CHRISTOS VELISSARIS

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EDUCATION - DIPLOMA'S:

- **Ph.D. in Particle Physics, University of Rochester,** January 1995
  Advisors: Prof Arie Bodek and Prof Steve Olsen. "*Dilepton production cross section and asymmetry measurements at 58 GeV e^+ e^- annihilation with the AMY detector at TRISTAN, Univ. of Rochester"*, March 1995, UR1356
- **M.S. in Physics. University of Rochester**, August 1990.
- **B.Sc. in Physics, Athens University**, July 1985.
  "Quarks and Structure Function phenomenology". Advisors: Prof Antoniou and Prof Maintas.

WORK HISTORY:

- **Lecturer of Physics, University of Central Florida** (2006 – current)
- **Visiting Assistant Professor, Monmouth College** (2005-2006)
- **Assistant Scientist. University of Wisconsin-Madison.** (2000 - 2005)
- **Post-doctoral Associate. New Mexico State University.** Stationed at Brookhaven National Lab. (1997-2000)
- **Military Service**. Corps of Engineers (1995-1997)

TEACHING PORTFOLIO:

- Calculus and Algebra based Physics I.
- Calculus and Algebra based Physics II
- Physics III for Scientists and Engineers. Modern Physics.
- Astronomy for non Science majors.
- Physical Science for non Science majors
- Quantum Mechanics for Physicists
- Statistical Mechanics
- Analog Electronics.
- Digital Electronics and Design.
- Intermediate Labs.

NEW COURSES (proposed):

- Introduction to Cosmology, (at Monmouth College).
- The Science and Engineering of Interaction of Radiation with Matter (at UCF)

ADVISING/STUDENTS:

- Thomas Evaskis. "Physical Properties and operation principles of semiconductor microelectronic devices." University of Central Florida, Fall 2013
- Adelaide Baker. "Statistical Error Analysis of Data". University of Central Florida, Fall 2013

- Jacque Ernotte. “Charged Particle Beam Optics, Ring Stability, Accelerators Physics and Simulations”. University of Central Florida Fall 2011.
- Jeremiah Campion. “The KTeV Experiment at Fermilab. Monmouth College. Spring 2006. (Now a High School Physics Teacher).
- Huican Ping. University of Wisconsin at Madison. (2000-2006) Supervised Dr. Ping (now a programmer in industry) to successfully complete his Ph.D Thesis.

COMMITTEES AND SERVICE:

- Undergraduate Assessment Coordinator (UCF)**:** 2007-current.
- Developed the Undergraduate Assessment procedure for the Department’s Analog and Digital Electronics Laboratories.
- Upper Lab Committee (UCF): 2012, 2013, 2014.
- Undergraduate Curriculum Committee. (UCF): 2010-2011.

PROFESSIONAL ACTIVITIES AND CERTIFICATIONS:

- Completed coursework (IDL) and received certification by UCF for Remote Education. Certified to teach Web Courses. (2008)
- FCTL (Faculty Center for Teaching and Learning) Diversity Track summer workshop attendance and poster prestenation. (UCF, 2008-20012).
- Attended the *“Activity Based Faculty Institutes”* workshop at Dickinson College, Pennsylvania (Summer 2008). One week workshop and activities for University and college faculty who want to transform their classes into an Activity Based learning environment and employ *“Workshop Physics”* pedagogical methodology.
- BattlebotsIQ: Taught introductory robotics to High School students (Orlando Science Center, Summer 2009).
- Has taught Physical Science (Basic Physics for non Science Majors) in the *“Physics in Films”* flavour. In that course, video clips from movies are employed as motivational tools to convey the concepts of Physics to non-Science majors. Developed Activities for the course based on three movies. *“Superman returns”:* Conservation of Momentum and Energy. “*Hancock*”: Kinematics in a gravitational field, acceleration, Energy and the Work kinetic Energy theorem. *“City of Ember”:* Energy, Electromagnetism and conversion of Mechanical Energy into electric.

SELECTED PUBLICATIONS:

- “AC Circuit Analysis in a nutshell”. Fall 2012. Written for the Intermediate laboratory and the Analog Electronics Physics courses at UCF.
- “Statistical data Analysis in a nutshell”. Fall 2012. Written for the Intermediate laboratory Physics course at UCF.
- More than 50 publications in internationally recognised Scientific Magazines.

OTHER SKILLS:

- Excellent C/C++, OOP Perl, LabView. AutoCAD. Linux and Windows operating systems.
- Extensive statistical analysis of large data volume(s). Algorithm specialist.

