Spring 2024 Joint Meeting of the Texas Sections of the American Physical Society and American Association of Physics Teachers and Zone 13 Society of Physics Students

NPI High School Festival

March 21-23, 2024
Tarleton State University
Stephenville, Texas 76401

Meeting Program
The physics faculty of Tarleton State University and the rest of the Texas Physics Consortium welcome you to the Spring 2024 Joint Meeting of the Texas Sections of the American Physical Society (TsAPS), American Association of Physics Teachers (TsAAPT), and Zone 13 of the Society of Physics Students (SPS) and the NPI High School Physics Festival that is being run concurrently.

These events would not be possible without the time and effort of many individuals including the executive boards and membership of the TsAAPT and TsAPS, the local organizing committee and the Tarleton students and staff. The organization of teacher workshops were once again the result of the outstanding work of Dr. Tom O’Kuma. Finally, we are indebted to the assistance and financial support of our partners including:

- Nuclear Power Institute (NPI) – Providing support for high school students and teachers
- TsAAPT and TsAPS – Providing travel grants for students and high school teachers
- Tarleton College of Science and Mathematics (COSM)

Most of the activities including all the teacher workshops will be on the first two floors of the Science Building so as to make it easy for participants to move between different events. We hope that you have a productive meeting and that your visit to our campus is an enjoyable one with attending the star party, taking a leisurely campus stroll in the evening, or attending one of the many other events on campus. If you need anything during your stay, please don’t be afraid to ask one of the Tarleton workers or come to the Departmental office next to the Tarleton Planetarium on the 1st floor of the Science Building.

Campus Wifi is accessible throughout the campus using the Tarleton Visitor network with instructions using the link below:

https://www.tarleton.edu/technology/wireless/
Thursday March 21

<table>
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<tbody>
<tr>
<td>5:00 PM – 7:30 PM</td>
<td>Registration and Check-in</td>
<td>Science Building 1st Floor Foyer</td>
</tr>
<tr>
<td>7:00 PM – 8:30 PM</td>
<td>TsAAPT Executive Board Meeting</td>
<td>Science Building Room 235</td>
</tr>
<tr>
<td>7:00 PM – 8:30 PM</td>
<td>TsAPS Executive Board Meeting</td>
<td>Science Building Room 122</td>
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<tr>
<td>7:00 PM – 9:00 PM</td>
<td>SPS Social</td>
<td>Math Room 125</td>
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Friday March 22

Snacks, Coffee, etc. are on the tables in the foyer of the 2nd floor of the science building near the entrance to the auditorium.

Information on Tarleton Scholarships, physics graduate programs, TAMU High School Quantum School, and other items are in the foyer near registration.

Box lunches will be on tables in the foyer near registration.

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<tr>
<th>Time</th>
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<th>Location</th>
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<tbody>
<tr>
<td>7:00 AM – 11:30 AM</td>
<td>Registration and Check-in</td>
<td>Science Building 1st Floor Foyer</td>
</tr>
<tr>
<td>8:15 AM – 8:30 AM</td>
<td>Welcoming Remarks</td>
<td>Science Auditorium Room 102</td>
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<tr>
<td>8:30 AM – 10:00 AM</td>
<td>Plenary I</td>
<td>Science Auditorium Room 102</td>
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<tr>
<td>10:00 AM – 10:30 AM</td>
<td>Break</td>
<td>Science Building 2nd Floor Foyer</td>
</tr>
<tr>
<td>10:00 AM – Noon</td>
<td>W-1 Teacher Workshop</td>
<td>Science Building Room 234</td>
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<tr>
<td>10:00 AM – Noon</td>
<td>W-2 Teacher Workshop</td>
<td>Science Building Room 236</td>
</tr>
<tr>
<td>10:30 AM – 11:42 AM</td>
<td>SPS-1 Student Talks</td>
<td>Science Building Room 105</td>
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<tr>
<td>10:30 AM – 11:42 AM</td>
<td>AAPT – 1 (Physics Teaching/Education Research)</td>
<td>Science Building Room 112</td>
</tr>
<tr>
<td>10:30 AM – 11:45 AM</td>
<td>Planetarium Shows</td>
<td>Planetarium 1st Floor Foyer</td>
</tr>
<tr>
<td>10:30 AM - 11:45</td>
<td>Information Booths</td>
<td>Science Building 1st Floor Foyer</td>
</tr>
<tr>
<td>11:45AM – 12:15 PM</td>
<td>High School Demo Show</td>
<td>Outside on Rudder Way</td>
</tr>
<tr>
<td>Noon – 1:15 PM</td>
<td>Lunch</td>
<td>1st Floor Foyer, 102, 122, Outside</td>
</tr>
<tr>
<td>12:30 PM – 1:00 PM</td>
<td>TsAAPT/TsAPS Business Meeting</td>
<td>Science Auditorium Room 102</td>
</tr>
<tr>
<td>12:45 PM – 1:15 PM</td>
<td>HS – 1 Physics &amp; Chemistry Demo Show</td>
<td>Outside on Rudder Way</td>
</tr>
<tr>
<td>1:30 PM – 2:30 PM</td>
<td>Registration and Check-in</td>
<td>Science Building 1st Floor Foyer</td>
</tr>
<tr>
<td>1:30 PM - 3:30 PM</td>
<td>Information Booths</td>
<td>Science Building 1st Floor Foyer</td>
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<tr>
<td>1:30 PM – 3:30 PM</td>
<td>Planetarium Shows</td>
<td>Planetarium 1st Floor Foyer</td>
</tr>
<tr>
<td>1:30 PM – 3:18 PM</td>
<td>APS - 1 (Biophysics and Medical Physics)</td>
<td>Science Building Room 102</td>
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<tr>
<td>1:30 PM – 2:42 PM</td>
<td>SPS-2 Student Talks</td>
<td>Science Building Room 105</td>
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<tr>
<td>1:30 PM – 3:30 PM</td>
<td>APS - 2 (Condensed Matter and AMO)</td>
<td>Science Building Room 110</td>
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<tr>
<td>Time</td>
<td>Event Description</td>
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<tr>
<td>1:30 PM – 3:06 PM</td>
<td>AAPT – 2 (Physics Teaching/Education Research)</td>
<td>Science Building Room 112</td>
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<tr>
<td>1:30 PM – 2:15 PM</td>
<td>HS - 2 TAMU Quantum School Info. (High School)</td>
<td>Science Building Room 122</td>
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<tr>
<td>1:30 PM – 2:15 PM</td>
<td>HS – 3 Nuclear and Laser (High School)</td>
<td>Science Building Room 232</td>
</tr>
<tr>
<td>1:30 PM – 2:15 PM</td>
<td>HS -4 Environmental Sci. and Geoscience Careers</td>
<td>Science Building 1st Floor Foyer</td>
</tr>
<tr>
<td>1:30 PM – 2:15 PM</td>
<td>HS -7 Tarleton Rocket Team</td>
<td>Engineering Building Room 140</td>
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<tr>
<td>1:30 PM – 3:00 PM</td>
<td>W-4 Teacher Workshop</td>
<td>Science Building Room 235</td>
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<tr>
<td>2:00 PM – 5:00 PM</td>
<td>W-3 Teacher Workshop</td>
<td>Science Building Room 234</td>
</tr>
<tr>
<td>2:15 PM – 3:15 PM</td>
<td>HS – 5 Campus Tours (Engineering College, etc.)</td>
<td>Planetarium (Outside Building)</td>
</tr>
<tr>
<td>2:30 PM – 3:15 PM</td>
<td>HS – 3 Nuclear and Laser (High School)</td>
<td>Science Building Room 232</td>
</tr>
<tr>
<td>2:30 PM – 3:15 PM</td>
<td>HS - 6 Chemistry Lab Tour</td>
<td>Science Building 1st Floor Foyer</td>
</tr>
<tr>
<td>3:15 PM – 5:00 PM</td>
<td>Break (Snacks)</td>
<td>Science Building 2nd Floor Foyer</td>
</tr>
<tr>
<td>3:30 PM – 5:00 PM</td>
<td>Poster Session</td>
<td>Science Building 1st Floor Hall</td>
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<tr>
<td>3:45 PM – 5:15 PM</td>
<td>W-5 Teacher Workshop</td>
<td>Science Building Room 235</td>
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<tr>
<td>7:00 PM – 8:30 PM</td>
<td>Banquet (Off Site at City Limits)</td>
<td>Washington St. (HWY 377 Bus.)</td>
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<tr>
<td>9:00 PM -10:30 PM</td>
<td>Tarleton Observatory Tour</td>
<td>Tarleton Observatory</td>
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**Saturday March 23**

