the real and continuing urgency of the work of the IAP and encouraged IAP members in their mission (see a transcript of his address later in this newsletter). Archbishop Cordileone was not able to attend in-person because of the National Eucharistic Conference that was unfortunately at the exact same time. However he very much wanted to be present in spirit, so he sent his remarks in a video format.

After the Archbishop's address, **Dr. Rizzi** gave a brief address and presented awards to IAP members. A special award was given to Mrs. Susan Rizzi, recognizing her for her "over 20 years of assisting Dr. Rizzi in irreplaceable ways and for her invaluable service to the whole IAP family." Another special award was given when IAP members **Anthony DiCarlo**, **Fletcher Williams**, and **Dr. Murray Daw** came forward to present Dr. Rizzi a clock plaque and a giant "thank you" card on behalf of the whole IAP community, thanking Dr. Rizzi for "over 20 years of his courageous and selfless leadership in grounding and advancing modern science."



After the award presentations, all stood and sang the *Salve Regina*, and then IAP associate member **Fr. Neal Nichols** led grace and blessed the food. A delicious banquet followed, with lots of merriment and good conversation.

After dinner, conference participants enjoyed dancing to music from the "IAP Jukebox", a computer program created by IAP associate member **Giuseppe Rizzi** back in 2018 which allows listeners to pick from a variety of great music and to learn a little bit about the background of each song. After dancing for awhile, everyone took a break to enjoy some Anniversary cake (two varieties: Italian Creme

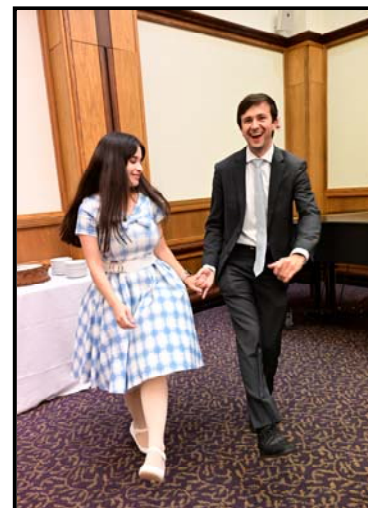


and Chocolate) and a concert given by IAP associate member and world-class pianist **Anthony Coniglio** accompanied by **Dr. Stephen Strickland** on the violin. As a grand finale to the concert, IAP associate members **Benjamin Luna** and **Fletcher Williams** and IAP volunteer

picture is, as the saying goes, worth a thousand words!



member **Michael Rutland** sang the Battle Hymn of the Republic, with all those in attendance chiming in during the chorus. After the concert, dancing resumed, including IAP associate member **Anthony DiCarlo** leading the “Locomotion” train around the Cook Hotel Conference Center and IAP associate member **Casey Izard** and his wife **Anna** (left dance photo) treating their on-lookers to some of their acrobatic dancing abilities! At some point during the festivities, **Fr. Nichols** stepped up to do a special formal blessing of Dr. Rizzi. Fr. Nichols wrote this special blessing for the occasion.



The Ball and Banquet festivities lasted late into Friday night, with most participants hanging around outside even after the venue closed just talking and enjoying each other’s company. It was truly a night to remember!

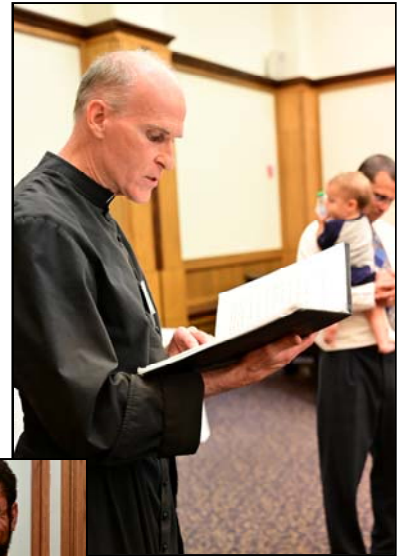
In this and the preceding articles, we’ve tried to give you a feel for just how great the IAP 20th Anniversary Family Conference truly was, but this is hard to do with mere words. I hope you will enjoy the following pictures of the Ball and Banquet celebration and of the rest of the conference, as well. Oftentimes a



IAP 20th Anniversary Family Conference Photos

photos courtesy of Maikel Garcia, IAP Associate Member







Conference photos courtesy of **Maikel Garcia** (pictured with his wife Deya). Maikel has been an IAP Associate Member, Level II, since 2013. He is currently teaching: Adjunct Professor, Physics and Astronomy at Odessa College; Adjunct Professor, Mathematics at Austin Community College; Instructor at Leander High School, Leander, TX.