- Nuclear radiation detector quality assurance, maintenance, operation and commissioning. Head of the Quality and Assurance program for a large detector system at Brookhaven Lab. Deep understanding of science and operation principles of nuclear radiation detectors.

AWARDS-HONORS:
European Community award to do research in Japan. Selection 1997. (Declined).

DETAILED WORK HISTORY:

Lecturer of Physics (August 2006 – current)
University of Central Florida

- Taught extensively (Algebra and Calculus based) general education introductory Physics courses (Physics I and II). Introductory statics, dynamics, rotational and translational motion, electromagnetism.

- Revised and upgraded the Laboratory Course "Modern Electronics for Scientists". Adopted a new textbook (Malvino & Bates "Electronic Principles") and laboratory exercises from the *"Experiments Manual to accompany Electronic Principles"* book.

- Revised and upgraded the Laboratory Course "Industrial Electronics for Scientists". Reformed it into a Digital Electronics and Data Acquisition Lab course. Adopted a new textbook (William Kleitz "Digital Electronics") and laboratory exercises from the *"Laboratory Manual to accompany Digital Electronics"* book.

- Modern Physics for Scientists and Engineers. Special Relativity, Introduction to Quantum Mechanics.

- Taught General Education Science courses for non Science Majors. Introductory Astronomy and Physical Science.

    - Proposed and developed a new course *"Interaction of Radiation with Matter"*. The course is aimed to Scientists and Engineers who are interested to understand the nature of Nuclear Radiation, the Mechanism of its interaction with Matter, the principle of operation of Nuclear Radiation Detectors and its biological effects. It is also aimed to Physicist who are contemplating a career on Nuclear Medicine and Health Physics.

- **Students:**

Supervised the Undergraduate Research/Independent Study of three undergraduate Students Mr. Thomas Evaskis, Ms Adelaide Baker and Mr. Jaque Ernotte

- **Service:**
    - Undergraduate Education Assessment Coordinator. Has been the Undergraduate Assessment Coordinator for years. Authored pre-post-tests for the *"Analog Electronics for Scientists"* lab class and used it for the annual undergraduate Assessment report. Similar effort for the *"Digital Electronics for Scientists"* lab class under way.

- **Workshops, Conferences and Professional Activities:**
    - Attended the *"Activity Based Faculty Institutes"* workshop at Dickinson College, Pennsylvania (Summer 2008). One week workshop and activities for University and college faculty who want to transform

their classes into an Activity Based learning environment. Competent in *"Workshop Physics"* teaching techniques.

- Attended *the "Physics with Video Analysis"* workshop at UCF (Fall 2010). This was a one week workshop who want to introduce in their classes video Analysis of Experiments using Video clips of their Activities and Vernier Logger Pro video Analysis software.

- Continuous Attendance of the Summer Faculty Development Conferences (Diversity Track) offered by UCF Faculty Center for Teaching and Learning (FCTL). Posters:
  Summer 2011 Faculty Development Conference: ***"Diversity in Films: Cultural and Diversity Education via Hollywood Movies."*** C. Velissaris.
  Summer 2010 Faculty Development Conference: ***"Assessment of Cultural Competencies in the Studio Classroom"*** C. Efthimiou, E. Flitsiyan, O. Molina, E. Ramos, H. Saha, C. Velissaris.
  Summer 2009 Faculty Development Conference: ***"Building Cultural Competencies in the Studio Classroom."*** C. Efthimiou, O. Molina, V. Ray, H. Saha, C. Velissaris.

- Has taught Physical Science (Basic Physics for non Science Majors) in the *"Physics in Films"* flavour. In that course, video clips from movies are employed as motivational tools to convey the concepts of Physics to non-Science majors. Developed Activities for the course based on three movies. *"Superman returns":* Conservation of Momentum and Energy. "*Hancock"*: Kinematics in a gravitational field, acceleration, Energy and the Work kinetic Energy theorem. *"City of Ember":* Energy, Electromagnetism and conversion of Mechanical Energy into electric.

- Selected Textbook Reviews:
  Spring 2009 Reviewer of "College Physics" by Urone. W.H. Freeman and Company.
  Fall 2010 Reviewer of Electronics with Discrete Components. Enrique Galvez. John Wiley.
  Fall 2009 Reviewer of "University Physics "by Wolfgang Bower and Gary Westfall. McGraw Hill
  Spring 2009 Reviewer of "College Physics" Urone, Hinrich, Sharma, Dirks. W. H. Freeman.

