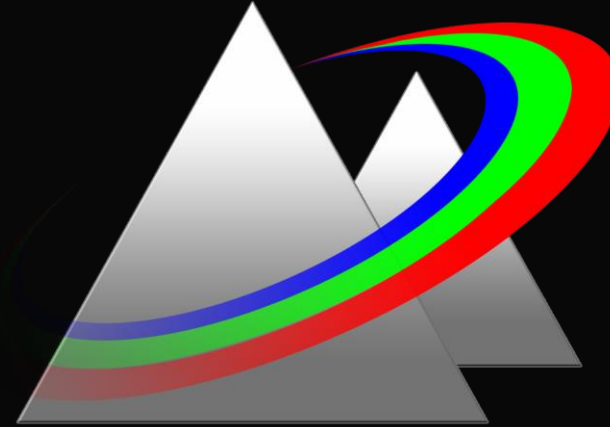


August 2016

UNM's

Optical Science and Engineering Program



OPTICAL SCIENCE & ENGINEERING
University of New Mexico

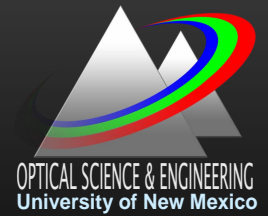
Administered jointly by P&A and ECE

Established in 1983

One of five universities in the US with PhD and MS degrees in Optics

Affiliated Faculty (33)

<http://www.optics.unm.edu/faculty.html>



P&A

C. Caves
I. H. Deutsch
J.-C. Diels
F. Bacerra-Chavez
V. M. Kenkre
K. Malloy
S. Prasad
W. Rudolph
M. Sheik-Bahae
J. Thomas
A. Mafi
B. V. Acosta
C. J. Matthews
A. Manjavacas

ECE

S. Brueck
C. Christodoulou
R. Dawson*
P. Eliseev*
M. Hayat
R. Jain
S. Krishna
M. Osinski
M. Hossein-Zadeh
G. Balakrishnan
L. Arissian*
O. Lavrora
D. Feezell
F. Cavallo

Chemistry

T. Habteyes
J. Grey

Biomedical Eng.

A. Shreve

15 Fellows
(OA, APS,
IEEE, SPIE)

* Research faculty



Graduate Student Data

➤ **Ph.D. degrees awarded in the past 10 years: 70**

➤ **Current Graduate Student Enrollment: \approx 64**

New, incoming students in 2016: 10

➤ **New TAs/GAs = 8 (Current total \approx 14)**

➤ **Total RAs: \approx 35 (P&A, CHTM and ECE combined)**

M.S. PROGRAM

Requirements (Credit Hours):

Plan	Courses (Total)	Courses A	Courses B	Thesis	Res.Seminar/ Problems	Free Elect.	Internship
Plan 1 (Thesis)	30	15	6	6	-	3	-
Plan 2a(Course)	33	15	9	-	3 (2 in optics)	6	-
Plan 2b(Internship)	33	15	9	-	-	6	3

- ✓ 12 hours of coursework must be taken at 500 level or higher
- ✓ students in Plan 1 must submit and defend a thesis
- ✓ students in Plan 2a must pass an oral exam, 2b has technical report and public presentation

M.S. Program

Mandatory

- Advanced Optics I (Physics 463 or ECE 464)
- Optics Lab (Physics 476L or 477L)
- E&M (Physics 511 or ECE 561)

List B (Option-Based):

- Introduction to Optoelectronics (ECE 475)
- Quantum Mechanics I (Physics 521)
- Microelectronics Processing Lab (ECE 574L)
- Nonlinear Optics (Physics 555 or ECE 568)
- Solid State Physics (Physics 529) or Semiconductor Properties (ECE 572)
- Topics in Modern Optics (Physics 569) or Special Topics (ECE 595)
- Laser Physics II (Physics 564)
- Semiconductor Lasers and LEDs (ECE 577)
- Quantum Optics (Physics 566)
- Atomic and Molecular Structure (Physics 531)
- Optical Coherence Theory (Physics 556)
- Guided Wave Optics (ECE 564)
- Optical Fiber Communication (ECE 565)
- Synthesis of Nanostructures (ECE 518 or NSMS 518)
- ECE 595 - Microwave Photonics
- + more

