NOMINATION COVER SHEET

2016 Virginia Outstanding Faculty Awards

1. NAME Full (Legal): **Charles Earl Hyde** Preferred First Name: **Charles**	
2. INSTITUTIONAL INFORMATION Institution: Old Dominion University Rank/Position Title: **Professor** Year Rank/Title Attained: **2002** Years at Institution: **22** Campus Email Address: **chyde@odu.edu** Campus Phone: **(757) 683-5853** Campus Mailing Address: **Physics Department, Old Dominion University, 4600 Elkhorn Ave, Norfolk, VA 23529** Campus Communications Contact: -Name: Giovanna Genard -E-mail: ggenard@odu.edu	**3. PROFESSIONAL INFORMATION** Academic Discipline: **Physics** Specialization/Field: **Experimental Nuclear Physics** Type of Terminal Degree: **Ph.D.** Year Awarded: **1984** Awarding Institution: **Massachusetts Institute of Technology, Cambridge, MA** **4. PERSONAL INFORMATION**

Please check only one box:

RESEARCH/DOCTORAL INSTITUTION NOMINEE: ☒
MASTERS/COMPREHENSIVE INSTITUTION NOMINEE: ☐
BACCALAUREATE INSTITUTION NOMINEE: ☐
TWO-YEAR INSTITUTION NOMINEE: ☐
TEACHING WITH TECHNOLOGY NOMINEE: ☐
RISING STAR NOMINEE: ☐

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Signature (President or Chief Academic Officer)_____

Printed Name: Chandra de Silva, Interim Provost and Vice President for Academic Affairs

E-mail address: cdesilva@odu.edu Telephone: 757-683-3079

Mission Statement

Old Dominion University

The Mission of Old Dominion University is as follows:

"Old Dominion University, located in the City of Norfolk in the metropolitan Hampton Roads region of coastal Virginia, is a dynamic public research institution that serves its students and enriches the Commonwealth of Virginia, the nation, and the world through rigorous academic programs, strategic partnerships, and active civic engagement."

The Mission Support section of the mission statement describes in detail the principles and practices that underlie the University's undergraduate and graduate teaching, research, and service missions: a sound general educational program; critical thinking; diversity; academic freedom; serving the needs of the local, national, and international communities, including military members and their families; and collaborating with government, industry, and alumni. Finally the Major Goals of the University are described under the following headings: Students, Faculty, Academic Programs, Teaching, Research, Scholarship and Creativity, Distance Learning, Life-long Learning, Community Service, Student Life, Alumni, and Quality.

A complete statement of the mission and major goals may be found in the *Old Dominion University Undergraduate Catalog 2015-2016* (p. 10-12) and it is available at the following URL: http://catalog.odu.edu/pdf/2015-16-undergraduate.pdf.

Summary of Accomplishments

There are no boundaries between teaching, discovery and service in Dr. Hyde's career at Old Dominion University (ODU). In his first semester, he joined President Koch's 'Bus Tour' to introduce ODU to northern Virginia high school students with brief expositions and demonstrations on topics from air pressure, to particle physics detectors, to the value of learning a foreign language. Dr. Hyde has never stopped, combining international programs, innovative teaching, and community outreach, while leading a world renowned research program.

Teaching

Dr. Hyde is a talented and versatile teacher who has taught almost the entire ODU physics curriculum, from Conceptual Physics (Physics 101) to graduate courses.

In the introductory courses, Dr. Hyde keeps the classroom interactive, with extensive use of physics lecture demonstrations and 'clicker questions' (student response technology). He was an early adopter of the Student-Centered Active-Learning Environments for Undergraduate Pedagogy (SCALE-UP) format of teaching introductory physics for science and engineering majors at ODU. This format divides the class period into mini-lectures of roughly 15 minutes followed by assigned problems, which the students work on in small structured groups. The classroom is arranged 'banquet' format to facilitate interaction, with nine students seated around each round table, and projector screens and white boards on all the walls. This style of teaching provides both the instructor and students with instant feedback on learning, and helps the students integrate the material just presented in the mini-lecture. Dr. Hyde also developed twenty new SCALE-UP style interactive laboratory exercises.

Dr. Hyde has also applied the SCALE-UP format to his other classes, including Conceptual Physics and the senior undergraduate Quantum Mechanics courses. The power of SCALE-UP to dramatically increase learning is reflected in his student course evaluation comments:

> University Physics:
>
> "Prof Hyde seems like he really does want his students to succeed, but by their own accord."
>
> "Dr. Hyde explains everything so well! I failed this class last semester and had a slight grasp of the material prior to this semester however I actually understand it so much better now."
>
> "The labs were fun, and Prof. Hyde was always helpful."
>
> "I enjoyed the demonstrations, which were often surprising, as well as the teachers explanations."
>
> "I like that he did do a lot of examples in class and provided us with the proper study materials needed."
>
> Quantum Mechanics:
>
> "Dr. Hyde adapted Dr. Havey's "Quantum 360" approach to the course where instead of a 75 minute lecture, a shorter lecture is given and the remainder of the class time is

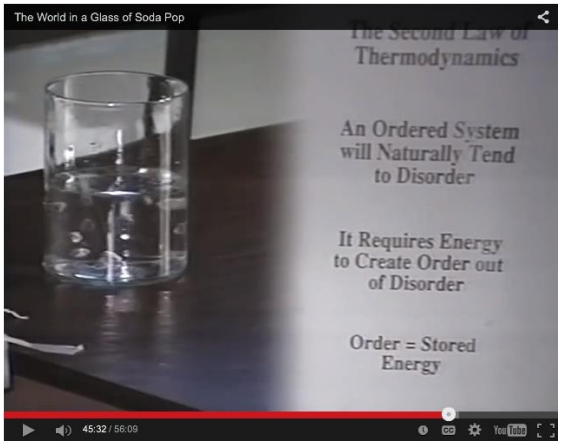
spent doing quantum mechanics in groups on the many white boards in the Scale Up room. I believe Dr. Hyde's lectures of 45-60 minutes and the rest as group work is an excellent ratio. That this course is held in the Scale Up room is also hugely beneficial, even for a small class of 20-25 students, as it allows the groups to have plenty of white board space to work without standing on top of each other, and the noise level is kept low enough to not be distracting.

"For what is probably the first time in my academic career, I cannot think of any substantive improvements that could be made to the course or suggestions on what the instructor could have done better. This is what college physics courses should be like."