- **Outreach:**
  - BattlebotsIQ: Taught introductory robotics to High School students (Orlando Science Center Summer 2009).

Visiting Assistant Professor of Physics (September 2005 – August 2006)
Monmouth College

- **Courses taught:**
  - Digital Electronics for Scientists (Lecture and Laboratory)
  - Quantum Mechanics (for Physics Majors)
  - Statistical Mechanics (for Physics Majors)
  - General Education "Astronomy for non Scientists".

- Assisted and supervised the Laboratory sessions for the Astronomy for non Science majors and Digital Electronics courses. Showed a strong interest in curriculum development and developed new Laboratory exercises in Digital Electronics.

- Proposed and prepared a new Course on Introductory Cosmology.

- **Students:**

Supervised undergraduate Student (Mr. Jeffery Campion) during his Senior Research Project:

Assistant Scientist. (September 2000 - Summer 2005)
University of Wisconsin-Madison. (Supervisor: Prof. Albert Erwin)

Member of the MINOS DCS group.

- Working with a graduate student, we were **responsible for the design, installation and operation of a SCADA, networked system** to monitor Environmental parameters (Temperature, Humidity, Radon), thermocouples and control signals from the Magnet Power Supplies, in the Far and Near detector areas of the MINOS experiment. We chose the commercial *Fieldpoint* (National Instruments) system and the control was done from a PC running Windows-2000 using Visual Basic and the Measurement Studio set of libraries (from National Instruments).

Member of the MINOS Beam Monitoring group.

- Constructed test ionisation chambers and measured their response in a high intensity beam environment by performing experiments at the Brookhaven ATF accelerator facility. Analysed data from that experiment to obtain the ion chamber response as a function of the produced ionisation density from the incident beam. (**Nucl. Instrum. Meth. A496:293-304, 2003**). I was the first person to announce at a collaboration meeting that a 5mm gap chamber at 400-500 Volts (according to my analysis) performs marginally in MINOS ionisation environments.

  I personally developed various **original phenomenological models** and authored three NUMI/MINOS notes regarding the operation of ion chambers under a high intensity ionisation environment **(NuMI-NOTE-BEAM-0717, NuMI-NOTE-GEN-0814, NuMI-NOTE-ELEC-0754)**.

  Authored software, using **MFC (Microsoft Foundation Classes) with Visual C++**, as well as Network communication algorithm with the **Win32 Socket library**. This software was used to collect data from the ion chambers. The data were sent through the network via the UDP protocol. A client thread in our program was continuously questioning the appropriate port

and acquiring chamber data from the network. The data were subsequently analysed and graphically displayed **in real time**.

- Discovered a solution describing the space and time dependence of the ion density distribution inside an ionisation chamber, operating under intense ionisation conditions. Thus, **<u>discovered an equation</u>**, the operational parameters of the ion chamber should satisfy, in order to operate saturation free. My equation takes into account not only the total charge deposited in the chamber but also the time duration of the pulse, and connects the steady state with the short pulse approximation conditions (two extreme cases already described in the ionisation chamber literature). More specifically I have proven that the condition for an ion chamber to operate saturation free is: $\mathbf{V_0/d^2 \geq 2\pi\rho(\tau^2/3-\tau+1)}$ **for** $\mathbf{\tau \leq 1}$ and $\mathbf{V_0/d^2 \geq 2\pi\rho_0/3}$ **for** $\mathbf{\tau \geq 1}$ where $\mathbf{\tau=T/T_0}$ when the ion chamber with gap d and voltage V_0 is subjected to an external pulsed beam with duration T, that causes a total ionisation density in the ion chamber ρ. Also, ρ_0 is the total space charge density accumulated in the chamber after time T_0. The characteristic time of the chamber $T_0=d^2/\mu V_0$ is the time it takes for the steady state charge density in the chamber active volume to be formed. The condition $V_0/d^2 \geq 2\pi\rho$ is the well known in the literature short pulse approximation and the $V_0/d^2 \geq 2\pi\rho/3$ is the steady state solution. Although my equation assumes constant positive-ion drift velocity $\mu \times V_0/d$, this analysis can be used at least to estimate when pulse duration effects will be significant and their first order of the effects. **No experiment yet has demonstrated the effect of pulse duration in the operation of ionisation chambers.**

  A paper has been published with my results at Nucl. Instrum. Meth. A547(2-3): 511-516, 2005. Also posted at **arXiv: physics/0501085.**

Member of the KTeV collaboration.