Snacks, Coffee, etc. are on the tables in the foyer of the 2<sup>nd</sup> floor of the science building near the entrance to the auditorium.

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>8:45 AM – 10:15 AM</td>
<td>Plenary II</td>
<td>Science Auditorium Room 102</td>
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<tr>
<td>10:15 AM – 10:30 AM</td>
<td>Break</td>
<td>Science Building 2nd Floor Foyer</td>
</tr>
<tr>
<td>10:00 AM – 2:00 PM</td>
<td>W-6 Teacher Workshop</td>
<td>Science Building Room 234</td>
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<tr>
<td>10:30 AM – 11:30 AM</td>
<td>APS - 3 (Cosmology and Astrophysics)</td>
<td>Science Building Room 102</td>
</tr>
<tr>
<td>11:45 AM – 12:00 AM</td>
<td>Student Awards</td>
<td>Science Building Room 102</td>
</tr>
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</table>
Opening  Friday 8:15 AM
Science Auditorium Room 102

Please enter and leave the Auditorium by the 2nd floor so as to not disturb presentations.

Chair: Chris Marble, Tarleton State University

8:15 AM  University Welcome  President James Hurley
8:25 AM  Department Head Welcome  Daniel Marble

Plenary I  Friday 8:30 AM
Science Auditorium Room 102

Please enter and leave the Auditorium by the 2nd floor so as to not disturb presentations.

Chair: Chris Marble, Tarleton State University

8:30 AM  “Fusion Energy Technology Development,” Dr. Kevin B Wollard, Principal Research Scientist, Group Leader, Accelerator and Molten Salt Laboratories, Plasma Science & Fusion Center, Massachusetts Institute of Technology

9:00 AM  “Words Matter: Problems to Consider in Teaching About Work and Energy,” Gay Stewart, Eberly Professor of Stem Education, Department of Physics and Astronomy, West Virginia University

9:30 AM  “Radiation Effects Testing of Transistors at Sandia’s Ion Beam Laboratory,” Joshua Young, Senior Member of the Technical Staff, Ion Beam Laboratory, Sandia National Laboratories

W - 1  Friday 10:00 AM
Science Room 234

“Integrating Computation into Physics Courses,” Kelly Roos, Bradley University
W - 2  Friday 10:00 AM
Science Room 236

“Supporting Students’ Understanding of Work and Energy through Careful Use of Language,” Gay Stewart, University of West Virginia

SPS - 1  Friday 10:30 AM
Science Room 105
Chair: Fabian Gonzalez, Tarleton State University

10:30 AM  “Challenges in Installing and Calibrating a Research Spectrograph,” Stephen Bardowell, Tarleton State University

10:42 AM  “Evolutionary Computation of TPC Data Utilizing a Graph Similarity Fitness Function,” Camden Wilson, University of Texas El Paso

10:54 AM  “Metabolic Effects of Glutamine on Glycolysis in Kidney Cancer Cells Using 13C Nuclear Magnetic Resonance,” Melaud Elahi, University of Texas at Dallas

11:06 AM  “Alterations in Glycolysis and Pentose Phosphate Pathway in Renal Cancer Cells Under Normoxia and Hypoxia,” Ilakkia Maruthupandian, University of Texas at Dallas

11:18 AM  “Exploring the Impact of Sodium Oxamate on Lactate Generation in Liver Cancer,” Abhik Kumar, University of Texas at Dallas

