School of Natural Sciences and Mathematics

Department of Physics

Department Faculty

Cecil and Ida Green Chair in Physics: Roderick A. Heelis

Distinguished Chair in Physics: Myron B. Salamon

Green Distinguished Chair in Academic Leadership: B. Hobson Wildenthal

Professors: Phillip C. Anderson, Austin J. Cunningham, Robert Glosser, John H. Hoffman, Joseph M. Izen, Mark Lee, Xinchou Lou, Wolfgang A. Rindler, Robert M. Wallace, Anvar A. Zakhidov

Professor Emeritus: Ervin J. Fenyves, Walter Heikkila, Brian A. Tinsley

Associate Professors: Yuri Gartstein, Mustapha Ishak-Boushaki, Lindsay J. King, David J. Lary, Anton V. Malko, Chuanwei Zhang, Jie Zheng

Assistant Professors: Lunjin Chen, Xingang Chen, Michael Kesden, Lloyd Lumata, Fabiano Rodrigues, Jason D. Slinker, Fan Zhang

Senior Lecturers: Paul MacAlevey, Beatrice Rasmussen

Affiliated Faculty: Yves J. Chabal, Kyeongjae (KJ) Cho, John P. Ferraris, Matthew J. Goeckner, Christopher L. Hinkle, Julia W. P. Hsu, Wenchuang (Walter) Hu, Stephen D. Levene, Lawrence J. Overzet, A. Dean Sherry, Mary L. Urquhart, Duck Joo (D. J.) Yang

Objectives

The goal of the Graduate Program in Physics is to develop individual creativity and expertise in the fields of physics. In pursuit of this objective, study in the program is strongly focused on research. Students are encouraged to begin participating in ongoing research activities from the beginning of their graduate studies. The research experience culminates with the doctoral dissertation, the essential element of the PhD program that prepares students for careers in academia, government laboratories, or industry.

A Master of Science degree is offered to those seeking to acquire or maintain technical mastery of both fundamentals and current applications.

Admission Requirements

The university's general admission requirements are discussed on the Graduate Admission page (catalog.utdallas.edu/2014/graduate/admission).

The Graduate Physics Program seeks students who have a BS degree in Physics or closely related subjects from an university or college, and who have superior skills in quantitative and deductive analysis. Official scores from the GRE General Test (verbal and quantitative) and the GRE Subject Test in Physics are required. Decisions on admission are made on an individual basis. However, as a guide, a combined score on the verbal and quantitative parts of the GRE General Test of 308, with at least 155 on the quantitative part, is advisable based on past experience with student success in the program.

For graduate work it is assumed that the student has an undergraduate background that includes the following courses at the level indicated by texts referred to: mechanics at the level of Symon, *Mechanics*; electromagnetism at the level of Reitz and Milford, *Foundations of Electromagnetic Theory*; thermodynamics at the level of Kittel, *Thermal Physics*; quantum mechanics at the level of Griffiths, *Introduction to Quantum Mechanics* (chapters 1-4), some upper-division course(s) in modern physics, and atomic physics. Students who lack this foundation may be required to take one or more undergraduate courses to complete their preparation for graduate work.

Financial Support

A limited number of teaching assistantships (TAs) are awarded to those students displaying the most promise in teaching or research. Specific decisions regarding TA awards are made on an individual basis. Students who wish to be considered for financial support are encouraged to submit completed applications by February 1st for admission in the fall semester. Admission for the spring term is possible, but opportunities for financial support in such cases are extremely limited and not guaranteed. Teaching assistantship awardees are required to complete 12 graduate physics courses approved by the graduate advisor during the first 24 months in residence. Continuation of support is evaluated yearly and requires achievement of a minimum GPA of 3.0, and a satisfactory record in teaching or research assignments.

Financial support is preferentially provided to students in the PhD track.

Specializations

The central principle in the structure of the graduate program is that a student's progress and ultimate success is best served by early and varied research experiences coupled with individually tailored course sequences.