- Studied the **Weak Radiative Hyperon Decay** $\mathbf{\Xi^0 \rightarrow \Lambda^0 \gamma}$ using KTeV data. This type of Ξ^0 decay belongs in the class of Weak Radiative Hyperon Decays (WRHD). Hara's theorem predicts that in the exact SU(3) symmetry case the expected decay Asymmetry should be zero. In reality, massive quarks give rise to non vanishing parity violating amplitudes and therefore decay asymmetries. Vasanti in 1976 assuming single quark transition ($q_1 \rightarrow q_2\gamma$) predicted positive Asymmetry for all WRHD. However, the first measurement in the decay $\Sigma^+ \rightarrow p^+\gamma$ revealed a large negative value meaning that simple quark transition arguments cannot describe the experimental data.
  By using data from the KTeV 1999 run period I found ≈3,000 $\Lambda^0\gamma$ decays of the Ξ^0, which enabled me to measure the decay asymmetry and Branching Ratio. The Branching Ratio was measured to be $\mathbf{Br(\Xi^0 \rightarrow \Lambda^0\gamma)=Br(\Xi^0 \rightarrow \Lambda^0\pi^0)\times (1.22\pm0.03\pm0.04)\times 10^{-3}}$ where as Normalization Mode we chose the dominant Ξ^0 decay into $\Lambda^0\pi^0$. The Electro-Weak Asymmetry of the decay was measured to be $\mathbf{\alpha(\Xi^0 \rightarrow \Lambda^0\gamma) = -0.73\pm0.10}$. **I authored the long write-up** and a paper is currently under review by the collaboration.

<u>Post-doctoral Associate. (1997-2000)</u> Brookhaven National Laboratory (stationed by New Mexico State University). Supervisors: Dr. Melynda Brooks, Dr. Dave Lee, LANL Head of P-25 Group.

Member of the Muon Tracking collaboration.

- **Instrumental Participation in the building the endcap Cathode Strip Muon chambers of the PHENIX experiment. Assumed the leading role and took full responsibility for the conditioning and Quality and Assurance process for the Muon Cathode Strip Chambers**. Trained and tested Station 2 and 3 chambers (approx. 7,000-8,000 wires) by myself. **("The PHENIX Muon Arms" Nucl. Instrum. Meth. A499:480-488, 2003**). The signals from every wire, induced in the bleeding resistor immediately after the decoupling capacitor, were individually viewed in an oscilloscope. The signals were induced by either a radioactive source or by cosmic rays. A working wire was producing signals exhibiting the characteristic Landau distribution. A discharging wire was producing signals of almost a constant height, exhibiting at the scope, a bright narrow band.

  Designed, proposed and implemented a data acquisition scheme (based on NIM and CAMAC modules) to be used in the chamber testing. The system was used to obtain data induced by a radioactive source from every wire of the muon chambers as part of the QA process. This was a self-triggered data acquisition system. I designed it, such a way that **the signal from the wires was used both as trigger and signal to be measured**. By splitting the signals via linear FAN-IN FAN-OUT's, we could use the OR'ed signal from the first output as trigger and gate generator for the ADCs and the signals from the second output as input to the ADCs after appropriate delay. This way, the usage of large scintillator modules for triggering was avoided, the useful trigger rate was maximized (since the whole wire, not only the part covered by the scintillator, could provide a trigger signal) and hot wires were easily identified from the narrow (non-Landau like) signal spectrum. The testing was done either with a radioactive source or with cosmic rays.

- Participated in the PHENIX Magnet mapping effort by running the Magnetic field measurement experimental setup and analysing data. (The work resulted the publication; **"PHENIX Magnet System" Nucl. Instrum. Meth. A499:480-488, 2003**). A series of Hall probes mounted on a metal frame were used to measure the magnetic field inside the endcap PHENIX magnets. The frame was rotating 360^0 around the beam axis (PHENIX axis). The magnetic field was mapped across the plane, for various angles around the beam axis. A finite element program was subsequently employed to produce the magnetic field at every point, using our measurements and Gauss' theorem.