IAP Jukebox and *Holy Gassers* Video

IAP created the **IAP Jukebox** which played the music for the Ball at both the 15th and 20th anniversary celebrations. Using a computer, members selected a playlist from the 100 song database which played during the ball and banquet. The software was made by **Giuseppe Rizzi**.

IAP also produced an educational video, *Holy Gassers*, which premiered at the 15th Anniversary Conference. The skit, outlined by **Dr. Anthony Rizzi**, is done in the spirit of the parables of Jesus. It helps us examine the way we approach the Sacraments and use the grace we receive through them. Associate Member **Ronald Heisser** directed, acted, and filmed the video with **Giuseppe Rizzi** providing the video editing. **Fletcher Williams** narrates the introduction and conclusion of the video.

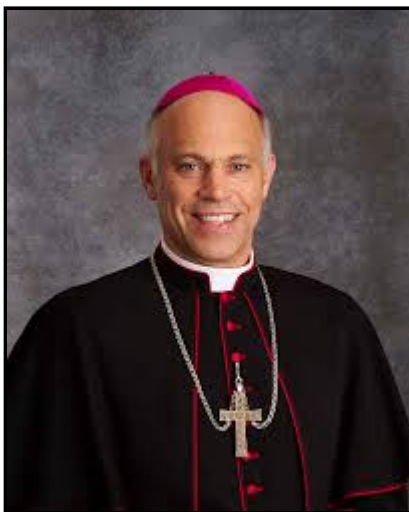


Ronald Heisser directs and acts in *Holy Gassers*

Archbishop Salvatore Cordileone of San Francisco Keynote Address at the Ball and Banquet

Greetings, and congratulations on the celebration of your 20th anniversary! The 20th Anniversary of the Institute for Advanced Physics is indeed a very important event, worthy of much celebration. I am sorry that I cannot be with you in person due to my involvement in the National Eucharistic Congress, but it is a joy to be with you, at least in this way, as you celebrate another important milestone. I remember celebrating your 15th anniversary with you in this way. It's amazing how much IAP has done in the intervening time.

Thank you for all of the good work that you have done in the last 21 years. Let me join in this opportunity to celebrate the 20 years of existence of IAP and also the book that re-establishes our ground, *The Science Before Science: A Guide to thinking in the 21st Century*, published June 24, 2004, the feast of St. John the Baptist, who like the book, prepares the way for Christ.



What a wonderful pair of events to celebrate!

Let me thank you, each one of you, for being an important part in the ongoing efforts in fully grounding and advancing modern science in the proper fashion. I know each of you has overcome serious obstacles to grow in truth to the point where you are now. It is not convenient to think in a grounded way in our ungrounded culture; in fact, it is very hard. I congratulate you on valuing truth enough to go through that real cross necessary to really get it. Never forget, never tire of repeating: you and I are made for truth. And, in the name of the Church, I thank you for that contribution to her health which you give by gaining and holding foundational truth yourself and by giving it to others.

As you know, the foundational work that IAP alone is doing is truly essential and is urgently needed in our times; the popes, especially over the last 150 years have been sounding the alarm about the many errors in modern thinking. The centuries of a growing disconnect between modern man and the Faith, and its more recent great acceleration is alarming; Saint John Paul II, in his letter to the Vatican Observatory, said "The matter is urgent. Contemporary developments in science challenge theology...deeply."

I was told that on the very first day of the first IAP conference that St. John Paul II made an important announcement in a special Vatican press release. That announcement also appeared in the church bulletin that day at Notre Dame University where that conference was held. The pope called on everyone to pray for scientists "to make prudent and responsible use of the

successes achieved." He did not know it, though the Holy Spirit obviously did, but, in a Notre Dame lecture hall, this request was being met for the first time in the root way required, that is taking modern science and modern thinking all the way back to the simple things we get through the senses.

The IAP has answered the call! You have correctly identified the core problem of our culture and its depth; it's about respecting our nature as physical creatures who learn through the senses. The whole Faith depends on our recognizing this knowable fact. How does it so depend? The Incarnation is at the center of the Faith and the reason God became incarnate is because He respects that nature and speaks to us through it. Grace builds upon nature, does

not destroy it. IAP has, for the first time, explained the full nature of modern science and given us *in specificity* what is true and essential in it as well as how its impressive and deep content has been misunderstood. In so doing, the IAP has put clearly in front of us the nature of the problem of scientism. And, what's more, IAP has profoundly advanced the solution by core research followed by education in what has been discovered. IAP's great success in this is partly testified to by your very presence here.