Current areas of research specialization in the physics program are: Atmospheric and Space Physics; Astrophysics/Cosmology/Relativity; Condensed Matter Physics/Materials Science; and High

Energy Physics. Further details on the current research topics in these areas are provided below.

Astrophysics, Cosmology and Relativity

This research group studies fundamental problems in theoretical astrophysics, contemporary cosmology, and relativity. These research efforts typically involve analytical, numerical, and cosmological-data related projects. The group is instrumental in organizing the biennial Texas Symposia on Relativistic Astrophysics, beginning in Dallas in 1963 and recurring regularly all over the world since then. Current areas of research include: gravitational lensing (lenses) and its applications to cosmology; the acceleration of the expansion of the universe (cosmological constant, dark energy); fitting cosmological models to observational data (e.g. CMB, lensing, supernovae); dark matter; the structure of the big bang; the role of inflation; computer algebra systems applied to general relativity and cosmology; space-time junction conditions and wormholes; cosmological models of wider generality than the classical homogeneous models and their possible observational signatures. More specific information is available at: www.utdallas.edu/~mishak/relativitycosmology.html.

Atmospheric and Space Physics

Research in Atmospheric and Space Physics encompasses both theory and experiment, with emphasis on aeronomy, ionospheric physics, planetary atmospheres, atmospheric electricity and its effects on weather and climate, and space instrumentation. Much of the research occurs in the William B. Hanson Center for Space Sciences, which includes laboratory facilities for instrument design, fabrication, and testing. Faculty and students participate in ongoing satellite missions sponsored by NASA and DoD, and suborbital sounding rockets. Most students participate in analysis of large data sets from previous missions, and from ground-based optical and radar instruments at locations ranging from Greenland to South America. Particular areas of interest include large and small scale dynamics and electrodynamics, numerical modeling of the thermosphere and ionosphere, characteristics of the near earth plasma environment, the effects of solar variability on atmospheric electricity, cloud microphysics and tropospheric dynamics, plasma instabilities and irregularities, and development and testing of innovative space flight instrumentation. Computer facilities include a network of dedicated workstations and access to supercomputers. For further details see www.utdallas.edu/research/spacesciences.

High Energy Physics and Elementary Particles

The UT Dallas High Energy Physics Group collaborates on the Atlas experiment at the CERN Large Hadron Collider (LHC) and the BaBar experiment, at the PEP-II asymmetric b factory located at the Stanford Linear Accelerator Center (SLAC). Atlas will search for the Higgs boson, believed to be responsible for electroweak symmetry breaking, for new physics beyond the standard model such as supersymmetric partners to known particles, and for new hadrons. Atlas data-taking will begin in 2009. BaBar measures CP violation in the decays of bottom mesons and is exploring whether the origin of this CP violation lies within the Standard Model. BaBar data is fertile ground for

precision and rare decays of bottom and charm particles, and tau lepton. The group explores both charmonia and a class of unexpected particles with charm-anticharm quark content with properties that are quite different from conventional charmonium. BaBar has completed data-taking and is analyzing its data. The group's research is funded by the U.S. Department of Energy. The UT Dallas High Energy Physics group specializes in high performance computing, simulation production, and data analysis while contributing to the commissioning and operation of experiments. Additional information can be found at: www.utdallas.edu/~joe/hepweb/utdhep.html

Solid State/Condensed Matter Physics/Materials Science

Materials Science is at the interface of many disciplines and involves a collaborative approach with colleagues in chemistry, and electrical engineering. Our research facilities are distributed over the physics laboratories, the NanoTech Institute (nanotech.utdallas.edu) and Electrical Engineering Clean Room. Research in Materials Science involves both experiment and theory with emphasis on the physical aspects of solid state materials, optical properties of solids, Raman scattering, physical properties of thin films, and carbon nanotubes. Various nanoscale and synthetic materials are being studied for their optical, electronic, magnetic and transport properties, as well as applications in photonics, spintronics and (opto)electronics. The materials of interest include nanostructures (quantum dots and wires, fullerenes and carbon nanotubes) and low-dimensional systems, photonic band gap crystals and "left-handed" electromagnetic meta-materials, organic and polymeric materials. Unconventional superconductivity and superconducting nanostructures are also under investigation.