11:30 AM  “Solar Activity,” Josiah Baker, LeTourneau

AAPT - 1  Friday 10:30 AM
Science Room 112
Chair: James Espinosa, Weatherford College

10:30 AM  “The Organization for Physics at Two Year Colleges - Year 2,” Tom O’Kuma, Lee College (Retired)

10:42 AM  “OPTYCs and Incorporating Inclusion into STEM Classrooms,” Jennifer Parsons, Tyler Junior College

10:54 AM  “New Faculty Development Program [Optycs] and My Last Two Semester Experiences,” Neda Zargar, Dallas College

11:06 AM  “Quantum for All,” Meghan DiBacco, Cinco Ranch High School

11:30 AM  “Teaching Physics at the Rift Valley Academy in Kijabe, Kenya,” Steve Ball, LeTourneau University

**APS - 1  Friday 1:30 PM**
Science Auditorium Room 102
Chair: Bimal Pandey, Tarleton State University

1:30 PM  “Mathematical Modeling and Characterization of Virus-Mediated Cell Fusion,” Hana Dobrovolny, Texas Christian University

1:42 PM  “Investigating Pain Neurons’ Glucose Metabolism Following in vitro Paclitaxel Treatment Using Nuclear Magnetic Resonance Spectroscopy,” Kathleen Domalogdog, University of Texas at Dallas

1:54 PM  “Metabolic Insights into Dichloroacetate Effects on Cultured Cancer Cells Utilizing 13C Nuclear Magnetic Resonance Spectroscopy,” Emmanuel Ameh, University of Texas at Dallas

2:06 PM  “Buckling transition of semiflexible filaments,” Greg Morrison, University of Houston

2:18 PM  “Dynamic Nuclear Polarization of 23Na Nuclear Spins at 4.6T and 1.25 K,” Daniel Anable, University of Texas at Dallas

2:30 PM  “Exploring Neuroblastoma Cancer's Glycolytic Response to Lanthanides and Transition Metals via 13C NMR Spectroscopy,” Cody Larsen, University of Texas at Dallas

2:42 PM  “NMR Study of D-Mannose Metabolism in the Cultured Renal Cancer Cells,” Asiye Asaadzade, University of Texas at Dallas

2:54 PM  “Diagnostics with Graphene Quantum Dots,” Anton Naumov, Texas Christian University

3:06 PM  “Molecular Wrench Activity of DNA Helicases: Keys to Modulation of Rapid Kinetics in DNA Repair,” Melodee Seifi, University of Texas at Dallas

**SPS - 1  Friday 10:30 AM**
Science Room 105
Chair: Stephen Bardowell, Tarleton State University

1:30 PM  “Metabolic Competition of Glucose and Mannose in A549 Lung Cancer Cells,” Muhammad Ehsan, University of Texas at Dallas

1:42 PM  “Metabolic Competition of Glucose and Mannose in SK-N-SH Neuroblastoma Cancer Cells,” Faiez Qureshi, University of Texas at Dallas
1:54 PM  “Quantum Mechanics of Room Temperature Superconductivity,” A. Hira, Northern New Mexico College
2:06 PM  “Assessing Radiation Dose of AC-LGA Detectors for the EIC Luminosity Detectors,” Yugbhai Patel, University of Houston
2:18 PM  “NMR study of Glucose Metabolism in Renal Cancer Cells under Normoxia and Hypoxia Conditions,” Deepika Sai Tadepalli, University of Texas at Dallas
2:30 PM  “Developing Position Information Read-out Capabilities for Pepper-Pot Emittance Measurements,” Keslyn Stonum, Texas Lutheran University

APS - 2  Friday 1:30 PM

Science Room 110
Chair: Cristian Bahrim, Lamar University

1:30 PM  “Influence of an Assisted Voltage on Light-Dielectric Glass Surface Interaction with Two TEMoO CW-Diode Lasers,” Cristian Bahrim, Lamar University
1:42 PM  “Effects of Defects and Nitrogen Doping on Magnetic Moments in 4H-SiC,” Sadia Rahman Jhiliik, University of Texas at Arlington
1:54 PM  “Predicting Surface-Bound Kinetic Fitting Parameters of Electrochemical Voltammograms via Machine Learning,” Austen Adams, University of Texas at Dallas
2:06 PM  “Electron Irradiation of Graphene in an Environmental Scanning Electron Microscope,” Jacob Hardin, University of North Texas
2:18 PM  “Effects of Electron Irradiation on Graphene Exfoliated on Mica,” Mahendra Subedi, University of North Texas
2:30 PM  “Raman D Peak to D’ Peak Ratios in Electron-Irradiated Graphene Drums,” Thineth Jayamaha, University of North Texas
2:42 PM  “Impact of Oxygen Vacancies on the Optoelectronic Properties of Heteroanionic La$_2$O$_2$Te,” Hoa Nguyen, University of Texas at Arlington
2:54 PM  “Raman Characterization of Electron-Irradiated Graphene on Silicon Dioxide,” Anil Pudasaini, University of North Texas
3:06 PM  “Ultrafast Electron Diffraction Studies in the Two-Dimensional Magnet CrSBr,” Jayajeewana Ranhili Pelige, University of Houston
3:18 PM  “Comparison Between the Interference Patterns for Two Polarization Orientations of a Coupling Laser Interacting with a Probe Laser on a Crown Glass Surface,” Rishi Bharadwaj, Lamar University
**AAPT - 2  Friday 1:30 PM**

Science Room 112

Chair: Christopher Baird, West Texas A&M University

1:30 PM  “Lessons Learned from Redesigning Gateway Science Courses,” Christopher Baird, West Texas A&M University

1:42 PM  “Adapting Reforms,” Evan Richards, Lee College

1:54 PM  “STEMACES: Expanding opportunities in STEM+C for rural, under-represented, and high-need eighth-grade students in Texas and California,” Kenneth Carrell, Angelo State University

2:06 PM  “Physics Education and Research Opportunities with Quarknet,” Mary Yarbray, Klein High School