It is to be lamented that our culture has lost its stable grounding in the basic physics that we get through our senses. This means it has lost simple and essential truths which everyone used to know. The culture has, as a result, also deprived itself of the further truths that can be had by building upon those truths, including new ones as well as those already found by our forefathers.

The good news is: IAP has firmly reestablished that ground. And, IAP has done so much to ground and advance modern science with much success for over 21 years now! I understand others will talk about this in detail at this conference. But, as atheism is the fruit of the scientism that you fight, let me just say that the conversions from atheism that IAP, under God, is responsible for, are already a sign of great hope.

I encourage you to keep seeking, discovering, and learning the grounded truths that we so badly need and to spread them widely. Also, continue, as you are, to be thankful to God from Whom these things come and point to.

IAP has shown that there is a real conflict between the Faith and science, not of course between the Faith and true science but between the Faith and the equation-alone science that is at the base of our science today. That science is riddled with misapprehensions and philosophical errors, but a proper understanding of modern science, which is of

itself good, very good, indeed irreplaceable, would be a balm to all.

As it is, all that we hold dear is under attack by the scientism, which advances rapidly every day. The absence of real knowledge of the foundational physics and the metaphysics that grows out of those truths, and the growing irrationality in the culture it produces, are wreaking havoc in every area of our society and causing unprecedented confusion, even within the Church. The sanctity of innocent human life, the true nature of marriage, and even the reality of gender are lost on us more and more with each passing day. We are truly losing our sanity, and along with it our Faith, our families, and our country.

Of course, we should expect this since, as the IAP Central Theorem proves, the physics of our culture is incomplete, leaving us ungrounded. We start with what we get through the senses, and if we don't get our science, our understanding of nature, right, then our culture is bound to do what it is doing now. We must each make a firm commitment to take seriously our nature as rational animals and to make time for the intellectual life. We must seek to foster habits of rationality in our day-to-day lives, building on the foundational truths upon which all others depend, the simple truths of physical nature that we get directly through the senses, deliberately integrating them into every area of our lives. We must ask for God's grace to do this, for only with His help and in Him can we succeed. Only in this way, can we return to sanity and combat the scientism in the culture and in ourselves.

The Faith too, depends on a right understanding of physical nature. St. Thomas says "Although by Revelation we are elevated to the knowledge of things that would otherwise remain unknown to us, yet we are never raised so far as to know them in any way other than through things that can be known by the senses." The Church has echoed this in her teaching. For example, Pope Pius X, in his *motu proprio Doctoris Angelici* written to directors of

seminaries, said that these principles “...are to be considered as the foundations upon which the whole science of natural and divine things is based.” He goes on to say that “if such principles are once removed or in any way impaired, it must necessarily follow that students of the sacred sciences will ultimately fail to perceive *so much as the meaning of the words in which the dogmas of divine revelation are proposed by the magistracy of the Church.*” I can testify that this has been and is happening!

So, it is fitting that you should celebrate your 20th anniversary during the culmination of this Eucharistic Revival, as your work is essential to it! A right understanding of physical nature not only provides the foundation on which theology depends, but it gives insights that help us in understanding the Faith. Saint John Paul II points this out in his letter to the Vatican Observatory quoted earlier. After warning of the urgency of the situation, he says: “Yet these developments also offer to theology a potentially important resource. Just as Aristotelian philosophy, through the ministry of such great scholars as St Thomas Aquinas, ultimately came to shape some of the most profound expressions of theological doctrine, so can we not hope that the sciences of today, along with all forms of human knowing, may invigorate and inform those parts of the theological enterprise that bear on the relation of nature, humanity and God?” This is really what the Church needs, to open the book of nature so that the Faith can be more deeply understood and appreciated and God’s nature can be more wonderfully seen. For this reason, I look forward to having the IAP come back out to my seminaries (as we did in 2015) to help with the formation of my seminarians.