The interaction of nanoscale materials, such as carbon nanotubes, with biological entities are being investigated for prospective biomedical and electronic applications. For example, chemically functionalized carbon nanotubes are being studied as building blocks in transistor and sensor applications.

Degree Requirements

The university's general degree requirements are discussed on the Graduate Policies and Procedures page (catalog.utdallas.edu/2014/graduate/policies/policy).

All candidates for graduate degrees in physics must satisfy general university degree requirements. Well-prepared students may demonstrate by examination adequate knowledge of the core and basic course material. In addition to the general university graduation requirements, graduation in physics requires achieving a grade of B or better in each core course in the MS and PhD programs.

Master of Science in Physics

30 semester credit hours minimum

A minimum total of 30 graduate semester credit hours is required, including the core courses listed below.

Core Courses: 12 hours

PHYS 5301 Mathematical Methods of Physics I

PHYS 5311 Classical Mechanics

PHYS 5320 Electromagnetism I

PHYS 6300 Quantum Mechanics I

Elective courses: 18 semester credit hours

In addition to the core courses, 18 semester credit hours of additional graduate level physics or related field courses must be successfully completed by MS candidates in physics, with prior approval from the graduate advisor. Up to 6 semester credit hours of elective credit may be satisfied through approved industrial internships, supervised research, or the satisfactory completion of an MS thesis. Prior approval for these options must be obtained from the graduate advisor.

Doctor of Philosophy in Physics

75 semester credit hours minimum beyond the baccalaureate degree

Core Courses

A minimum of 24 semester credit hours in the graduate core sequence are required for the PhD degree, plus additional courses specified by the student's thesis committee chair. The required core courses must include:

PHYS 5301 Mathematical Methods of Physics I

PHYS 5302 Mathematical Methods of Physics II

PHYS 5311 Classical Mechanics

PHYS 5313 Statistical Physics

PHYS 5320 Electromagnetism I

PHYS 5322 Electromagnetism II

PHYS 6300 Quantum Mechanics I

PHYS 6301 Quantum Mechanics II

Students in space sciences must also take:

PHYS 6383 Plasma Science

A candidate must also take a minimum of 3 elective courses, 1 from within his/her area of specialization and 2 selected from outside the student's specialty area. Additional courses may be required to satisfy the particular degree requirements and/or to ensure sufficient grounding in physical principles. The graduate advisor and the student's supervisory committee must approve course selections. A minimum of one year residency after admission to the doctoral program is required.

Students are required to take and pass a qualifying examination during their first year in the PhD program. The qualifying examination is normally given in January of the first year of graduate study. At the discretion of the Physics Qualifying Exam Committee, a student may pass the exam, fail the exam, or be offered a second attempt at the qualifying examination. A second attempt, if offered, will normally be given before the end of the summer semester of the first year of graduate study. A student taking the second attempt will either pass or fail the exam; under no circumstances will a third attempt be given. Students who fail the qualifying examination will be ineligible to continue enrollment in the physics graduate program after the completion of their first full year in residence.

After a student has completed the required coursework with a minimum grade of B in each core course and a minimum GPA of 3.0 for all courses, passed the qualifying examination, and decided upon his/her field of specialization, the student is required to identify a dissertation topic and form a Supervising Committee to guide the student's dissertation work. The student must submit a proposal that outlines the present state of knowledge of the field and presents the research program the student expects to accomplish for the dissertation. This proposal must be approved by the Supervising Committee and the department head. A seminar on the dissertation proposal must be presented, followed by an oral examination conducted by the faculty on the proposed area of research and related topics. The Supervising Committee shall determine by means of the exam and any ancillary information whether the student is adequately prepared and has the ability to conduct independent research. The approved dissertation proposal is then filed with the Dean of Graduate Studies. An approved dissertation proposal is normally expected no later than the end of the first semester of the student's third year.