2:18 PM  “Working your physics muscles,” James Espinosa, Weatherford College

2:30 PM  “Analyzing Learning Outcomes from Graduate Level Classical Mechanics for Lagrangian Methods and Symmetries,” Kyle Wipfli, Texas Tech University

2:42 PM  “Double-Slit, then Dark Slit: Exploring Classical Interference Versus Quantum Behavior,” Arno Vigen, Renaissance Physics and Chemistry

2:56 PM  “Learning Quantum Science: A Cognitive Psychology Perspective,” Meveryn Chua, William and Mary

**W - 4  Friday 1:30 PM**

Science Room 235

“Affordable Circuits,” Regina Barrera and Tom O’Kuma, Lee College

**W - 3  Friday 2:00 PM**

Science Room 234

“Integrating Computation into Physics Courses,” Kelly Roos, Bradley University

**Poster Session  Friday 3:30 PM**

Science 1st Floor Hall


P2  “Python Advanced Laboratory 1 Experiment,” Conrad Schmitt, University of Houston
“Analytical Tools for Visualizing Spatially-Resolved SAXS/WAXS Structural Data: Examples from Cross-Sections of an Advanced Manufactured Material,” Leonardo Chavez, University of Texas at El Paso

“Weather Detector Device,” Matthew Pyle, McMurry University

“Study on Biomolecules to Control Reactive Oxygen Species(ROS) by Photodynamic Therapy(PDT) for the Treatment of Oral Diseases,” Yuna Han, University of Pittsburgh


“Structural and Practical Identifiability Analysis of Models for Syncytia Growth,” Gabriel McCarthy, Texas Christian University

“Study on Physical Properties of Nanoparticles Used in Drug Delivery Systems for the Treatment of Alzheimer’s Disease,” Juhyung Park, University of California at Santa Barbara.

“Ground Based Photometry and Analysis of the Planetary Candidate TOI-2018.01,” Meghan Buchanan, Stephen F Austin State University

“N-Body Simulation of Mass Transfer Between Binary Star Systems,” Fabian A Gonzalez, Tarleton State University

“Efficiency in Photometry: Optimizing Pipeline Performance and Usability with a Relational Database,” Micaela Landauro, University of Texas at Dallas

“Transit Observation and Analysis of TOI-2109b,” Derek Martin, Tarleton State University

“Radio JOVE Detection of Ionospheric Dimming During the October 2023 Annular Eclipse,” Antoneitte McConnell, Concordia University


“T' - Expansion Scheme in Hadron Resonance Gas Model,” Irene Gonzalez, University of Texas at El Paso

“Error Analysis of ProtoDune Raw Data with Uniform Manifold Approximation and Projection,” Ashley Marines, Texas A&M University at Corpus Christi

“Magnetic Field Effect on the Speed of Sound for Neutral and Charged Hadrons,” Cesar Morales Alba, University of Texas Rio Grande Valley

“Data Visualization for Neutrino Interaction Physics,” Gabriella Ozuna, University of Houston
**P19**

“Design and Fabrication of a Transmission Pulse Oximeter Device with Applications for Functional Near Infrared Spectroscopy (fNIRS),” Adrian Martinez, Texas Lutheran University

**P20**

“Design and Construction of Hair Characterization Apparatus,” Jason Castro, Texas Lutheran University

**P21**

“Implementation of an Asynchronous, Online Learning for a Fundamentals of Radio Astronomy Course,” Kyle Wipfli, Texas Tech University

**P22**

“Nonlinear Analysis of Drug-Treated Syncytia,” Anthony Greg, Texas Christian University

**P23**

“Decoding Dopamine: Advancements in Sensing Technology with Graphene Quantum Dots,” Mudit Panda, Texas Christian University

**P24**

“Constraining Tidal Dissipation in Kepler Binaries Via Bayesian Techniques,” Joshua Schussler, University of Texas at Dallas

**P25**

“Reproducing the Eddington Experiment with Modern Telescopes and Cameras,” Kenneth Carrell, Angelo State University

**P26**

“The Existence of a Speed Higher Than Light Using Mathematical and Physical Equations of the Speed of Light,” Gh. Saleh, Saleh Research Centre

**P27**

“Replacing Bohr ‘Orbit’ ‘Angular Momentum’ Model with Hemispherical, Static Duo-Pole Axis Transposition,” Arno Vigen, Renaissance Physics and Chemistry

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**W - 5 Friday 3:45 PM**

Science Room 235

“A Potpourri of Solar Eclipse Activities,” Larry Isenhower, Abilene Christian University; Mary Urquhart, UT-Dallas; Stephanie Ingle, Lee College; Shaukat Goderya, Tarleton State University; Kenneth Carrell, Angelo State University; SPS Chapters, and others

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**Banquet at City Limits Friday 7:00 PM**

“The ACU Molten Salt Research Reactor, a Springboard to the Future,” Dr. Tim Head, NEXT Lab Assistant Director, Abilene Christian University

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**Tarleton Observatory Tour Friday 9:00 PM**
Plenary II  Saturday 8:45 AM
Science Auditorium Room 102

Please enter and leave the Auditorium by the 2nd floor so as to not disturb presentations.

Chair: Daniel Marble, Tarleton State University

8:45 AM  “The Sanford Underground Research Facility (SURF), America’s deepest underground laboratory, hosts world-leading research experiments in physics, biology, geology and engineering. The overview of the SURF science program as well as current and future science facilities will be presented in conjunction with introduction to The Institute for Underground Science at SURF,” Dr. Barbara Szczerbinska, Professor of Physics and Associate Dean for Academic Affairs, Texas A&M at Corpus Christi

9:15 AM  “Teaching Quantum Mechanics at the High School and Freshman College Level,” Dr. M. Suhail Zubairy, Munnerlyn-Heep Chair in Quantum Optics and University Distinguished Professor of Physics, Texas A&M University

9:45 AM  “Computational Algorithms Enabling Particle-in-Cell Plasma Physics Simulations of Realistic Plasma Devices,” Dr. Jose Pacheco, Principal Member of the Technical Staff R&D/S&E Nuclear Engineering, Sandia National Laboratories

W -6  Saturday 10:00 AM
Science Room 234

“LHC Physics in the Classroom,” Shane Wood, QuarkNet National Staff, Shoreview, MN; Rice University QuarkNet Center – Mary Yarbray, Klein High School; Julie Bell, Klein Collins High School; and Chris Hatten, Cypress Lakes High School.