Mathematical Methods:

"I thought the material was very interesting and the teacher showed us examples that grounded the math techniques in a more physical way. The instructor was also open to questions, which I found very helpful."

While teaching the core graduate Electricity and Magnetism course, Dr. Hyde utilized many of the same demonstrations from the introductory courses. These demos illustrate fundamental principles, and can be discussed and appreciated at any level of sophistication. The graduate students are also Teaching Assistants and future professors and instructors so that the graduate classroom is a perfect setting to learn about demonstrations as a teaching tool.



Two of Dr. Hyde's favorite physics demonstrations can be viewed in his 1994 CEBAF (now Jefferson Lab) Science Series lecture: "The World in a Glass of Soda Pop" http://education.jlab.org/scienceseries/soda_pop.html. He causes a 50 gallon drum to collapse suddenly from air pressure alone (see picture). (This demo, using soda cans instead of 50 gallon drums, is a perennial hit at the yearly Virginia Children's Festival.) Dr. Hyde loves to illustrate the 2nd law of thermodynamics by pouring chocolate chips into a glass of soda pop. The thermodynamics is explained in the three simple phrases in the image, with the punch line that "it is possible to extract energy from a system as order transforms to disorder (as the CO_2 confined to the liquid escapes to the atmosphere)".

Hyde has also directed nine undergraduate Senior Thesis research projects. This capstone experience is part of the required curriculum for physics majors. Hyde's students have completed original research projects on chaotic dynamics, computer based data acquisition, particle detectors, analysis of Jefferson Lab data, and a proposal for how to calibrate data from a future high-energy electron-ion collider.

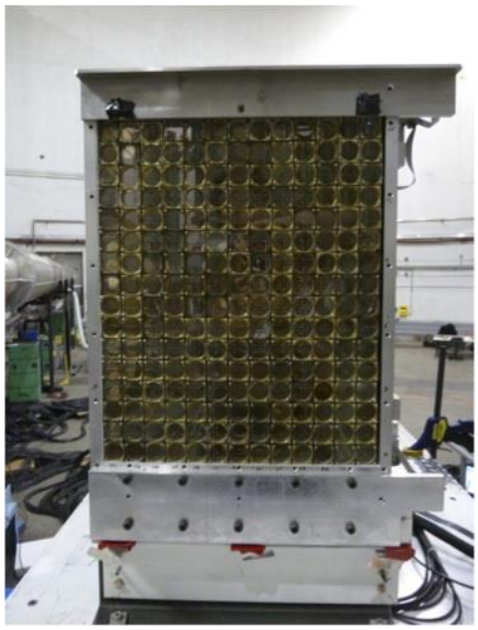
Prof. Hyde's teaching accomplishments inside and outside the classroom were recently recognized by his promotion to University Professor. This is the University's highest award for teaching, and has been conferred on only 44 ODU faculty in the past ten years.

Dr. Hyde's teaching extends beyond the United States to France and beyond the classroom to mentoring the next generation of scientists and leaders. He has mentored five French research interns (Masters or Doctoral level), all of whom later completed their Ph.D's at French institutions; directed five doctoral students (plus two current) at ODU and at Blaise Pascal University (BPU); and mentored four post-doctoral fellows (plus two current) at ODU and BPU. These students have gone on to positions as a patent lawyer, staff scientists at the French Atomic Energy Commission (CEA), the Institute of Nuclear Physics in Orsay, France, the French Institute for Radiological Protection and Nuclear Safety and The Thomas Jefferson National Accelerator Facility in Newport News, VA (Jefferson Lab or JLab), an assistant professor at Texas A&M, a scientist at the US Patent and Trademark Office, a post-doctoral fellow at CEA-Saclay, a NASA consultant, and an entrepreneur and high school teacher. He has also served by invitation as the external thesis reviewer or Thesis Defense Jury of eight doctoral candidates at French universities.

Dr. Nicolas Trégourès, Director of the Institute for Radiological Protection and Nuclear Safety, recently wrote to Dr. Hyde: "I have a fond memory of our trips from ODU to JLab, during which you made very complicated calculations in your head, all the while driving".

Hyde's accomplishments in building an international program at Old Dominion University were recognized in 2012 with the Provost's Award for Leadership in International Education.

Discovery



Dr. Hyde's is a world leader and pioneer of an experimental technique called Deeply Virtual Compton Scattering (DVCS) to create 3D images of the distribution of quarks and gluons inside the atomic nucleus, by scattering extremely high energy light (gamma ray photons) off the atomic nucleus over a range of wavelengths. Dr. Hyde leads five approved (plus four already completed) DVCS and related experiments on the proton at The Thomas Jefferson National Accelerator Facility (Jefferson Lab) in nearby Newport News, VA. Each experiment is performed by a team of about 100 physicists and has exclusive use of one of Jefferson Lab's four experimental halls for several months. It thus represents a significant fraction of the Lab's yearly scientific output. The photo shows the gamma-ray detector built by Dr. Hyde, installed at Jefferson Lab and ready to run as one of the first experiments using the Jefferson Lab Upgrade.

The research field of spatial imaging of quarks in the proton has a very strong Virginia pedigree. Dr. Hyde co-authored the section of the 2006 Jefferson Lab 12 GeV `Pre-Conceptual Design Report' detailing the importance of quark imaging. This report and specifically this physics topic was one of the key motivations for the almost-complete $300M energy-doubling 12-GeV Jefferson Lab Upgrade.

The larger questions that Dr. Hyde's research addresses are:

- What is the origin of the mass of the ordinary matter of the universe? We know that 5% comes from the Higgs mechanism, recently confirmed at the Large Hadron Collider in Geneva, Switzerland, but the other 95% comes from the interactions of quarks and gluons inside the proton (via inverting Einstein's famous equation: $M = E/c^2$). Although we have a theory (Quantum Chromodynamics, or QCD) for these interactions we still do not really quantitatively understand what causes the mass.

- What is the precise nature of the forces binding protons and neutrons together to make atomic nuclei? Again, the broad answer is QCD, but understanding why our sun burns hot enough to fuel life on earth but cool enough to burn for six billion years requires understanding these forces at a level of precision of 0.2%, which is beyond our current theoretical understanding.

Jefferson Laboratory is a world premier facility for the study of these questions, and Dr. Hyde is a world leader at Jefferson Lab. His research on spatial imaging of quarks and gluons is designed to provide novel insight into the quark-gluon structure of matter.