- Analysed Monte Carlo data and devised a method to tag prompt photons and to assess the background from neutral narrow jets (that is η^0 and π^0) faking a photon. Highly energetic η^0 and π^0 decay into two almost collinear photons, whose clusters merge into one in our finite granularity calorimeter. The task of the experimentalist measuring prompt photons is to correctly assess the background from η^0 and π^0 into the collected data sample. Since the fragmentation function employed in the Monte Carlo generator cannot **accurately** predict the number of jets containing almost one highly energetic η^0 or π^0, the background has to be estimated from the data sample itself and from a parametrized form of the calorimeter response. The method I devised

was essentially based on a **multivariate χ^2 discriminant function, (Mahalanobis distance), of the transverse and lateral neutral shower parameters**. Using the discriminant function, I was testing the prompt photon hypothesis. I devised the discriminant function in such a way that the χ^2 for each observed cluster is not dependent on the cluster energy (as much as possible) but on its single or dual-merged nature. This way I tried to remove uncertainties related to the cluster's visible energy. The method was devised and tested from Monte Carlo Data, with neutral clusters up to 40 GeV.

Military service (obligatory). Corps of Engineers (1995-1997)
Taught under-privileged high school students the usage of PC's. **Community Service**.

Research associate (internship). (1994-1995) INS Institute for Nuclear Studies (Univ. of Tokyo). **Supervisor: Prof. T Katayama, Head of the INS Accelerator Department.**

- Spearheaded the transverse and longitudinal beam dynamics simulation in an IH-Linac based on first order optics. **Introduced at the INS accelerator department the usage of the High Energy Physics Analysis package PAW for advanced Accelerator Data Analysis.** Lastly, by varying the voltage and RF phase at the last Linac cavity, I determined from simulations the optimum operating voltage and phase parameters of the cavity, in order to achieve the best possible emittance for a predetermined value of beam energies. This way we could achieve the best output emmittance with variable output beam energy.

- Performed measurements of RF cavity parameters by using brass cavity test models. The shunt impedance and eigen-frequency were measured with the perturbation method and the geometrical parameters of the real cavities were tuned to meet the shunt impedance and eigen-frequency design specifications.
  These tests were necessary since the initial design specifications were based on results from the finite element program "*Superfish"*. However, that program assumes very long cavities (of infinite length). The actual cavity length had to be rather small (for the LINAC to be accommodated into a small space), therefore tuning of the cavity's geometrical parameters was necessary, mainly to ensure the design eigen-frequency.
  The method is based on the fact, that when a small object (usually referred as bead) is moving through the central beam pipe of the cavity it perturbs the resonant energy stored in the cavity by a very small amount. This results in a small shift in the resonant frequency of the cavity. From the frequency shift $\Delta f(x)$ at various positions x of the bead we can determine the shunt impedance R_0 and Q_0 factor of the RF cavity.
  During the execution of the experiments, **I devised and introduced a procedure based on precision brass spacers to expedite the test cavity assembly and alignment accuracy of the various test cavity parts**.
  Our testing and simulation results were published in EPAC96: 780-782 and presented at International Conferences.

<u>Graduate student. (1988-1994)</u> KEK Lab. For Particle Physics (Tsukuba, Japan). Advisors: Prof Steve Olsen and Prof Arie Bodek University of Rochester.

Member of the AMY collaboration.

- Participated in building the Forward Muon Tracking Chambers. These were gaseous wire chambers (drift chambers) positioned in the endcap regions of the AMY experiment, aiming primarily to detect forward and backward going muons. Supervised undergraduate students participating in the factory operations.

- Analysed electron positron data and measured the dilepton production cross-section and the Forward Backward charge asymmetries. (Ph.D. Thesis). Devised novel analysis method and solved a major problem associated with the correct estimation of systematic errors. The problem I had to solve was to correctly measure the dimuon cross section. The result was indicating (with the latest high luminosity run) an almost 5σ lower than the predictions of Standard Model cross-section. After I determined that the detector was operating with no unaccounted inefficiencies, **I discovered a discrepancy between data and Monte Carlo momenta distributions**. Since the Monte Carlo yielded somewhat larger than the real acceptance (catastrophic when the cross section is small) **I corrected the result by using a kinematicaly "similar" Bhabha electron positron sample.** By comparing the selected dimuon, Bhabha electron and Monte Carlo di-muon samples, I introduced an appropriate correction factor to account for the data Monte Carlo mismatch.

  I was the first person among the three TRISTAN experiments to announce the $\mu^+\mu^-$ cross section at the *2nd Workshop on TRISTAN Physics at High Luminosities* international conference. (**Phys. Lett. B331, 227, 1994**)

- As a Teaching Assistant I **managed and prepared undergraduate Electromagnetism laboratory classes**. I assisted and mentored undergraduate students during the execution of the experiments (mostly engineers and pre-meds).