APS - 3  Saturday 10:30 AM
Science Auditorium Room 102

Chair: Shaukat Goderya, Tarleton State University

10:30 AM  “Search for Short-Period Jupiter-Size Exoplanet in Open Cluster NGC884 and NGC869 via the Transit Method”, Shaukat Goderya, Tarleton State University

10:42 AM  “Exploring the Popcorn Symphony of Gravitational Waves from Binary Black Hole Mergers,” Jessica Lawrence, Texas Tech University

10:54 AM  “Two- and Three- Photon Fusion into Charmonium and Dimuonium in Ultrapерipheral Nuclear Collisions,” Dipesh Bhandari, Texas A&M University at Commerce

11:18 AM  “Cosmological Constant and Universe,” Mohammed El-Lakany, Researcher

11:30 AM  “Identifying precessional modulation in gravitational-wave events,” Michael Kesden, University of Texas at Dallas

Student Awards Ceremony  Saturday 11:45 AM

Science Auditorium Room 102

Chair: Chris Marble, Tarleton State University
High School Festival Events

HS – 1  Physics and Chemistry Demo Show

Presenters:  Physics and Chemistry Faculty

12:45 PM  Rudder Way (Outside of the Science Building)

Come and enjoy a few large-scale physics and chemistry demonstrations including a LN2 depth charge and a “Swoosh” bottle.

HS – 2  Texas A&M Summer Quantum School for High School Students and Teachers

Presenters:  Bob Brick, Texas A&M University

1:30 PM  Science Room 122

Are you a high school student or teacher interested in spending two weeks in Wyoming this summer doing experiments in quantum Physics?

• Is matter made of particles and/or waves?
• Quantum uncertainty. Can you know where something is and how it’s moving?
• Quantum eraser. Can you erase or change the past?
• Quantum superposition, entanglement and teleportation. Can something be in two places at the same time?
• Quantum computing. A perfect security system needs an unbreakable code.
• How has quantum science increased our understanding of cellular systems and processes of living organisms?

Taught by professors and scientists from Texas A&M University’s Institute for Quantum Science and Engineering, this summer camp will delve into selected principles of quantum science in the first week and in applications of quantum science in the second week. Special guest lecturers include members from the National Academy of Sciences and other world-renowned scientific organizations. The opportunity for students to learn from leading researchers, scientists, and professionals in the field of quantum science brings a level of learning and interaction to the Quantum Science Summer Camp that is world-class. The camp includes an opportunity for a limited number of current high school or college instructors to attend and reinforce their knowledge of selected topics in quantum science and from added live activities. Teachers are encouraged to invite interested students to attend the camp. The cost for the camp including meals and lodging is free. Students and teachers are responsible for their travel to and from the camp.
HS – 3 Nuclear and Laser Physics

Presenters: Daniel and Chris Marble, Tarleton State University

1:30 PM and 2:30 PM Science Room 232

Tour Tarleton’s ion accelerator and advanced physics laboratories and learn how nuclear and laser physics and laser physics are used to solve problems and manufacture items from computer chips to radiation therapy and medical diagnostics. See demonstrations showing how high Z materials can be injected into blood to make vessels appear in x-rays; Laser light used as an optical tweezer to pick up microscopic objects and much more.

HS – 4 Environmental Science and Geoscience Careers

Presenters: Environmental Science and Geoscience Faculty, Tarleton State University

1:30 PM Science 1st Floor Foyer

Are you interested in the protecting the environment, food production, weather, the Earth’s climate, and how government and industrial policies can help in these areas? Are you interested in fossils, using science to discover oil and gas, managing ground water, or studying rocks on the Earth or from other worlds? If you are then you might be interested in pursuing a career in Environmental Science and Geoscience. Come talk with faculty from these programs and learn about their programs and potential careers.

Interested in how plant-based polymers can be used for cleaning oil spills, drug delivery and other uses? Interested in a career in Petrogeology or in how electron microscopy and x-ray fluorescent spectroscopy can be used to analyze rocks? Come talk with faculty of the chemistry and geoscience programs about their fields and tour their labs.

HS – 5 Campus Tour

Presenters: Welcome Center Staff, Tarleton State University

2:30 PM Planetarium (Outside)

Take a tour of the Tarleton campus including the new engineering college with its state-of-the-art labs and teaching facilities and learn about the history of the school.

HS – 6 Chemistry Research and Lab Tour

Presenters: Chemistry Faculty, Tarleton State University

2:30 PM Science 4th Floor Foyer

Interested in how plant-based polymers can be used for cleaning oil spills, drug delivery and other uses? Interested in pursuing a medical degree or in doing forensics? If you are then come talk with faculty of the chemistry program about their program, the research they do with students, and tour their labs.
Since its founding in 2011, the Tarleton Rocket team has a successful history of placing in both NASA and national rocket and satellite competitions. Presently, Tarleton Rocketry has designed and built a 5-inch diameter, 12-foot-long rocket to launch a quadcopter-type landing vehicle that is deployed at 400 ft above ground level as the rocket descends under parachute.
Dr. Kevin B. Woller  
Department of Nuclear Science  
Massachusetts Institute of Technology

**Fusion Energy Technology Development**

**Abstract:** Technological developments and triumphant achievements in fusion science in recent years are adding momentum to a renaissance in a push for fusion energy. Ambitions are high to herald in fusion as the holy grail of energy production so purported by generations of scientists. To satisfy those ambitions, national and international fusion development communities are focusing efforts to determine fusion nuclear science and technology research priorities towards applications of fusion energy utilization. The lowest temperature approach to controlled thermonuclear fusion power is to use deuterium (D) and tritium (T), heavy isotopes of hydrogen as the fuel. Tritium breeding technology is a potential bottleneck for the roll out of D-T based fusion systems, and one approach to satisfy the need for T breeding in fusion devices is the so-called Liquid Immersion Blanket (LIB) which utilizes high temperature liquids (for high thermal conversion efficiency) that contain lithium (for T breeding). There is large overlap in the technology for blankets for fusion and for Gen. IV fission concepts, including molten salt (Tm>600K) compatible materials, pumps, sensors, etc. A number of projects on-going at MIT seek to evaluate and contribute to the development of these technologies that bridge fusion and fission energy. Irradiation experiments with neutrons and ions, in addition to salt chemistry, pumping, and corrosion analysis will be presented and discussed.