Dr. Hyde's early work largely anticipated the current program in spatial imaging. In his first experiment at Jefferson Lab, he and collaborators measured what he calls "the squishiness of the proton": how much the proton deforms (squishes) when subjected to strong electric and magnetic forces. This experiment revealed that the quarks and gluons that constitute the proton move at close to the speed of light. A second experiment resolved a decades-old dispute regarding the behavior of extremely short wavelength quark-waves inside the proton. These were followed by the first DVCS experiment at Jefferson Lab (led by Dr. Hyde), which showed that spatial imaging of the interior of the proton was possible.

In recognition of these accomplishments, Dr. Hyde was named a Fellow of American Physical Society in 2005 "For the development of Virtual Compton Scattering as a probe of the structure of the Nucleon". The criterion for election to APS Fellow "is exceptional contributions to the physics enterprise". Fellowship is a distinct honor signifying recognition by one's professional peers. Only about 0.5% of APS members are named Fellows in any given year.

Looking to the longer future, Dr. Hyde is helping lead the call for the construction of a major new accelerator, dubbed the Electron-Ion Collider (EIC), that would collide high-energy beams of electrons and atomic nuclei (from protons to lead). This groundbreaking project offers an unprecedented opportunity for "Understanding the glue that binds us all". Roughly half Dr. Hyde's grant support is dedicated to R&D for this proposed accelerator and its experimental equipment. He is detailing the exciting science that can be done at the EIC, and is developing novel detector technologies that can realize the full potential of the EIC.

Due to the efforts of Dr. Hyde and others, construction of the Electron-Ion Collider is expected to receive high priority for new funding under the Nuclear Science Advisory Committee's 10-year plan for nuclear science in the United States (due out in October 2015). The total cost of EIC construction and ten years of operations is estimated at $2.5 billion. There are two competing concepts for the EIC project, one in Virginia at Jefferson Laboratory, and one in New York at Brookhaven National Laboratory. Dr. Hyde is working hard to win the competition for Virginia, highlighting the advantages and unique features of the Virginia design.

Dr. Hyde's contributions in research and the Integration of Knowledge were recognized in 2015 by his promotion to Eminent Scholar. This award is limited to a fixed number of active faculty; ODU has named only 36 Eminent Scholars in the past 20 years.

Integration of Knowledge

Beyond the excitement of advancing scientific knowledge, Dr. Hyde's research and graduate teaching has many specific and tangible benefits to society. A physics education teaches students not just the arcane mysteries of quantum mechanics, but also how to apply quantitative methods to analyze complex problems, and teaches the principles and applications of a large array of technologies. This is reflected in the diverse career directions of Dr. Hyde's former students and post-docs, including patent law, education, national security, nuclear reactor safety, and space sciences. Two crucial spin-offs of forefront nuclear physics research are the development of ever more sophisticated particle detectors and particle accelerators - which have extensive applications in medicine, national security, and applied research. Hyde's work on the proposed EIC project is strongly focused on novel detector and accelerator technologies. In 2003, Dr. Hyde secured from the ODU Office of Research $104,000 start-up funding for a Research Assistant Professorship in Particle Detection Technology. This led to the hiring of Dr. Stephen Bueltmann (now Associate Professor) and a very successful series of miniaturized high-resolution detectors at Jefferson Laboratory.

Dr. Hyde has made many contributions to the undergraduate curriculum at ODU. He introduced a one-credit freshman seminar to provide students with an overview of the exciting frontiers of physics in the 21st century, with connections to new technologies. In order to make physics education practical, technology-oriented, and hands on, he has introduced or revised the laboratory exercises in a wide range of courses. In 1996 he revised and updated the introductory physics labs. In 2011–2014, he developed completely new laboratory exercises appropriate for the new interactive (flipped) introductory-physics SCALE-UP classroom. Hyde developed a new curriculum, including lab exercises, for "The Physics of Music", an upper division General Education course aimed at non-physics majors. He completely revised the two semester upper-level experimental physics and electronics course for physics majors. Dr. Hyde also adopts new pedagogical techniques as they become available. This includes extensive use of student response technology (clickers). He is currently experimenting with 'Course Capture' in senior-level Physics classes, to record in real time all notes and audio in the classroom.

Dr. Hyde brings examples from his research into all of his classes. Some examples include how measuring the velocity of an elementary particle at Jefferson Lab is similar to using a stop-watch to time a cart on a track, and how waves behave the same whether they are sound waves, waves on a guitar string, light waves, or the wave of a quark inside a proton.

Science is intrinsically international, and Dr. Hyde has built strong international connections at Old Dominion University. He authored the 1996–2005 Memorandum of Understanding (MOU) between ODU and Blaise Pascal University in Clermont-Ferrand, France. This was the basis for internships at ODU of five French students (Master's and Doctoral level), funded visits to Blaise Pascal University (BPU) of three ODU physics doctoral students (as well as Dr. Hyde), and the joint ODU-BPU doctoral thesis of Dr. C. Jutier.

Hyde's strong `French connection' led to his being awarded a prestigious Excellence Chair at BPU 2007–2010 with a €800,000 grant from the French National Agency for Research (ANR) and additional funding from the National Institute of Nuclear and Particle Physics (IN2P3) of the French CNRS. Dr. Hyde has also served as a grant reviewer to funding agencies in France, Austria, Belgium, and Canada (as well as the U.S.).

Service

Dr. Hyde has a very broad record of service to the university, the physics profession, and the broader community. As Chief Departmental Advisor for the Physics Department, he takes a personal interest in each and every undergraduate in the physics department. One notable example is US Army Chief Warrant Officer Frank Berardi. After graduating with a B.S. in Physics, he wrote to Dr. Hyde:

> I just got the final word that I have completed my degree. Dr. Hyde, your constant attention and how much effort you put into getting my credits transferred and accepted really made this all possible.

CW2 Berardi first contacted Dr. Hyde in the summer of 2012 to work out a plan that would allow him to complete a Physics B.S. degree in just 15 months: 3 academic semesters and one summer, while on full-paid leave with the Army's Degree Completion Program. In consultation with several academic units at ODU, Dr. Hyde worked out a plan to maximize both his military and previous college transfer credits. Due to his Army commitments, CW2 Berardi had to defer for 18 months. In the Autumn 2014 semester, Dr. Hyde arranged with an Adjunct Instructor from Jefferson Lab to allow Frank to take a critical Physics course by independent study prior to his full time enrollment at ODU, with weekly consultation at Jefferson Lab (much closer to CW2 Berardi's home base at Ft. Eustis). Starting full time at ODU in Jan 2014, and with a last minute petition to the Experiential Learning program at ODU to complete an English Composition requirement by exam, Frank proudly graduated this past May.