We need to look to the stars, look to the depth of the heavens, and we can only do that if we have the right understanding of how to use the modern scientific method in a fully grounded way, which only IAP has realized and

done. I encourage everyone to take science seriously, to take what IAP is doing seriously, because it’s addressing the core problem of our culture. Don’t give up! Keep going, run the race to completion; fight the good fight! We need you to continue in this quest with all your might and the help of God’s grace. Congratulations IAP! May God continue to bless and protect your valiant efforts. Keep close to Christ and His Mother. I invoke the protection of your patron, St. Thomas Aquinas. Be assured of my prayers for you as I leave you with my blessing. I pray:

May the Lord bless you and keep you.

May he let His face shine upon you and be gracious to you.

May He look upon you kindly and grant you His peace.

*The Father, and the Son, and the Holy Spirit.
Amen.*

How to Learn in Four Steps

by Dr. Anthony Rizzi

An article in IAP’s

Physic and Culture magazine

In this article Dr. Rizzi teaches us that “the first two steps have to do with thinking itself, while the second two have to do with how to use the thinking. In short, there is a distinction between thought and practice. Both are necessary and both need to be in their proper place.”

[Click here to read *How to Learn in Four Steps*](http://www.iapweb.org/iapmagazine.htm)

or go to this link:

<http://www.iapweb.org/iapmagazine.htm>

To support IAP’s research that leads to the understanding and writing of these articles, ***we ask for a donation of \$2 per article that you read or download.***

There are more articles at

<http://www.iapweb.org/iapmagazine.htm>

New IAP Members

Congratulations to our new members! They have completed rigorous training over the course of more than 12 months three of them to complete the requirements for associate membership. There are two levels of Associate Members determined by the individual's science background and there also is an Associate Humanities Member category. We have four new members. One is an associate humanities member, and three are regular level I associate members, which requires at least a Bachelor's degree from an accredited 4-year college or university, usually in science but in exceptional cases with some level of science concentration. Potential candidates typically should have completed the book *The Science Before Science*. They have successfully completed the formal course centered on the *Science Before Science* (typically Level I will be a shorter course than Level II) and completed a final written exam. Candidates commit to taking an active part in explaining and generally advancing the IAP mission by becoming part of our various outreaches. Becoming involved is essential to learning the material (it's by living and teaching the principles that we really learn them). Most all course work is done by phone and internet. The course meets approximately once per week for about 1.5 to 2 hours. Class schedule is decided by the lead faculty member and the candidates.



Christian Captain was born in Atlanta, Georgia and was a child full of questions about the world and wonder for all the things in it! Growing up, he wanted to be a surgeon, doctor, astronaut, paleontologist and many more things. He was raised Greek Orthodox and went to Catholic schools growing up. During elementary school, he moved to Chattanooga, TN, where he completed the remainder of his primary education. In Catholic high school, he struggled to find purpose, meaning and direction in life. After graduating, he attended a local community college where he received his Associate's degree in English in December of 2017. In that same semester, he converted to Catholicism at his local Basilica church in Chattanooga, TN, while continuing to find the truth and live the best life he could.

While finishing his Associate's degree, he took a physics class with a good professor whose enthusiasm for physics and skill in teaching made him interested in studying physics. So, the following year he enrolled at the University of Chattanooga as a physics major. However, during his first semester there, he had heard all sorts of strange things such as "reality isn't really real" and "things aren't there when you aren't looking at them" and many other things that made him question his readiness to address such important things that very intelligent people seemed to take very seriously. So, after his first semester, he changed majors to double-major in Classics and Philosophy, hoping to find a real foundational knowledge and wisdom that would help him understand and answer those difficult and deep questions. During that time when he was completing that coursework, Christian met IAP's Benjamin Luna going to Mass in Nashville, TN. Through many hours-long conversations and a steady deepening of friendship with Benjamin, Christian learned the truths found in *The Science Before Science* in his last semester finishing that double-major. It was then that he learned the real intellectual emptiness of the way modern philosophy is done and finally learned what a famous physicist meant when he said that "philosophy is dead."

A few months after graduating in May of 2021 with those degrees, he began a friendship with IAP associate member Anthony DiCarlo who helped him really take stock of his life and carefully think

The Institute for Advanced Physics

about the right direction that he should go in. So, after much thought and many different life events, Christian saw that he should return to studying physics, and so went to Clemson to study physics because of the Institute for Advanced Physics community there and the opportunity to take classes where *Physics for Realists* is taught. Right now, he is halfway through his junior year of physics, studying senior-level Quantum Mechanics using *Physics for Realists: Quantum Mechanics* taught by IAP Certified Member Dr. Murray Daw! He is so infinitely grateful and happy with his newfound purpose and direction in life, finally finding his vocation thanks to Dr. Anthony Rizzi, and the Institute for Advanced Physics and all the friends he has made in the IAP!