**Bio:** Dr. Kevin B. Woller got a start in ion irradiation and plasma technologies as a student in Dr. Daniel Marble's Accelerator Facility at Tarleton University, graduating from the Engineering Physics program in 2009. Dr. Woller has been working in fusion and fission science and technology since 2009, first as a graduate student at MIT studying helium plasma effects on tungsten utilizing the unique ion beam analysis capabilities of the DIONISOS plasma-material interaction experiment. Since graduating in 2017, Dr. Woller has been dabbling in the realm of materials irradiation damage, tritium breeding, and plasma-material interactions. In particular, the CLASS accelerator lab at MIT has a proclivity for combining ion irradiation with other environmental effects, such as corrosion (molten salt or liquid metal), high temperature (T<1200K), cryogenic temperature (T>20K), and plasma exposure.
Words Matter: Problems to Consider in Teaching About Work and Energy

Abstract: Energy and systems are crosscutting concepts, and physics is the place to help students develop deep conceptual understanding. However, students hear what we say, not what we mean! Simplifying our discussions can generate increased confusion. What could be a single approach to solving a wide variety of problems becomes compartmentalized into many special cases to be memorized. The NSF-sponsored best practices study (what the best COLLEGE classes should look like) that informed the AP physics redesign led to such descriptions being avoided in the AP Physics 1 and 2 framework; but they are still commonly used. For a few examples of common wording that can generate incorrect models, we will share how small changes can help students develop a coherent conceptual model that significantly impacts their ability to use more robust problem-solving approaches and to describe and model physical situations. Our students can so build a logical framework that does not require memorization of special cases (or guessing), which prepares them to do better in future study.

Bio: Gay Stewart received her PhD in Physics from UIUC in 1994. For the next 20 years, at University of Arkansas she focused on three interrelated issues: improving introductory courses, improving physics majors’ preparation for many careers options, and preparing future faculty, both high school and professoriate. UA saw a 10-fold increase in physics graduates and was one of six initial Physics Teacher Education Coalition institutions. Her Graduate Teaching Assistant program grew into one of four NSF/AAPT “Shaping the Preparation of Future Science Faculty” sites. She was co-PI of an NSF GK-12 project placing fellows in middle school mathematics and science classrooms. Helping math and science teachers work together was central to her $7.3M NSF Math Science Partnership, College Ready in Mathematics and Physics. She was PI of Noyce grants to support pre-service, and master physics, teachers. She chaired the College Board’s Science Academic Advisory Committee, and co-chaired the AP Physics Redesign commission and Development Committee. In 2014, Gay transitioned to WVU, where she founded and directs the WVU Center for Excellence in STEM Education, is one of the PIs of one of the first NSF INCLUDES Alliances and directs many STEM education initiatives in partnership with other state organizations. A fellow of the APS and AAPT, she received the Oersted Medal from AAPT in 2019.
Radiation Effects Testing of Transistors at Sandia’s Ion Beam Laboratory

Abstract: Understanding how electronics perform in extreme radiation environments is important for reliable and safe operations in commercial aviation, space exploration vehicles, satellites, and nuclear reactor or accelerator facilities. In this talk, we will explore how the Sandia National Laboratories Ion Beam Laboratory studies radiation effects (e.g. in Si and SiC based transistors and circuits). We give a brief facility overview and highlight how we explore electronic degradation of transistors by utilizing ion irradiation as a neutron surrogate. We present a survey of data and analysis with simple modeling for the transient annealing of Si bipolar junction transistors (BJT), and modification of on state resistance in SiC Metal Oxide Semiconductor Field Effect Transistors (MOSFET) after neutron or ion irradiation. We show how simple models can be used to extract underlying physical processes for electronic device performance. We will conclude the talk with a survey of how to get involved in this research area with an emphasis for student researchers.

Bio: Josh Young is a Senior Member of the Technical Staff at Sandia National Laboratories. Josh received his B.S. in physics from Tarleton State University in 2015. He then continued to the University of North Texas where he received his M.S. (2017) and Ph.D. (2020), both in physics. In 2020, he took a post-doctoral appointment at Sandia’s Ion Beam Laboratory where he continued on as a staff member. His research at the University of North Texas investigated synthesis of astrophysical dust grain analogues using ion beam implantation techniques. During his post-doctoral appointment, Josh gained expertise utilizing ion beams as a surrogate for neutron displacement damage in commercial electronics. He also characterized the degradation of polymers due to electron irradiation with residual gas analysis. Currently, Josh is leading a wide variety of research tasks including efforts to understand the performance of commercial and custom electronics to various radiation environments. He is also involved in fundamental materials research to understand the role ionizing radiation plays in polymer degradation. When he’s not at work, Josh enjoys time with his family, playing music at his local church, or enjoying a good history book.
Abstract: The Sanford Underground Research Facility (SURF), America’s deepest underground laboratory, hosts world-leading research experiments in physics, biology, geology and engineering. The overview of the SURF science program as well as current and future science facilities will be presented in conjunction with introduction to The Institute for Underground Science at SURF.

Bio: Barbara Szczerbinska is a Professor of Physics and Associate Dean for Academic Affairs at Texas A&M University - Corpus Christi. Prior moving to Texas, she was a faculty at Dakota State University in Madison, SD. Dr. Szczerbinska earned her M.S. from University of Wroclaw (Poland) and her Ph.D. from the University of South Carolina in Columbia, SC. Her main research interest is focused on theoretical aspects of Neutrino Physics, Geoneutrinos and Dark Matter. Her intensive collaborations with scientists from around the world lead to establishing in 2011 The Center for Theoretical Underground Physics and Related Fields known internationally as CETUP*. In 2023 CETUP* programs are developed under the auspices of the Institute for Underground Science at Sanford Underground Research Facility in Lead, SD.