For twenty years, Dr. Hyde has coordinated a tent of hands-on physics demonstrations at the annual Virginia Children's Festival, in Norfolk's Town Point Park. Thousands of children and their parents come every year to see cans crushed, to visualize sound and electricity, to observe the atomic world, and to experience the mysteries of rotation. According to Crispin Pond, the FestEvents Programming Manager, this booth is a "highlight of the festival each year".

Hyde has given numerous public presentations, from the President's Bus Tours mentioned above to his recent presentations to an international high school in Clermont-Ferrand (on The Nature of Reality), to the technical and non-technical staff of the Particle Physics Laboratory at Blaise Pascal University (in French), and to a local audience at a panel discussion on the movie "Particle Fever" (about the Higgs boson discovery) at the Naro Cinema in Norfolk.

Dr. Hyde has served as a referee for the top journals in his field, including Physical Review Letters, Physical Review C, and European Journal of Physics A. He is also a frequent grant referee for the Nuclear Physics Division of the Office of Science at the U.S Department of Energy, and for the National Science Foundation. In June 2015, Hyde was elected to a two-year term on the Jefferson Lab Hall A Collaboration Coordinating Committee, and he has just been appointed to the Electron Ion Collider Users Group Steering Committee.

As a full professor at Old Dominion University, Charles Hyde has served on numerous Departmental and University committees, including the Faculty Senate, faculty search committees, and the physics Undergraduate Curriculum committee. He is committed to promoting excellence in research and student achievement at ODU, while also serving the larger Hampton Roads community.

Personal Statement

"EeeeeeeeeeEEH-UMPH (laughter)." That is the sound of a siren attached to a pumpkin falling 9 stories from the top of the ODU Batten Arts and Letters building on Oct, 29, 1999, at the inaugural Pumpkin Drop, initiated by Walter Babel III, president of the ODU chapter of the Society of Physics Students, with help from myself as Faculty Advisor. This event pretty much sums up my 20+ years of service to the Commonwealth of Virginia as a member of the faculty at Old Dominion University: 1) Find something fundamental to study (in this case gravity and inertia); 2) Analyze it quantitatively; 3) Have fun; and 4) Share it with the community. The now-annual Pumpkin Drop has become an iconic event, with student teams competing to build imaginative `Pumpkin Catchers' to break the pumpkin's fall without breaking the pumpkin. Students in my `Physics of Music' class digitally analyzed the recorded siren to measure the ever-increasing pumpkin velocity during its 2-second fall. As the pumpkin accelerates towards the microphone, the Doppler effect shifts the siren tone to a higher pitch, about one musical whole step higher just before impact. A chance encounter at an ODU career fair with a NASA-Langley wind tunnel engineer led to the idea of slowing down gravity by adding a crown of dowels to the pumpkin. The increased drag resulted in a noticeable slower velocity, as recorded by the siren Doppler shift.

Communicating with the general public about physics is a great thrill for me. At the annual Virginia Children's Festival, the semi-annual Jefferson Lab Open House, the annual ODU Physics Department Open House, and many other events I always strive to present fundamental principles in the language of my audience, but without 'dumbing it down'.

As someone approaches my physics demonstration booth at one of these events, I must engage them in one or two sentences, or they will just keep walking. Some of my `pick-up' lines include "Do you want to see Quantum Color?" or "Want to understand how we know what stars are made of?" I then give my visitors a pair of diffraction glasses to look at the light from an atomic vapor lamp, a neon (or hydrogen or helium or …) light bulb. When viewed through the diffraction glasses, instead of a continuous rainbow of color they see a specific set of narrow wavelengths (quantum colors) unique to that atomic element. This leads to a discussion of how this technique, when applied to starlight (including our sun's), reveals the composition of the stars (almost entirely hydrogen and helium). This discussion also comes with a stern safety warning to never look directly at the sun. This interaction is not a lecture, but rather a conversation about science as my guest and I make quantitative observations of the world around us (and as presented in the demonstrations). Those who hang around a little longer will learn that the composition of stars was first discovered in this manner by a female graduate student: Cecilia Payne at Harvard in 1925. However, her conclusions were so radical (most astronomers were convinced the stars were made of iron and other common elements of the Earth's crust), that her thesis advisor forced her to include a disclaimer in her Ph.D. thesis that her conclusions were "almost certainly not real". Yes, culture and prejudice can affect the progress of science, but science itself has proven to be universal.

I embrace the tension between the strict discipline necessary for serious scientific inquiry and the equally necessary nearly unlimited open-mindedness to new ideas. In the classroom, this means both insisting on mathematical rigor, and also emphasizing the limitations of both our theories and our measurements. A favorite phrase of mine is that "physics is not an exact science, it is an approximate science". By this I mean that in physics we don't have exact answers, but instead we have rigorous estimates of the accuracy (conversely uncertainty) of both measurements and theoretical predictions. This also means that there is more than one way to approach a problem, more than one way to learn, and more than one way to teach.

In the internet era, it can be argued that all of the resources necessary to education are openly and freely available to all. What then is the value-added of classroom instruction? The simple

answer is interpersonal interaction and attention to the dynamics of the teacher-class relationship. Teaching should inspire, should be passionate, and should be responsive. At Old Dominion University, I am committed to teaching what our students need to learn, but also teaching from the base of what they already know. One key approach, in both introductory and advanced undergraduate courses, is to break the course hour into smaller segments. In each segment, I introduce a concept and then I assign a problem for the students to work on together in teams. In this manner, the students have an immediate opportunity to apply the new ideas, and I get immediate feedback on their progress. In outreach, I engage the public by doing science together. In teaching, I engage students in problem solving together, in conceptual questions ('clickers'), and in observing and analyzing demonstrations and experiments together.