M.S. Program

Three Concentrations:

Common Core Courses to all Concentrations:

Advanced Optics I (PHYC 463 or ECE 463)

Experimental Techniques of Optics (PHYC 476L OR 477L)

Electrodynamics (PHYC 511 or the ECE 555/ECE 561 sequence)

Three credit hours of seminar, including one Optics seminar

Plus the following core courses depending on the concentration:

-Optical Science Concentration

Advanced Optics II (PHYC 554 or ECE 554)

Laser Physics I (PHYC 464 or ECE 464)

-Photonics Concentration

Semiconductor Optical Materials and Devices (ECE 570)

Semiconductor Physics (ECE 471/ECE 572 sequence)

-Imaging Science Concentration

Probability Theory and Stochastic Processes (ECE 541)

Digital Image Processing (ECE 533)

Ph.D. Program

Four Concentrations:

- i. Optical Sciences & Engineering
- ii. Photonics
- iii. Imaging Science
- iv. Quantum Optics

Mandatory List A (Common to tracks i,ii,iii)

- Advanced Optics I (Physics 463 or ECE 464)
- Optics Lab (Physics 476L or 477L)
- E&M (Physics 511 or ECE 561)

Ph.D. Program

Optical Science and Engineering Concentration

- Advanced Optics I (PHYC 463 or ECE 463)
 - Electrodynamics (PHYC 511 or the ECE 555/ECE 561 sequence)
 - Optics Lab (PHYC 476L or 477L)
 - Advanced Optics II (PHYC 554 or ECE 554)
 - Laser Physics I (PHYC 464 or ECE 464)

 - Methods in Theoretical Physics I (PHYC 466 or Math 466) or ECE 555
 - Quantum Mechanics I (PHYC 521) or Semiconductor Physics (the ECE 471/ECE 572 sequence)
 - Nonlinear Optics (PHYC 568 or ECE 568)
- 3 credit hours of seminar, including one Optics seminar

Ph.D. Program

Photonics Concentration*

- Advanced Optics I (PHYC 463 or ECE 463)
- Experimental Techniques of Optics (PHYC 476L or 477L)
- Electrodynamics (PHYC 511 or the ECE 555/ECE 561 sequence)

- Semiconductor Optical Materials and Devices (ECE 570)
- Semiconductor Physics (the ECE471/ECE 572 sequence)
- 3 credit hours of seminar, including one Optics seminar

**Under revision*

Ph.D. Program

Imaging Science Concentration

- Advanced Optics I (PHYC 463 or ECE 463)
- Experimental Techniques of Optics (PHYC 476L or 477L)
- Electrodynamics (PHYC 511 or the ECE 555/ECE 561 sequence)

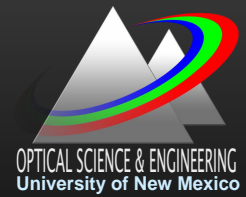
- Probability Theory and Stochastic Processes (ECE 541)
- Digital Image Processing (ECE 533)
- 3 credit hours of seminar, including one Optics seminar

Ph.D. Program

Quantum Optics Concentration

- Laser Physics I - PHYC 464
- Quantum Mechanics I – PHYC 521
- Quantum Mechanics II – PHYC 522
- Electrodynamics – PHYC 511 or ECE 561
- Quantum Optics I – PHYC 566
- Three credit hours of seminar, including one Optics seminar

Ph.D. Program



Quantum Optics Concentration

B. Option based

Choice of three from the following list

- Nonlinear Optics – PHYC 568
- Optics I – PHYC. 463
- Optics II – PHYC. 554
- Optics Lab - 466L/467L
- Quantum Optics II – PHYC. 581
- Quantum Information Theory – PHYC. 572
- Quantum Computation – PHYC. 571
- Semiconductor Physics (the ECE 471/ECE 572 sequence)
- Semiconductor Materials and Optical Devices – ECE 570
- Materials and Devices II – ECE 471

Depending on the student, the remaining 22 course work credit hours can be satisfied with a combination of courses (500 level or above) including problems courses and research hours.