The IAP has helped me get back my wonder and awe for the amazing world we all live in that I had when I was a child, and in this way I really have gotten my childhood back. Through the IAP, I have also reclaimed my vocation as a Catholic physicist which was almost lost due to the very core thinking problems that I as a new Associate Member am honored to join the fight against. This is truly the most noble cause a man can join, and with the most wonderful friends a man can have. Without the truths the IAP has discovered, which ground everything in our lives, there is nothing, and as the Central Theorem shows, if this core problem persists, more and more of what makes life worth living will be swallowed up and destroyed. I am overjoyed to be joining these heroic efforts to restore truth to the world and help make it a place where the truth can flourish again! Christian



Christopher Scott Hoffman is a new IAP associate humanities member. He is a fourth generation military officer in the US Air Force currently assigned to Altus Air Force Base as an Instructor Pilot teaching student pilots to fly the C-17A Globemaster III. Prior to this assignment, Captain Hoffman was assigned to Charleston Air Force Base, South Carolina where he commanded a variety of worldwide sustainment missions and directly participated in combat and contingency operations, most notably the evacuation

of Kabul in 2021 (see Fall 2022 IAP Newsletter for more on this) and the Defense of Israel in 2023.

Captain Hoffman earned his commission and a Bachelor of Science degree in Economics with a minor in Philosophy from the United States Air Force Academy in June 2016. He was awarded his pilot wings at Columbus Air Force Base, Mississippi in April 2018 and he certified as IAP Associate Humanities Member this October.

His proudest accomplishment is being a husband to his wife Kristin and father to his three children (Caroline, Beckett, and Adrian). In his free time, Captain Hoffman enjoys traveling with his family, reading history, exercising, and following the news.

I am extremely thankful for the IAP's critical work. Before being exposed to IAP thought, I knew that something was wrong in the culture, but I could not say precisely what was wrong. This lack of clarity in foundational principles made it difficult to navigate an increasingly confused culture. Thanks to my IAP courses, I now have an intellectual foundation to begin building off of and guides to help show me the way! Chris



Kateri Robson is the wife of IAP Associate Member Ethan Robson and mother to their baby to be born this summer! She is the daughter of Dr. & Mrs. Anthony Rizzi. She graduated with Honors from Louisiana State University Health Science Center in New Orleans with a Bachelor of Science in Nursing. She was awarded The DAISY Award for extraordinary compassionate care during her clinical work in 2021. Her preceptorship was in emergency medicine. She is a registered nurse and is taking continued nursing education classes. Moreover, she embraces her greatest joy yet of her now full-time job caring for her husband and family which overflows into community involvement, including many volunteer projects with the Institute for Advanced Physics. She continues to participate and assist the young adult multi-college *Science Before Science* group. She also enjoys leading women study groups particularly on *Physics and Culture* articles from the IAP magazine. She has given talks at some of the IAP

summer conferences to the biology group revealing how scientism is infecting nursing education.

The gift of receiving the proper understanding of the physical world throughout my life is a truly incredible blessing. This has changed my life so deeply that I can hardly begin to describe it because it literally touches every aspect. For example, as a nurse with such a strong desire to care for my patients, it was transformative knowing rigorously that it's not the body alone but what it meant to have the full person in my care. I would reflect on how the person's highest powers, the individual's intellect and will, deserve being addressed in all my actions which is crucial in true healing. Deep insights like these enlighten my daily life from simple things of playing with my dog to profound time in prayer, all bringing me closer to Truth Himself. I'm extremely grateful for everything I've learned and so much more. I continue to grow everyday through the IAP community. Kateri



Isaac Vaughn is an Electrical Engineer from **The University of Tennessee** in Knoxville, TN. He spent several semesters as an electrical engineering co-op in manufacturing plants and, while back in school, would volunteer in the Engineering Professional Practice development office, assisting other students in finding career opportunities. After graduating in 2022, he became a plant electrical engineer at Eastman, a material innovation company giving electrical component and equipment engineering support for the industry needs. As of Fall of 2024, he started at Bechtel National Incorporated, joining the Nuclear, Security, and Environmental team of electrical engineers contracted by the Department of Energy to design, construct and commission a multi-facility complex to dispose of WWII and Cold War era high-level radioactive waste into a stable form.