Jefferson Lab, in Newport News, VA is a unique and world leading facility for the study of the structure of the atomic nucleus. Whether smashing atoms or pumpkins, I follow the same four-point program of studying something fundamental, studying it rigorously, making it fun, and sharing it. The focus of my research is to understand how the interactions of quarks and gluons within protons and neutrons creates 95% of the mass[1] of the visible matter of the universe (the remaining 5% is created by the Higgs Boson, as recently confirmed at the Large Hadron Collider in Switzerland). This mechanism of `Mass without Mass'[2], is responsible for an extremely diverse range of phenomena, from the elements of the periodic chart to the fact that our sun burns just hot enough to bathe the earth in visible light, but just cool enough to burn steadily for billions of years. In studying the collisions of high-energy electrons with protons and other nuclei, I am trying to create spatial images of the quarks and gluons inside the proton and other atomic nuclei. Theoretical physics is a giant puzzle, and like modern video games, you get rewards as you reach each level. For example, a complicated series of algebraic steps simplifies to something that makes intuitive sense—the equations come alive and connect to real physical phenomena. Experimental physics is like a tinker-toy set (do they still have those?) or a Lego set (now connected to an Arduino controller)–and I get to play with it for as long as I like! In classroom lectures and public demonstrations, I always describe how the experiments at Jefferson Lab rely on and expand upon the basic principles I am presenting. I also thank them for the $1.00/year of their taxes (per person) that funds fundamental nuclear science in the U.S.

Why do I care so passionately about unraveling the secrets of the structure of the proton? First, it is an amazing thrill to participate in the centuries-old quest to gain a mathematical understanding of the universe. Second, basic research is constantly pushing the technological boundaries. In my discipline this is especially evident in particle accelerator and detection technologies, both of which have extensive applications. Finally, the quantitative scientific analysis of natural phenomena is not the only way to examine the world, but it is an important tool. Training a new generation of students in the methods, power, and limitations of quantitative analysis transcends all disciplines, and is the most important thing I do.

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[1] F. Wilzcek (Nobel Laureate) www.arXiv.org/abs/1206.7114

[2] J.A. Wheeler **Geometrodynamics** 1962.

Abbreviated Curriculum Vita Dr. Charles Earl Hyde **September 2015**

Education

Massachusetts Institute of Technology, Nuclear Physics, Ph.D. 1984
University of California, San Diego, Mathematics, B.A. 1978, *Summa Cum Laude*

Employment

8/02 –	Professor of Physics, Old Dominion University
1/07 – 12/10	Professor of Physics, Université Blaise Pascal, Clermont-Fd, France
8/93 – 8/02	Associate Professor of Physics, Old Dominion University
4/87 – 7/93	Assistant Professor of Physics, University of Washington
6/84 – 8/86	Nuclear Physics Post-Doc, Massachusetts Institute of Technology,
9/86 – 3/87	NSF-NATO Postdoctoral Fellowship CEA-Saclay, France

Awards

2015	University Professor, Old Dominion University
2014	Eminent Scholar, Old Dominion University
2014	College of Sciences Distinguished Teaching Award
2013	College of Sciences Distinguished Research Award
2012	Provost's Award for Leadership in International Education
2012	College of Sciences Outstanding Undergraduate Advisor 2011--2012
2007—2010:	Chaire d'Excellence, French “Agence Nationale de la Recherche"
2006	College of Sciences Gene Hirshfeld Faculty Excellence Award
2005	Fellow of American Physical Society
1987—1992	NSF Presidential Young Investigator
1986	Peter Demos Dissertation Award, Bates Linac Users Group
1978	Phi Beta Kappa, University of Callifornia, San Diego

Publications:

- 202 Publications in Refereed Journals, plus 30 published Technical Notes and Conference Proceedings.
- Online database inspirehep.net lists over 11,000 citations to a subset of 176 publications.
- Sixteen invited seminars and conference talks and 6 contributed talks in past 48 months.

Principal Recent Publications:

1) H. Fonvieille, … **C.E. Hyde**, *et al* [Jefferson Lab Hall A Collaboration], *Virtual Compton Scattering and the Generalized Polarizabilities of the Proton at Q^2=0.92 and 1.76 GeV^2*, Phys. Rev. C **86** 015210 (2012)
2) S. Abeyratne, … **C.E. Hyde,** *et al*., “Science Requirements and Conceptual Design for a Polarized Medium Energy Electron-Ion Collider at Jefferson Lab”, (2012) www.arXiv.org/abs/1209.0757
3) V.S. Morozov, R. Ent, P. Nadel-Turonski, C.E. Hyde, “Integration of Detector into Interaction Region at MEIC”, Proceedings of the Int’l Particle Accelerator Conference, IPAC2012, 21–25 May 2012, New Orleans,
4) **C.E. Hyde**, M. Guidal and A.V. Radyushkin, *Deeply Virtual Exclusive Processes and Generalized Parton Distributions*, J. Phys. Conf. Ser. **299**, 012006 (2011).
5) L.Frankfurt, **C.E.Hyde**, M.Strikman, C.Weiss*, Generalized parton distributions and rapidity gap survival in exclusive diffractive pp scattering*, Phys Rev **D75**, 054009 (2007)
6) M. Mazouz, A. Camsonne, C. Munoz Camacho, … **C.E. Hyde**, *et al.*, *Deeply Virtual Compton Scattering off the Neutron,* Phys Rev Lett **99**, 242501 (2007).
7) C. Munoz Camacho, A. Camsonne, … **C.E. Hyde-Wright** *et al*, *Scaling Tests of the Cross Section for Deeply Virtual Compton Scattering*, Phys Rev Lett, **97**, 262002(2006).

Teaching (ODU):

Phys 452	Quantum Mechanics I	Autumn 2014, 2015
Phys 456	Quantum Mechanics II	Spring 2015
Phys 355	Mathematical Methods	Summer 2015
Phys 226/231	University Physics I	Spring 2011, 2012
Phys 227/232	University Physics II	Autumn 2011, 2012, Spring1994, 2013
	Implemented new Lab exercises in Univ. Physics I and II.	
Phys 101	Conceptual Physics	Summer 2012, 2013, 2014
Phys 697	Graduate Seminar	Spring 2012 (with Dr. Gurevich)
Physics 313	Astrophysics	Spring 2009 (with Drs. Kuhn, Bueltmann, Amaryan)
Physics 604:	Electricity & Magnetism I	Autumn 2005, 2006
Phys 111, 112:	Introductory Physics I, II	1993, 2002—2005, 2010
Phys 120:	Freshman Seminar	Autumn 2003, 2004, 2005
Phys 226	Honors Physics Lab	Autumn 2003
Phys 403, 404	Electronics Laboratory	1994—1998, implemented new curriculum
Phys 332W	Physics of Music	Autumn: 1997, 2000, 02, 04, 06
Phys 319	Analytical Mechanics	Autumn: 1998-2000
Phys 456	Quantum Mechanics II	Spring 2000

- Supervised nine senior theses (1998—2015)
- Supervised five doctoral dissertations