A manuscript embodying a substantial portion of the dissertation research accomplished by the student must be submitted to a suitable professional refereed journal prior to the public seminar and dissertation defense. A public seminar, successful defense of the dissertation, and its acceptance by the supervising committee conclude the requirements for the PhD In lieu of the traditional dissertation, and at the discretion of the supervising professor, a manuscript dissertation following the guidelines published by the Graduate Dean's Office may be substituted.

Core Course listing for Doctor of Philosophy

24 semester credit hours required, 27 semester credit hours for Space Science

PHYS 5311 Classical Mechanics

PHYS 5313 Statistical Physics

PHYS 5320 Electromagnetism I

PHYS 5322 Electromagnetism II

PHYS 5301 Mathematical Methods of Physics I

PHYS 5302 Mathematical Methods of Physics II

PHYS 6300 Quantum Mechanics I

PHYS 6301 Quantum Mechanics II

PHYS 6383 Plasma Science (required core course for Space Science students)

Heelis, Roderick A.Professor, Physics; Distinguished Chair in Natural Sciences and Mathematics, School of Natural Sciences and Mathematics; Director, William B. Hanson Center for Space SciencesBS, University of Sheffield, United Kingdom, 1969PhD, University of Sheffield, United Kingdom, 1973

heelis@utdallas.edu972-883-2822

Salamon, Myron B.Professor, Physics; Distinguished Chair in PhysicsBS, Carnegie Mellon University, 1961PhD, University of California, Berkeley, 1966

mxs068100@utdallas.edu972-883-2416

Wildenthal, B. HobsonExecutive Vice President and Provost; Professor, Physics; Cecil H. and Ida Green Distinguished Chair of Academic LeadershipBA, Sul Ross State College, 1958PhD, University of Kansas, 1964

wildenbh@utdallas.edu972-883-2271

Anderson, Phillip C.Professor, PhysicsBS, North Texas State University, 1982MS, The University of Texas at Dallas, 1985PhD, The University of Texas at Dallas, 1990

pca015000@utdallas.edu972-883-2851

Cunningham, Austin J.Professor, Physics; Dean, Graduate StudiesBSc, Queen's University of Belfast, Northern Ireland, 1966PhD, Queen's University of Belfast, Northern Ireland, 1969

cunning@utdallas.edu

Glosser, RobertProfessor, Physics; Department Head, PhysicsBS, Massachusetts Institute of Technology, 1959MS, University of Chicago, 1962PhD, University of Chicago, 1967

glosser@utdallas.edu972-883-2876

Hoffman, John H.Professor, PhysicsBS, St. Mary's College, Minnesota, 1951MS, University of Minnesota, 1954PhD, University of Minnesota, 1958

jhoffman@utdallas.edu

Izen, Joseph M.Professor, PhysicsBS, The Cooper Union for the Advancement of Science and Art, 1977AM, Harvard University, 1978PhD, Harvard University, 1982

joe@utdallas.edu

Lee, MarkProfessor, Physics; Associate Department Head, PhysicsAB, Harvard University, 1986MS, Harvard University, 1986PhD, Leland Stanford Junior University, 1991

mxl101000@utdallas.edu

Lou, XinchouProfessor, PhysicsBS, University of Science and Technology of China, China, 1984MS, University at Albany, State University of New York, 1985PhD, University at Albany, State University of New York, 1989

xinchou@utdallas.edu

Rindler, Wolfgang A.Professor Emeritus, PhysicsBSc, University of Liverpool, United Kingdom, 1945MSc, University of Liverpool, United Kingdom, 1947PhD, University of London, United Kingdom, 1956

rindler@utdallas.edu

Wallace, Robert M.Professor, Materials Science and Engineering; Erik Jonsson Distinguished Chair, Erik Jonsson School of Engineering and Computer Science; Affiliated in Electrical Engineering, Mechanical Engineering and PhysicsBS, University of Pittsburgh, 1982MS, University of Pittsburgh, 1984PhD, University of Pittsburgh, 1988

rmw031000@utdallas.edu972-883-6638

Zakhidov, Anvar A.Professor, PhysicsMS, Tashkent Technical University, Union of Soviet Socialist Republics, 1975PhD, Institute for Spectroscopy of Soviet Union Academy of Sciences, Union of Soviet Socialist Republics, 1981