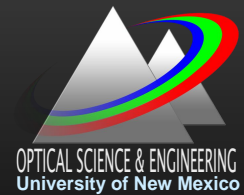
List B (Option-Based):

- Introduction to Optoelectronics (ECE 475)
- Quantum Mechanics I (Physics 521)
- Microelectronics Processing Lab (ECE 574L)
- Nonlinear Optics (Physics 555 or ECE 568)
- Solid State Physics (Physics 529) or Semiconductor Properties (ECE 572)
- Topics in Modern Optics (Physics 569) or Special Topics (ECE 595)
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- Quantum Optics (Physics 566)
- Atomic and Molecular Structure (Physics 531)
- Optical Coherence Theory (Physics 556)
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- Optical Fiber Communication (ECE 565)
- Synthesis of Nanostructures (ECE 518 or NSMS 518)
- ECE 595 - Microwave Photonics

Quantum Optics

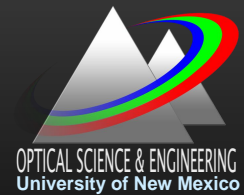
- Nonlinear Optics – PHYC 568
- Optics I – PHYC. 463
- Optics II – PHYC. 554
- Optics Lab - 466L/467L
- Quantum Optics II – PHYC. 581
- Quantum Information Theory – PHYC. 572
- Quantum Computation – PHYC. 571
- Semiconductor Physics (the ECE 471/ECE 572 sequence)
- Semiconductor Materials and Optical Devices – ECE 570
- Materials and Devices II – ECE 471

OSE Seminar Series, PHYC 500



- The OSE Seminar Series course (PHYC 500, CRN 46023 Section 018).
- Features a series of talks focused on the latest research in the field of Optical Science and Engineering.
- Speakers include world-wide experts in the field of optics from academia, industry and national labs, as well as OSE faculty and students.
- Class will meet every **Thursday from 11:00 AM to 12:00 PM** at the **CHTM (Room 101)** or **Physics and Astronomy (Room 190)**. Check the weekly announcement.
- Registered students will receive 1.0 credit hours for a successful completion of the course.
- **All new incoming students are required to sign up for the course.**
- **All continuing OSE students from all tracks are highly encouraged to take the course.**

Suggested First Year Course Schedule – Optical Science



Optical Science Concentration

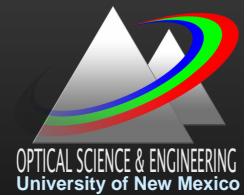
Fall 2016:

- Advanced Optics I (PHYC 463 or ECE 463)
- Methods in Theoretical Physics I (PHYC 466 or Math 466) or ECE 555
- Laser Physics I (PHYC 464 or ECE 464)
- OSE Seminar Series (PHYC 500)

Spring 2017:

- Advanced Optics II (PHYC 554 or ECE 554)
- Experimental Techniques of Optics (PHYC 476L or PHYC 477L)
- Electrodynamics (PHYC 511 or the ECE 555/ECE 561 sequence)
- OSE Seminar Series (PHYC 500)

Suggested First Year Course Schedule – Photonics



• Photonics Concentration

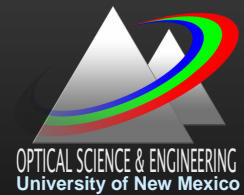
• **Fall 2016:**

- Advanced Optics I (PHYC 463 or ECE 463)
- Semiconductor Physics (the **ECE471/ECE 572** sequence)
- Methods in Theoretical Physics I (PHYC 466 or Math 466) or ECE 555
- OSE Seminar Series (PHYC 500)