Community and Professional Service

1. Faculty Senator, 2014 and 1996–2000.
2. Dep't of Physics Chief Departmental Advisor (undergraduate), 2011—
3. Organized physics demo booths at Jefferson Lab Open Houses and annual Virginia Children's Festival, Dep't of Physics Open Houses.
4. Discussion panelist, Naro Cinema screening of "Particle Fever" (Higgs Boson), 2015.
5. Public lecture "*What is Reality?*", at Ecole Bilingue International (High School), Clermont-Ferrand, France, Sept. 2008.
6. Advisor to the Society of Physics Students at ODU, 2002–2006.
7. **Grant Referee** for Dep't of Energy, NSF, Canadian Research Council, Austrian Programme for Advanced Research and Technology, Univ. of Gent, Belgium.
8. **Peer Reviewer**, Physical Review C, Physical Review Letters, Eur. Phys. Journal A
9. Scientific and Technical Council (CSTS), Institute for Research into the Fundamental structure of the Universe (IRFU), French Atomic Energy Commission, 2010—2013.
10. External reviewer, eight Ph.D. dissertations at French Universities (1997–2015).
11. Co-organizer or Advisory Committee member of five international workshops.
    a. Transverse Partonic Structure of Hadrons: Yerevan, Armenia, 2009
    b. International Workshop on Positrons at Jefferson Lab, 2009
    c. EIC Detector Workshop, Jefferson Lab, 2010
    d. Spectator Tagging: Old Dominion University, 2015
    e. Exclusive Meson Production: Jefferson Lab, 2015
12. Board of Trustees, Unitarian Church of Norfolk, 2004—2007.

Grant Funding (at Old Dominion University)

- **DIRC Based Particle Identification Detector for the EIC Central Detector**, BNL R&D grant. Aug 2011–Sept 2015 $267,000 (2016 renewal pending), sole ODU PI.
- **From Quarks to Nuclei** P.I. with co P.I.s Amaryan, Bueltmann, Dodge, Kuhn, & Weinstein. March 2014 – March 2017, U.S. Dep't of Energy (DOE) $2,263,000.
- Prior years DOE and NSF funding (co-PI) 1995–2014 $8,172,000

Letters of Support (Excerpted)

Undergraduate and Graduate Students

After being frustrated multiple times at area universities I found the guidance abilities of Dr. Charles Hyde exceeded my expectations and set him into a class above his peers. My desire to earn a physics degree is decades old. My life choices and military service has put this dream far in the background, and with the physics department guidance I received at other local colleges that is where I thought it would stay.

Dr. Hyde worked with other department heads to seek and receive approval for transfers from unaccredited schools and vaguely worded military training. He also worked to find how I could earn my degree in eighteen months, the only time the Army would allow. … From being an outstanding help, to being my teacher and mentor, to being my friend, I couldn't have completed my degree without Dr. Charles Hyde.

Frank Berardi, former student, Chief Warrant Officer 2, U.S. Army

One of the first things a student entering Hyde's classroom will notice is his absolute joy and exuberance with knowledge; it is delightfully infectious and impossible to ignore. While at first, if you were to meet him in another setting, he might seem quiet – in the classroom his passion for sharing the awesome spectacle of physics causes him to radiate with presence and excitement. In Dr. Hyde's classroom, on any given day, you can experience first-hand a master at work. Dr. Hyde is a master of not only physics, but also teaching in a way that fosters a genuine love of learning.

I can recall many occasions where Dr. Hyde's hands on teaching methods inspired awe in myself and my classmates. On a regular basis he would conduct experiments in class in order to showcase the wonder of this often dreaded subject. So captivating and inspiring to the imagination, some students could be heard audibly gasping in surprise or whispering "magic". Of course, there was no magic, but that was in itself the beauty of Dr. Hyde's demonstrations. With a simple display of the natural properties of the world, he could plant a seed of mystery and intrigue that could spur students on to ever greater heights of desire to learn and understand the world around them.

Leah Ewart, former student, now at Huntington Ingalls Industries

Of the many excellent professors that I have had the privilege to learn from and interact with, Dr. Hyde is one of the best. … I have taken many high level courses at ODU and there is one that is structured differently and has required me to think in a new way, thus making it stand out in comparison to other courses: *Physics on the Back of an Envelope* taught by Dr. Hyde. This class primarily focuses on using deductive reasoning, valid assumptions, and rough calculations to fill in unknowns and solve complex physical problems with surprisingly high accuracy. Dr. Hyde has a way of motivating an entire classroom to participate in solving these complex problems and refining critical thinking thought processes. At the time, the problems being solved were fun and thought provoking; but upon further review, the skills being learned are useful in future applications. … Using deductive reasoning and good estimation strategies learned from Dr. Hyde, I have been able to efficiently solve complex problems in the designing of satellite systems.

Succinctly, my extraordinary learning experiences with Dr. Hyde were not confined to the classroom, but are extremely applicable to engineering practices in a real world setting. In my opinion, Dr. Hyde and his teaching style and techniques are a tremendous asset to ODU.

Seth Berl, former student

In my senior year, Dr. Charles Hyde became my thesis advisor. This experience introduced me to physics detectors, hardware and software that were completely new to me and I greatly enjoyed the experience. I didn't realize how helpful that was in the real world until several years later when I took a job as an engineer developing nuclear physics data acquisition electronics. …I am grateful for the teaching advising and help received from Dr. Charles Hyde.

Benjamin Raydo, former student, Engineer at Jefferson Lab

Dr. Charles Hyde was my Physics 231N and 232N professor when I was pursuing my Degree in Mechanical Engineering. I graduated in May 2014 and am currently working for the Department of the Navy. Dr. Hyde is a highly motivated professor who loves to help his students whenever they need help. Even though I had classes with Dr. Hyde back in 2011, he still communicates with me everywhere I go. Dr. Hyde not only is helpful on the materials of Physics, but he also helped my friends and me on some Engineering material that we were struggling with.

Trucmy Nguyen, former student, Mechanical Engineer, Norfolk Naval Shipyard

Academic and Research Colleagues

Charles Hyde has established not only a national, but more importantly an international, reputation for his scholarly work in the area of intermediate energy nuclear/particle physics, specifically experiments that elucidate the quark/gluon structure of the nucleon. He is well known and well respected by fellow researchers both inside and outside that field. He is a leader in the JLab community. He is recognized as a deep thinker, one who really understands the physics and the important experiments to pursue. When he talks, people listen. He played an active and important role in defining the physics driving the JLab 12 GeV upgrade. His breadth and depth of knowledge is exceeded by very few experimentalists in the JLab commmunity. In that respect, I consider him the intellectual equal of some of the most highly regarded people in our field, such as Doug Beck (Illinois), Bob McKeown (JLab Deputy Director), Peter Bosted (JLab), and Steve Vigdor (Indiana).