Dr. Szczerbinska served on the Board of Directors for the Kirby Science Discovery Center, Community Learning Committee at the Washington Pavilion, Osher Lifelong Learning Institute Leadership Council, APS CUWIP National Organizing Committee and in Chair line of Texas Section APS. She is a member of Sanford Underground Research Facility Foundation Advisory Board and a member of Science Planning Advisory Committee at Sanford Underground Research Facility. She is also a member of Phi Kappa Phi and American Physical Society.
Quantum Mechanics at the High School and Freshman College Level

Abstract: Quantum mechanics is regarded as a highly mathematical and abstract subject that is inaccessible to anyone without an advanced knowledge of mathematics. In the fall of 2018, I offered a course on Quantum Mechanics to incoming freshman students at the Texas A&M University. These students, just out of high school, took this course before they took the usual Mechanics and Electricity/Magnetism courses. The main objective of this course was to present an introduction to quantum mechanics in an almost self-contained way for someone with a high school physics and mathematics background. No knowledge of calculus was assumed. In addition to the foundations of quantum mechanics I could also present some important applications, such as in quantum communication and quantum computing. The course was taught from the textbook entitled Quantum Mechanics for Beginners (Oxford University Press 2020) that I wrote based on my class notes. In this lecture I shall present my approach of teaching quantum mechanics to high school students and the freshman level college students.

Bio: M. Suhail Zubairy is a distinguished professor in the Department of Physics and Astronomy at Texas A&M University and the inaugural holder of the Munnerlyn-Heep Chair in Quantum Optics. He has made pioneering contributions in the fields of quantum computing, laser physics, and quantum optics. He has authored and co-authored several books and over 400 research papers on a wide variety of research problems relating to theoretical physics. He is most well-known for the textbook Quantum Optics (Cambridge University Press 1997) that he co-wrote with Marlan Scully. His research and work have been widely recognized by the physics community and he has won many international awards. His book, Quantum Mechanics for Beginners (Oxford University Press 2020) is written for someone with only a high school background in physics and mathematics to introduce them to the fascinating world of quantum mechanics. The book includes an introduction to the fields of quantum communication and quantum computing. Recently he has written another book A Mysterious Universe (Oxford University Press 2023) that introduces quantum mechanics, relativity and cosmology to someone with little or no background in physics.
Abstract: ‘Plasma in a box’ simulations have limited applicability in plasma device modeling; efforts to modeling more realistic plasma devices, with Particle-in-Cell (PIC) method, are typified by the large computational resources required. Efficiently computing both particle trajectories, collisions, and self-consistent fields (e.g. solving Poisson’s equation) in PIC with Direct Simulation Monte Carlo (DSMC) plasma codes becomes even more challenging in cases where the plasma is non-uniform or transient. State-of-the-art algorithms, (two-mesh decomposition, dynamic load balancing and particle reweighting) with a massively parallel PIC code developed at Sandia National Labs, enable a fully kinetic plasma modeling capability for simulating low temperature gas and plasma dynamics in realistic device geometries. We will discuss a series of benchmark problems used to verify fundamental capabilities, including self-consistent electrostatic field solve, particle transport, and energy transfer through collisions. However, as the number of computational particles and collisions occurring vary drastically across the computational domain, even high performance, massively parallel plasma (PIC) codes will experience idle processors during the field solve or the particle push/collisions. Independent decompositions of the same unstructured mesh enable balancing of the particle kinetics and field solve. The re-weighting algorithms enables an array of dynamic particle weighting strategies to maintain relevant particle statistics (for PIC to be applicable), avoid overwhelming the simulation with computational particles, and maintain statistically accurate representation of particle physics after a particle merge/split event. Key results will be presented to elucidate details of these algorithms and, to an extent, verify results where multiple algorithms, multiple physics process are invoked in a simulation. With the overarching restrictions on plasma physics simulations in mind (Debye Length and Plasma Frequency), the purpose of this talk is to present state-of-the-art plasma modeling capabilities developed to model plasma devices more realistically in terms of geometry, physics, and time scales. SAND2024-00744A

Bio: Jose L. Pacheco is a Principal Member of Technical Staff at Sandia National Laboratories. Under his current role, Nuclear Engineering S&T, supports activities related to physics and development of components, and component lifecycle engineering. Previous roles at Sandia National Labs include Principal Investigator for Advanced Plasma Transport and Kinetics code, and a Post-Doc Fellowship at the SNL Ion Beam Laboratory using novel ion beam techniques for fabrication of single atom devices. Formal education includes a Ph. D. in Accelerator and Plasma Physics from the University of North Texas and a Bachelor of Science in Engineering Physics from Tarleton State University. Jose’s other interests include machining, hiking/fishing, and working on some older cars.
The ACU Molten Salt Research Reactor, a Springboard to the Future

Abstract: Molten salt reactors hold promise to impact some of the world’s biggest problems including the availability of clean water, inexpensive power to lift people out of poverty, and production of isotopes for medical treatments and diagnostics. Abilene Christian University Nuclear Energy eXperimental Testing Lab (NEXT) is leading an effort partnering with the Georgia Institute of Technology, Texas A&M University, the University of Texas, and Natura Resources to take the first major step toward actualizing this promise as it works to design, license, and deploy the Natura Resources Molten Salt Research Reactor (MSRR) at ACU. The MSRR is planned as a testbed for researchers to implement solutions to address the world’s needs, and that will accelerate Natura’s efforts for commercial deployment of molten salt reactors to increase access to those solutions. This talk will describe where NEXT Lab is in working toward our goals, what comes next, and how this technology could push the country forward in the future.