zakhidov@utdallas.edu

Fenyves, Ervin J.Professor Emeritus, PhysicsMS, Eötvös Loránd University, Budapest, 1946PhD, Eötvös Loránd University, Budapest, 1950Doctor of the Physical Sciences, Hungarian Academy of Sciences, Budapest, Hungary, 1960

ezbd@utdallas.edu

Heikkila, WalterProfessor Emeritus, PhysicsBASc, University of Toronto, Canada, 1950MA, University of Toronto, Canada, 1952PhD, University of Toronto, Canada, 1954

heikkila@nomail.invalid

Tinsley, Brian A.Professor Emeritus, PhysicsBSc, University of Canterbury, New Zealand, 1958MSc, University of Canterbury, New Zealand, 1961PhD, University of Canterbury, New Zealand, 1963

tinsley@utdallas.edu

Gartstein, YuriAssociate Professor, PhysicsMS, Tashkent Polytechnic Institute, Union of Soviet Socialist Republics, 1982PhD, Institute for Spectroscopy of Soviet Union Academy of Sciences, Union of Soviet Socialist Republics, 1988

yxg037000@utdallas.edu

Ishak-Boushaki, MustaphaAssociate Professor, PhysicsBASc, University of Quebec, Canada, 1994BSc, Université de Montréal, Canada, 1998PhD, Queen's University at Kingston, Canada, 2002

mxi054000@utdallas.edu

King, Lindsay J.Associate Professor, PhysicsBA, University of Cambridge, United Kingdom, 1989MSc, University of Manchester, United Kingdom, 1990PhD, University of Manchester, United Kingdom, 1995

lindsay.king@utdallas.edu 972-883-2884

Lary, David J.Associate Professor, PhysicsBSc, King's College London, United Kingdom, 1987PhD, University of Cambridge, United Kingdom, 1991

djl101000@utdallas.edu972-883-5643

Malko, Anton V.Associate Professor, PhysicsBS, Moscow Institute of Physics and Technology, 1998PhD, New Mexico State University, 2002

avm074000@utdallas.edu

Zhang, ChuanweiAssociate Professor, PhysicsBS, University of Science and Technology, China, 2000PhD, The University of Texas at Austin, 2005

chuanwei.zhang@utdallas.edu 972-883-4520

Zheng, JieAssociate Professor, ChemistryBS, Inner Mongolia University, China, 1994PhD, Georgia Institute of Technology, 2005

jxz087000@utdallas.edu

Chen, LunjinAssistant Professor, PhysicsMS, University of California, Los AngelesPhD, University of

California, Los Angeles, 2011

lunjin.chen@utdallas.edu 972-883-2891

Chen, XingangAssistant Professor, PhysicsPhD, Columbia University, 2003

xxc133330@utdallas.edu972-883-3597

Kesden, MichaelAssistant Professor, PhysicsAB, Princeton University, 2000PhD, California Institute of Technology, 2005

mhk130030@utdallas.edu

Rodrigues, FabianoAssistant Professor, PhysicsBSc, Universidade Federal de Santa Maria, Brazil, 2001MSc, Instituto Nacional de Pesquisas Espaciais, Brazil, 2003PhD, Cornell University, 2008

fabiano@utdallas.edu

Slinker, Jason D.Assistant Professor, PhysicsBS, Southern Nazarene University, 2001MS, Cornell University, 2006PhD, Cornell University, 2007

jds107020@utdallas.edu972-883-6513

Lumata, LloydAssistant Professor, PhysicsMS, Florida State University, 2006PhD, Florida State University, 2008

lloyd.lumata@utdallas.edu 972-883-2850

Zhang, FanAssistant Professor, PhysicsPhD, The University of Texas at Austin, 2011

fan.zhang7@utdallas.edu

MacAlevey, PaulSenior Lecturer III, PhysicsBSc, University College Dublin, Ireland, 1988MSc, University College Dublin, Ireland, 1989MS, The University of Texas at Dallas, 1996PhD, The University of Texas at Dallas, 1999