Alan Nathan, Physics Professor Emeritus, University of Illinois

Prof. Hyde has acquired a tremendous expertise on the physics associated with this Compton scattering process, which among other applications, allows for tridimensional imaging of the proton. Such images will be one of the great achievements in hadronic physics, and actually constitute one of the main justifications for the recent 12 GeV upgrade of Jefferson Lab.

Charles is one of the few physicists I know with a deep knowledge of both the underlying theory and the techniques for nuclear physics experiments. This double expertise makes him an invaluable colleague and teacher.

Overall, Charles has made outstanding and sustained contributions in experimental nuclear physics. He is a remarkable physicist, whose innovations and leadership have made possible an important set of high impact experiments. He ranks in my mind among the most outstanding hadronic physicists in the world developing the experiments towards a better understanding of quantum chromodynamics.

Franck Sabatie, Staff Scientist, French Atomic Energy Commission (CEA)

I know Charles in his role as a prominent leader of experimental studies at Jefferson Laboratory. Dr. Hyde's experimental research focuses on real and virtual Compton scattering as a test of quantum chromodynamics. He also is a leader in nuclear chromodynamics—the interface of high energy and nuclear physics. Charles has a long list of successful accomplishments in measurements of exclusive and inclusive lepton- and photon-induced reactions. He is particularly

well-known for his incisive work on Compton processes, illuminating the structure of nucleons via photon scattering. He has clearly established a national reputation as a scholar.

Stanley J. Brodsky, Physics Professor, Stanford University

I regard Charles as a leader in the experimental study of deeply virtual Compton scattering (DVCS) and generalized parton distributions. … I came to personally know Charles around 1998. At the time, it was a prevailing opinion that this was an interesting piece of theory whose experimental study would be near impossible. Charles was one of the few people who gave the issue more thought and initiated the first efforts to measure DVCS at Jefferson Lab. I think he fully deserves the credit of being among the experimental pioneers of this field, which has grown to become one of the prime motivations for the 12 GeV upgrade of CEBAF (Jefferson Lab) and, beyond, for he Electron-Ion-Collider project in the US. … In summary, I regard Charles Hyde as a leading expert and driving force in the field of studying nucleon structure through Compton Scattering experiments.

Markus Diehl, Theory Group Leader, Deutches Electronen-Synchrotron (DESY), Hamburg, Germany

Charles Hyde was appointed Professor of Physics at Blaise Pascal University in Clermont-Ferrand. In recognition of his international reputation of high level expertise we asked him to create a new French group involved in the experiments at the Jefferson Laboratory in Virginia. … In view of these excellent results I decided to open for Charles Hyde a new permanent position at the highest rank level in IN2P3 (Directeur of Recherche 1st classe). Unfortunately, Charles Hyde left France in 2010.

Professor Charles Hyde is playing a leading role and has a worldwide reputation in the hadron physics domain.

Barbara Erazmus, Directeur of Recherche CNRS (France)

Charles is well recognized as one of the world wide leaders in the field studying Virtual Compton Scattering. His interest and leadership extends over two decades as he has been the co-spokesman for six successful Jefferson Lab proposals on the topic. What has made this so important is that intense theoretical developments now give us the fundamental background to make use of such exclusive measurements. … This insight has changed our view of what we know and more importantly what we can know about the internal structure of the proton. It is a major focus of the upcoming research program of the Jefferson Lab 12-GeV Upgrade, and extending into the future, is expected to be a main focus of the proposed experimental program of a future electron-ion collider where Charles has been one of the leaders of the formulation of the scientific directions for this machine.

Donald Geesaman, Distinguished Argonne Fellow, Argonne National Lab

To summarize, I support without any restriction Charles nomination. At least two facets of his are to be rewarded: his outstanding qualities as an experimental physicist; and, seen from France, the very rare result he has achieved in building such a solid network with the French community. The coherence (in the quantum mechanical sense) of these two facets applies to forefront topics, such as deeply virtual Compton scattering, that is considered to belong to the privileged tools to study hadron structure in the coming decade.

Charles is an outstanding physicist, who has very good international connections, who let the US profit of these connections, on topics that are among the best guaranties for the coming decade.

Jacques Martino, Director of CNRS/IN2P3, Institut National de Physique Nucléaire et de Physique des Particules Paris, France

Additional Documentation

Service and Knowledge Integration:

ODU Physics Department Open House, October 2013:

Illustrating how to inflate a balloon by removing the air outside the balloon, rather than blowing air into the balloon.

Jefferson Lab Open House, May 2014

Visitors observing cosmic ray signals on an oscilloscope. Detector is a segment of a detector previously built by Dr. Hyde at ODU and installed in a Jefferson Lab experiment.

Community and Public Outreach

Norfolk Festevents is exceedingly grateful for the partnership and opportunity to work with ODU Physics Department and Dr. Charles Hyde every year at The Virginia Children's Festival. Dr. Hyde co-organized the Physics Department exhibitor booth at the festival for over 20-years.

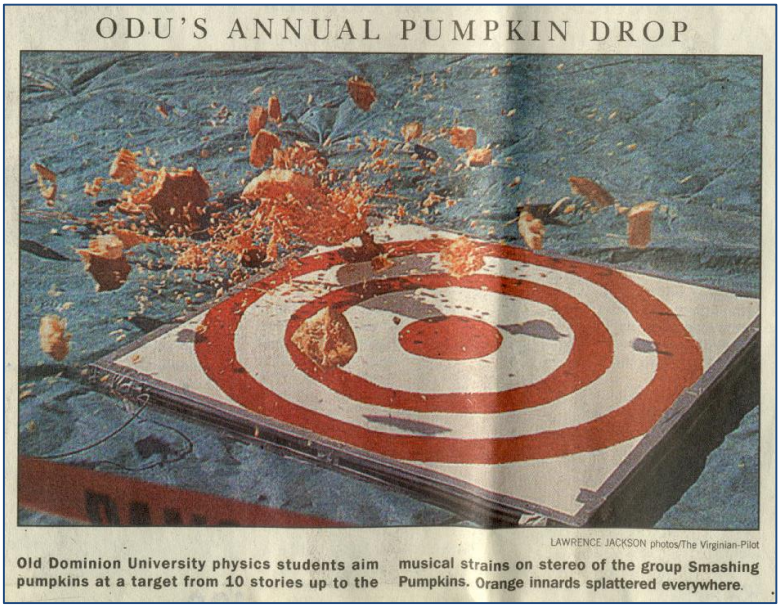
This impressive display of community service has been an invaluable service to the Hampton Roads Community and no small feat for any volunteer. The Children's Festival hosts over 10,000 people a year and is one of the most beloved annual community events in the Commonwealth. Dr. Hyde has

Above: Young scientists generating electricity.

brought his passion for learning and science to the Hampton Roads community and thousands of children over the many years of his involvement in the festival. Our partnership with the ODU Physic department is a highlight of the festival each year and we are extremely appreciative for the countless hours of dedication that Dr. Hyde has given to the Virginia Children's Festival and the Hampton Roads Community as a whole.