Bio: Dr. Tim Head is assistant director of the ACU Nuclear Energy eXperimental Testing (NEXT) Lab and professor and chair of the Department of Engineering and Physics at ACU. He earned a PhD from University of Illinois in solid state physics in the area of phonon imaging, and has been a faculty member at ACU since 2007. He has worked as part of the NEXT Lab since 2017 leading the molten salt systems research group with a focus on experimental thermal hydraulics and instrumentation advancing molten salt reactor technologies. He has led efforts to build and operate one nitrate and two fluoride molten salt loops, and experimental investigations of mechanical filters for fluoride molten salts. He is listed as co-inventor on multiple inventions including a high temperature flow meter, and sealing technologies related to fluoride molten salt fluids and instrumentation.
Workshop 3 will concentrate on advanced topics. This workshop is proudly supported by PICUP, https://www.compadre.org/PICUP/, and OPTYCs, https://optycs.aapt.org.

**Limited to 18 participants – 2.0 hours**  
**Location: SCIEN 234**  
**10:00 AM – 12:00 PM**

**W2  “Supporting Students' Understanding of Work and Energy through Careful Use of Language”**

Gay Stewart, University of West Virginia, Morgantown, WV.

Common simplifications can generate misconceptions, compartmentalizing a single approach to solving a wide variety of problems into many special cases. These simplifications seem so clear to experts that assessments may not be designed to elicit incorrect models, making correction difficult. The NRC presented design principles vital to improving the effectiveness of AP/college courses. Exploring key ideas in depth is one recommendation perfectly served by a careful approach. We will compare some common wording which generates incorrect models to framework language designed to help students develop coherent conceptual models that improve their approach to problem solving and ability to describe and model physical situations. We will throw in some useful models, too.

**Limited to 24 participants – 2.0 hours**  
**Location: SCIEN 236**  
**10:00 AM – 12:00 PM**

**FRIDAY PM**

**W3  “Integrating Computation into Physics Courses”**

Kelly Roos, Bradley University, Peoria, IL

Any physics educator from around the Stephenville area and the Texas Section AAPT/APS and Zone 13 SPS Spring Meeting (or anywhere else if you’re willing to travel) that want to energize their physics courses should attend! The scope of the W1 and W3 workshops is appropriate for physics teachers from high schools, 2-year colleges, and 4-year colleges and universities. The workshop will include demonstrations and discussions about various aspects of integrating computational activities into physics courses at all levels from introductory to advanced. Workshop 1 will concentrate on introductory physics and Workshop 3 will concentrate on advanced topics. This workshop is proudly supported by PICUP, https://www.compadre.org/PICUP/, and OPTYCs, https://optycs.aapt.org.

**Limited to 18 participants – 3.0 hours**  
**Location: SCIEN 234**  
**2:00 pm – 5:00 pm**

**W4  “Affordable Circuits”**

Regina Barrera and Tom O’Kuma, Lee College

Circuit kits were designed from inexpensive items to do DC circuits including series/parallel simple circuits, basic non-simple circuits and basic RC circuits. The kit is used to be given to students for lab or home activities. In this workshop, the kit will be used not only to do the activities but, if time allows, with some additional inexpensive items to do some electrostatics and magnetism activities.
Registration in the workshop must be completed by Friday, March 15\textsuperscript{th} to ensure enough kits are purchased and built to bring to the workshop. This workshop is proudly supported by the Organization of Physics in Two Year Colleges, OPTYCs, https://optycs.aapt.org.

Cost: $45 which includes the circuits kit and activities, but is paid by the Nuclear Power Institute

**Limited to 15 participants – 2.0 hours**  
**Location: SCIEN 235**  
1:30 pm – 3:30 pm

**W5  “A Potpourri of Solar Eclipse Activities”**

Larry Isenhower, Abilene Christian University; Mary Urquhart, UT-Dallas; Stephanie Ingle, Lee College; Shaukat Goderya, Tarleton State University; Kenneth Carrell, Angelo State University; SPS Chapters, and others

Are you ready for April's total eclipse? In this workshop presented by multiple TSAAPT members with eclipse expertise, participants will engage with activities designed for student or public outreach events. Whether you are at a university, 2-year college, a high school, or doing outreach, there will be activities and ideas appropriate for events on your campus or in your community. Presenters will bring their tips, tricks, and solar eclipse activities for any budget. Experience some eclipse fun of your own and leave with a toolkit of activities and ideas. Have your own ideas to share? Feel free to bring those, too!

**Limited to 24 participants – 1.5 hours**  
**Location: SCIEN 235**  
3:45 pm – 5:15 pm

**SATURDAY AM**

**W6  “LHC Physics in the Classroom”**

Shane Wood, QuarkNet National Staff, Shoreview, MN; Rice University QuarkNet Center – Mary Yarbray, Klein High School; Julie Bell, Klein Collins High School; and Chris Hatten, Cypress Lakes High School.

Students who complete an introductory physics course may be under the impression that physics somehow “stopped” in the late 19th or early 20th century. Of course, this idea could not be further from the truth, as physicists today continue to work on addressing an ever-growing list of unsolved questions: Where has all the antimatter gone? What is dark matter? What is dark energy? (What questions have we not thought of yet?) Physicists from all over the world work to address these and many other questions at the Large Hadron Collider (LHC) at CERN, on the border of Switzerland and France. This workshop will focus on how teachers can tap into the excitement of LHC physics to both motivate students and provide a contemporary context for them to engage with topics and practices covered in introductory physics courses, including (but not limited to) conservation laws, data collection, organization, and analysis, and making claims based on evidence. Participants in this workshop will alternate between “student mode” and “teacher mode”, will analyze authentic LHC data, and will get a chance to work through some activities from QuarkNet’s Data Activities Portfolio. The workshop will conclude with a discussion on classroom implementation. Some of the activities will be computer-based, so please bring along a
laptop! This workshop is supported by the NSF-funding for QuarkNet, [https://quarknet.org](https://quarknet.org), and OPTYC, [https://optycs.aapt.org](https://optycs.aapt.org).

**Limited to 24 participants – 4.0 hours  Location: SCIEN 234  10:00 am – 2:00 pm**