paulmac@utdallas.edu

Rasmussen, BeatriceSenior Lecturer I, PhysicsBS, Texas A&M University at Galveston, 1981MS, The University of Texas at Dallas, 1996

bearas@utdallas.edu

Chabal, Yves J.Professor, Materials Science and Engineering; Department Head, Materials Science and Engineering; Texas Instruments Distinguished University Chair in Nanoelectronics, Erik Jonsson School of Engineering and Computer Science; Affiliated in Physics, Chemistry and Electrical EngineeringAB, Princeton University, 1974PhD, Cornell University, 1980

yjc072000@utdallas.edu972-883-5751

Cho, Kyeongjae (KJ)Associate Professor, Materials Science and Engineering; Affiliated in Physics and Mechanical EngineeringBSc, Seoul National University, South Korea, 1986MSc, Seoul National University, South Korea, 1988PhD, Massachusetts Institute of Technology, 1994

kxc067000@utdallas.edu972-883-2845

Ferraris, John P.Professor, Chemistry; Department Head, Chemistry; Cecil H. and Ida Green Chair of Systems Biology Science; Affiliate Faculty, PhysicsBA, St. Michael's College, 1969MA, The Johns Hopkins University, 1971PhD, The Johns Hopkins University, 1973

ferraris@utdallas.edu

Goeckner, Matthew J.Professor, Mathematical Sciences; Department Head, Mathematical Sciences; Professor of Electrical Engineering, Mechanical Engineering, Materials Science, Physics, Science EducationBS, Southern Illinois University, 1982MS, University of California, Los Angeles, 1984PhD, University of Iowa, 1990

goeckner@utdallas.edu

Hinkle, Christopher L.Assistant Professor, Materials Science and Engineering; Affiliated in Physics and Electrical EngineeringBS, North Carolina State University, 1999PhD, North Carolina State University, 2005

clh066000@utdallas.edu972-883-5711

Hsu, Julia W. P.Professor, Materials Science and Engineering; Associate Head and Graduate Director, Materials Science and Engineering; Texas Instruments Distinguished Chair in Nanoelectronics, Erik Jonsson School of Engineering and Computer Science; Affiliated in PhysicsBSE, Princeton University, 1987PhD, Leland Stanford Junior University, 1991

jxh101000@utdallas.edu

Hu, Wenchuang (Walter)Associate Professor, Electrical Engineering; Affiliate Faculty, PhysicsBS, Peking University, Beijing, China, 1999MSEE, University of Notre Dame, 2001PhD, University of Notre Dame, 2004

wxh051000@utdallas.edu972-883-6329

Levene, Stephen D.Professor, Molecular and Cell Biology; Affiliated Faculty, PhysicsAB, Columbia University, 1979PhD, Yale University, 1985

sdlevene@utdallas.edu972-883-2503

Overzet, Lawrence J.Professor, Electrical EngineeringBSEE, University of Illinois, 1983MSEE, University of Illinois, 1985PhD, University of Illinois, 1988Licensed Professional Engineer, State of Texas

overzet@utdallas.edu972-883-2154

Sherry, A. DeanProfessor, Chemistry; Cecil H. and Ida Green Distinguished Chair in Systems Biology, School of Natural Sciences and MathematicsBS, Wisconsin State University-LaCrosse, 1967PhD, Kansas State University, 1971

sherry@utdallas.edu

Urquhart, Mary L.Associate Professor, Science Education; Department Head, Science/Mathematics Education; Affiliate Faculty, Physics, member, William B. Hanson Center for Space SciencesBS & BS, New Mexico Institute of Mining and Technology, 1992MS, University of Colorado, 1995PhD, University of Colorado, 1999

mlk023000@utdallas.edu

Yang, Duck Joo (D. J.)Research Scientist / Professor, Chemistry; Associate Dean for Research and Interdisciplinary ProgramsBS, Clark University, 1972PhD, University of California, Berkeley, 1977Executive MBA, University of Pennsylvania, 1982

djy031000@utdallas.edu972-883-6681
Updated: 2015-03-27 10:41:16 v2.c173b9