Cristin Pond, Programming Manager,
Norfolk Festevents
The Virginia Children's Festival

Right: Young scientists performing an experiment.



ODU'S ANNUAL PUMPKIN DROP

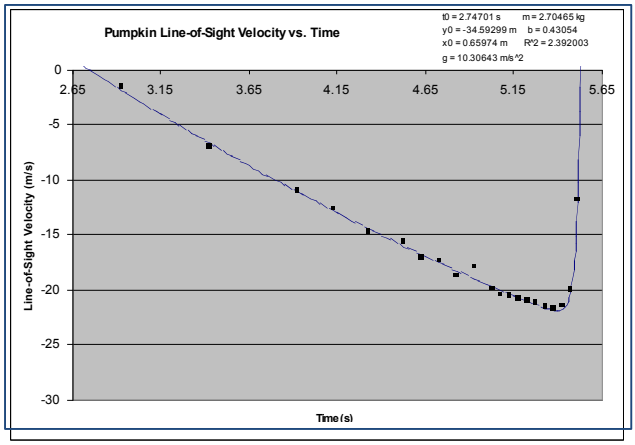
LAWRENCE JACKSON photos/The Virginian-Pilot

Old Dominion University physics students aim pumpkins at a target from 10 stories up to the musical strains on stereo of the group Smashing Pumpkins. Orange innards splattered everywhere.

ODU Society of Physics Annual Pumpkin Drop:

Leftt: The splat captured by the Virginian Pilot

Below: Analysis of Doppler-shift data from a siren on a falling pumpkin by Physics of Music student Robert Horne; a team celebrating their successful pumpkin catcher; two falling pumpkins; a broken pumpkin bouncing after hitting a pumpkin catcher.

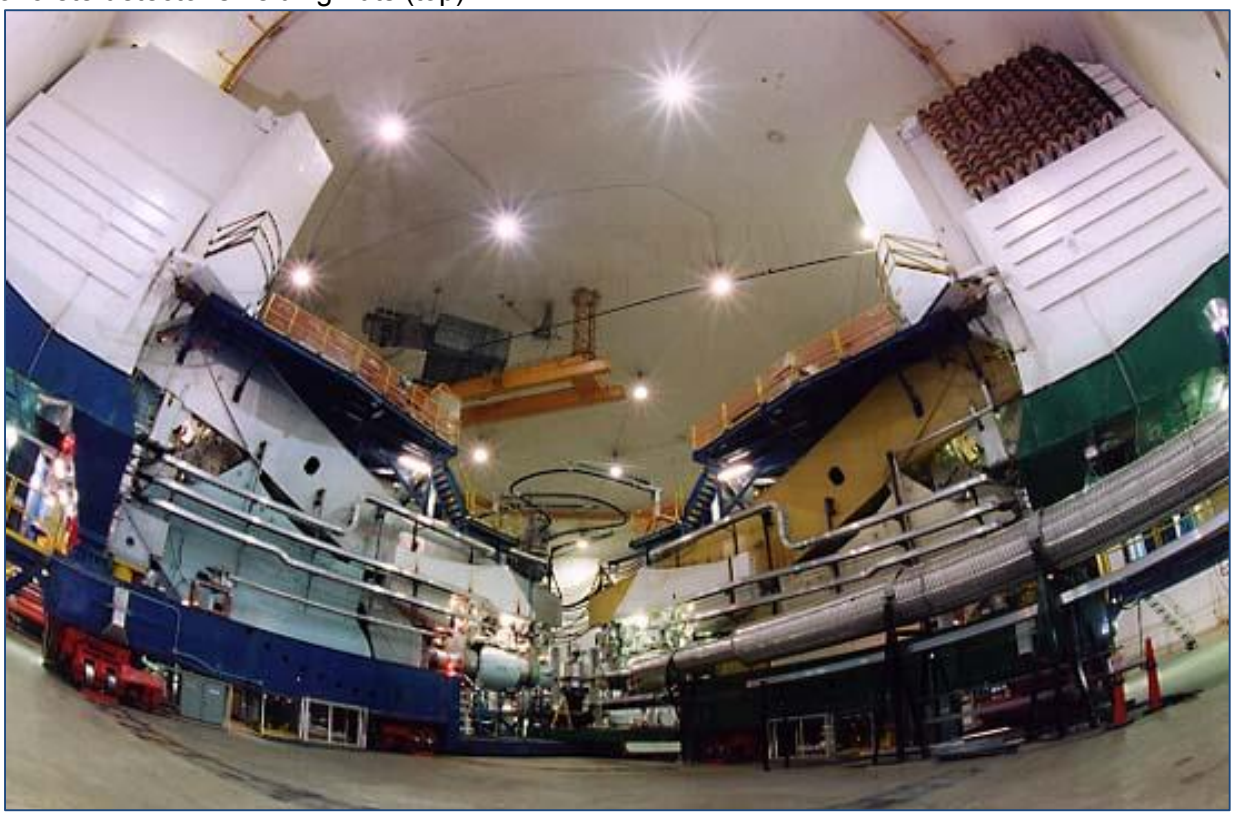


Discovery and Integration of Knowledge:

Featured Conference speaker at The European Centre for Theoretical Studies in Nuclear Physics and Related Areas (ECT*), Trento, Italy:

Receiving **Eminent Scholar Award** from ODU Chief Operating Officer David Harnage.

Discovery:

ODU undergraduate student Christian Wooten assembles one of 208 PbF_2 crystal gamma-ray detectors, while visiting scientist Dr. Carlos Muñoz Camacho looks on.

Experimental Hall A at Jefferson Lab showing the two 80-foot long, 1000-ton, High Resolution Spectrometers with their large dipole magnets (blue on the left and yellow on the right), and white concrete detector shielding huts (top).”