Isaac was introduced to the principles taught by the IAP while attending the University of Tennessee in the College *Science Before Science* Study Groups led by Giuseppe Rizzi and Ethan Robson. His read throughs of *The Science Before Science* and the many discussions of Dr. Rizzi's articles have established within him a love and respect for the truth and

The Institute for Advanced Physics

grounded his Catholic faith. He is honored to be an associate member of the Institute for Advanced Physics, and is grateful for IAP Assistant Professor of Practice, Fletcher Williams' guidance to become a member. He looks forward to studying the *Physics for Realists* series and further grounding his thinking through the physics first principles only found in the Institute for Advanced Physics to assist in this critical mission.

The Institute for Advanced Physics has given me the tools to ground my thinking. I owe this Institute and its director, Dr. Anthony Rizzi, my true appreciation for life and my renewed passion for knowledge that I used to be known for as a child. The work of this Institute, particularly the Science Before Science, is something I want to embody and share with everyone. Isaac

The Interstitium: Keeping You One Substance!

by Ethan Robson, IAP Associate Member

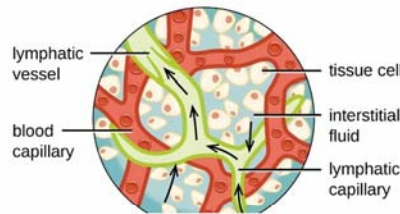
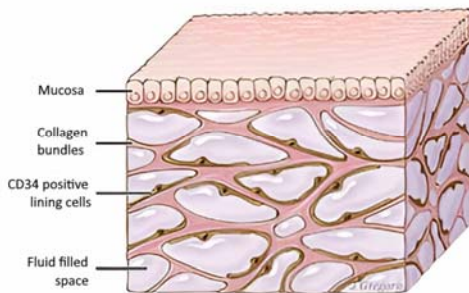


As a part of IAP's biology endeavors, associate member Ethan Robson gave an IAP colloquium titled "The Interstitium: Keeping You One Substance!" on November 21st. He presented on a newly discovered "organ" in the

human body (for discovery announcement see Benias, P.C., Wells, R.G., Sackey-Aboagye, B. et al. Structure and Distribution of an Unrecognized Interstitium in Human Tissues. *Sci Rep* 8, 4947 (2018) from March 27). The

tissue structure was first seen (unintentionally and in a not understood way) by a medical research team in 2015 while performing a confocal laser endomicroscopy and surgeries on the bile duct of cancer patients. Intrigued by this, the team launched further investigation and found the interstitium is present as a continuous network all across the body and acts as a means of delivering water, nutrients, and oxygen from the blood to all the rest of the cells! It also provides a layer of protection from blunt forces and is a conduit for immune cells and other mobile cells to move about. The interstitium accounts for 30% of the total fluid in your body (for reference, 10% of body fluid is blood). This tissue structure has gone undiscovered for so long

because the common preservation technique for biological tissue samples drains all of the water out of the tissue as a means of preserving it. Draining all the water collapses the interstitium, making it appear to be something like another layer of skin surrounding your organs instead of what it really is. This lapse shows the importance of



The Interstitium: keeping you one substance!

Institute for Advanced Physics
Ethan Robson- Associate Member

examining that everything we know comes through what we know through the senses and that fully understanding something means seeing the unity of the thing, not merely its shape or function. The live talk included a Q&A session with 16 targeted IAP members and Dr. Rizzi to further explore what we know empiriologically about the interstitium and probe it for fuller big physics insights into the nature of our bodies. The group explored in further detail what it means to be a part of a substance, and how to properly see one part

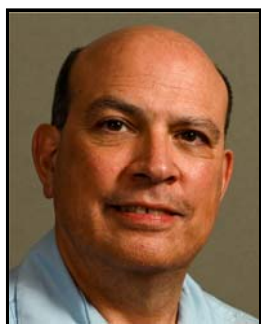
as distinct from other parts. The interstitium was not known before because a gap in common sense in the experimental methods of biology prevented us from knowing the full reality of how we breathe, drink, and eat. The big take home message is the importance of the mission of the IAP (see mission statement page <https://iapweb.org/mission.htm>). We have a dire need to restore common sense in every aspect of our life by studying and fully integrating the first physics into everything we think and do.

Physics for Realists: Quantum Mechanics remote course

By Christian Captain, IAP Associate Member



Dr. Strickland



Frank Camacho

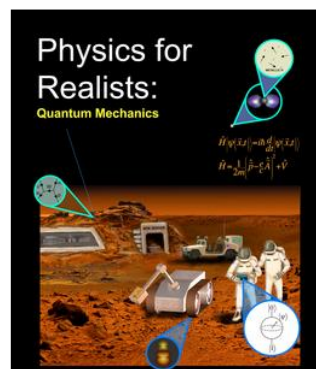
During the Fall 2024 semester (as well as the last part of summer 2024), IAP certified member and Samford University physics professor, **Dr. Stephen Strickland**, taught a special course over zoom on *Physics for Realists: Quantum Mechanics* (PFR:QM) by **Dr. Anthony Rizzi**. The course ran from July all the way to December, meeting once per week for a lecture by Dr. Strickland to review and discuss reading and homework materials. In addition to these lectures from Dr. Strickland, the group also centered around IAP certified member **Dr. Murray Daw's** recorded lectures on PFR:QM.

These lectures can be found here on the IAP YouTube channel:

<https://www.youtube.com/playlist?list=PLZMfBHXZZsLB-edsTN2A4je59CTgHIjkr>

The group got to learn quantum mechanics in a principled, ordered way that makes use of common sense and builds from that starting point, rather than destroying it. The foundational experiments in quantum mechanics were discussed, as well as the real nature of probability. The group learned that quantum mechanics is probabilistic, that the empiriometric theory deals with ensembles of similarly prepared systems of many particles, for instance, rather than only one particle. In this way, quantum mechanics is kept consistent as a theory, rather than being confused and contradictory as in the way (invoking wavefunction collapse) it is taught pretty much everywhere else outside of IAP.

Dr. Strickland was assisted by IAP associate member **Frank Camacho** and the class was



attended by many associate members, associate member candidates and volunteer members. The group thanked Dr. Strickland for his immense efforts and incredibly generous gifts of both his time

and knowledge by giving him a Christmas gift at the end of the course. Thank you, Dr.

Strickland! It is so amazing to understand quantum mechanics!

Course coming soon!

A **Physics for Realists Mechanics** course led by IAP associate member Frank Camacho will begin in January 2025. He will be assisted by IAP certified members Dr. Ken Klenk and Dr. Stephen Strickland. Come get a grounded understanding of Mechanics, the foundation of all of modern physics!

Approved candidates only. Contact the IAP Office at 225-667-0233.



The college SBS study group starts its 7th year!

by Christian Captain, IAP Associate Member



The college *Science Before Science* group began its 7th year this fall by studying the first half of *The Science Before Science* (SBS) together, starting with over 50 participants (more students than ever before!) coming from more than 12 universities across the US, from MIT to Texas A&M to Stanford! Lots of senior members of the previous years

returned, and many of them formed entirely new friendships with people and invited them to the study group for the first time. The group leaders, IAP Associate Members **Giuseppe Rizzi**, **Ethan Robson**, **Benjamin Luna**, and **Anthony Coniglio** did a wonderful job in planning and leading discussions at each weekly meeting. **Anthony Coniglio** began a full

in-person study group at the Princeton University Catholic Center this year, involving a great group of enthusiastic students. A lot of people joined this year because friends recommended the group, or someone who knew someone else told others about it who they thought might be interested, or someone investigated a poster or flyer about the group because it seemed worth looking into. The group all worked hard together to make this one of the best years yet. It really has been a great time for deepening friendships and making new friends. New participants had this to say about the group:

The group has truly filled a missing part of my life. Being a part of the meetings has helped explain many questions I've had about modern culture. I'm blessed to have met a one-of-a-kind community that strives to bring me closer to the truth. -Brenda

This study group has, for the first time in a long time, given me an opportunity to find clarity about topics that I did not know clarity could be found in. Every topic we discuss has become an enlightening discussion, and I'm glad that I decided to join the group! -Vincent

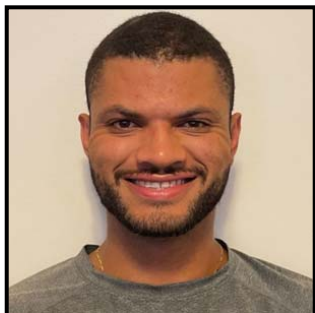
My first semester of FSR was very insightful and a lot of fun. I got to meet a lot of really cool people who brightened my outlook on the future of science in the Church. - Kathryn

I really enjoyed the group, and it was good to see areas like philosophy made more rigorous. I especially liked seeing how it puts the science we learn in the classroom in a larger and more complete context. - Samuel

The group paused its meetings for Christmas break (except for a Christmas social for all of the study group members) and will resume in the Spring semester to finish the second half of SBS!

Heisser and Blatchford Complete their PhDs

by Fletcher Williams, IAP Associate Member and Assistant Professor of Practice



IAP associate member Ronald Heisser received his PhD in Theoretical and Applied Mechanics from Cornell University after defending his dissertation on May 9, 2023, which is announced now as we move to keep you better in touch with the advancement of our members. His dissertation, “Arrays of millimeter-scale rubber combustion engines,” demonstrated the successful design and operation of arrays of 2 mm—diameter bistable rubber dots, which opens up exciting technological possibilities in the virtual reality and accessibility industries. He continues his application of mechanical engineering to biology now in his post-doctoral work at MIT. Having been immersed deeply in empiriological mechanics as well as biology, he is eager to take part more fully in IAP’s core work of bringing these things to a fully grounded understanding.

IAP associate member Kevin Blatchford received his PhD in Chemistry from the University of Tennessee at Knoxville after defending his dissertation on July 18, 2024. His dissertation, “Ligand Design, Synthesis, and Reactivity of Chiral and Achiral tetra-NHC Macrocyclic Complexes for Oxidative Transfer Catalysis,” lays out important advances achieved in making a certain class of catalytic processes both more accessible and safer, demonstrating the new method in a variety of important cases including the 1st asymmetric examples with this class of catalyst. With his advanced education, he is excited to join in a new way the deep work IAP is engaged in, in bringing the empiriological-alone content of modern science to full, human understanding.



Love and Friendship Updates



- The *Love and Friendship* audio article is now available on the IAP *Physics and Culture* webpage: <https://www.iapweb.org/iapmagazine.htm#vol3>

[Love and Friendship:](#)
[What is Love? What is a Friend? NEW](#)



Now you can enjoy this ground-breaking article on the go! Use your drive time to learn about the real meaning, purpose, and types of love and friendship.

- YouTube Shorts on *Love and Friendship* were published during November (except the last listed below, which was published in July 2023)
<https://www.youtube.com/@instituteforadvancedphysics/shorts>

The 5 Shorts, which come from and point back to the Love and Friendship Podcast, are:

- *Who Am I?*
- *What Was I Made For?*
- *Love Is Not a Negation*
- *Resist the Scientific Tendency*
- *If You Don't Feel It, You Don't Know It*

For more on the Love and Friendship podcast, see [IAPweb.org/friendship](https://iapweb.org/friendship)
 (<https://iapweb.org/friendship>)

- Mark your calendars: Upcoming Dr. Rizzi appearance on live TV!

Renowned Physicist and Thomist, Dr. Anthony Rizzi, discusses *Love and Friendship* with Fr. Pacwa on *EWTN Live* on **Jan. 15th, 2025 at 7pm CT (8pm ET)**. He will discuss ground-breaking new insights into the real meaning, purpose, and types of love and friendship. Be sure to tune in!

<https://www.iapweb.org/ewtn-live-friendship.html>

- An article covering material related to the *Love and Friendship* article was recently published in a prestigious journal.

Article coming soon:

Can We Trust Experts, especially in Psychology and Humanities?

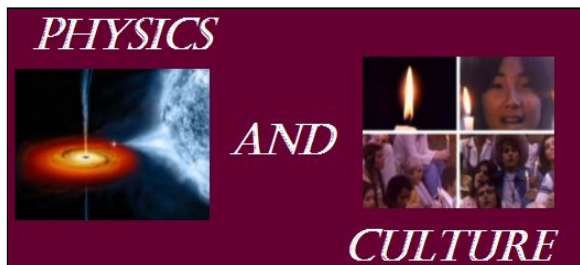
We all have an immense, but highly misplaced, confidence in our own ability to assess the modern world and our place in it. This is stark, considering the deep, wide and complex problems of the modern world, the core of which man has never had to confront before.

How do we know what is true and what to do? How do we know we are not making a complete mess of our lives?

We are in fact trusting experts of all types, even when we are not aware that we are, and this is more than problematic. Indeed, it is planting false principles that develop, like a cancer, subtly eating away our core nature, and thus our happiness. Find out about this situation and how we get to the truth of the matter, especially in psychology.

Keep an eye out for this important article in the *Physics and Culture* online magazine in early 2025!

IAPweb.org/magazine



Technology Update:

The IAP office is upgrading the computers and backup system for its electronic network. See part of the new backup system below.