• **Spring 2017:**

- Semiconductor Physics (the **ECE471/ECE 572** sequence)
- Experimental Techniques of Optics (PHYC 476L OR 477L)
- Electrodynamics (PHYC 511 or the **ECE 555/ECE 561** sequence)
- OSE Seminar Series (PHYC 500)

Suggested First Year Course Schedule – Imaging Science



Imaging Science Concentration

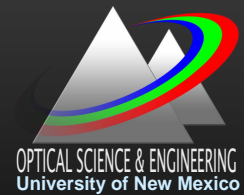
•Fall 2016:

- Advanced Optics I (PHYC 463 or ECE 463)
- Methods in Theoretical Physics I (PHYC 466 or Math 466) or ECE 555
- Probability Theory and Stochastic Processes (ECE 541)
- OSE Seminar Series (PHYC 500)

•Spring 2017:

- Digital Image Processing (ECE 533)
- Experimental Techniques of Optics (PHYC 476L OR 477L)
- Electrodynamics (PHYC 511 or the ECE 555/ECE 561 sequence)OSE Seminar Series (PHYC 500)

Suggested First Year Course Schedule – Quantum Optics



Quantum Optics Concentration

Fall 2016:

Lasers I (PHYC 464 or ECE 464)

Methods in Theoretical Physics I (PHYC 466 or Math 466) or ECE 555

Graduate Quantum Mechanics I (PHYC 521)

• OSE Seminar Series (PHYC 500)

Spring 2017:

Graduate Quantum Mechanics II (PHYC 522)

Experimental Techniques of Optics (PHYC 476L OR 477L)

Electrodynamics (PHYC 511)

OSE Seminar Series (PHYC 500)

TIME TO M.S. DEGREE

The Faster the better!

- ❑ All requirements for the master's degrees must be completed within *seven years* prior to granting the degree.
- ❑ No course work applied to the degree requirements, including transfer work, may be more than seven years old at the time a master's degree is conferred.

Common case: 1-2 years full time

TIME TO PHD. DEGREE

The Faster the better!

Doctoral students have a *five-year time limit* for completion of degree requirements commencing with the semester in which they pass the Doctoral Comprehensive Examination.

Common case: 3-5 years full time

PhD Qualifying Exam

- Four exams to be passed consist of two (2) common exams (common to all tracks) and two (2) track-specific exams (for each track).
- All exams are offered in August; some track-specific exams may also be offered in January.

The common exams are in

- Electromagnetics (3 hours) - largely based on material covered in PHYC511 or ECE561
 - General Optics (3 hours) - largely based on material covered in PHYC/ECE463 and PHYC476L.
- Must attempt the Written Qualifying Examinations after your first complete academic year;
 - Must pass all four examinations before beginning their third academic year;
 - Each exam may be attempted at most twice. The lowest passing score is 60%.

PhD Qualifying Exam

PH.D. QUALIFYING EXAM-CONCENTRATIONS

The track-specific (concentration) exams are in

Optical Sciences

- Advanced Optics
- Lasers

Photonics

- Semiconductor Optical Materials & Devices
- Semiconductor Physics

Imaging Science

- Stochastic Processes
- Digital Image Processing

Quantum Optics

- Lasers
- Quantum Mechanics (Physics Preliminary Exam)

- The content of these exams is largely based on the corresponding graduate courses.
- Each track exam is 1.5 hours.

PhD Qualifying Exam

PH.D. QUALIFYING EXAM-EXEMPTIONS

The exam is waived for students who earn an average GPA of 4.0 or greater for their OSE core courses:

Optical Science : Adv. Optics I & II, Electromagnetics, Laser Physics I

Photonics: Adv. Optics I, Electromagnetics, ECE 570, and ECE 572

Imaging Science : Adv. Optics I, Electromagnetics, ECE 533, and ECE 541

Quantum Optics: Electromagnetics, Laser Physics I, Quantum Mechanics I, & II

- Part-time students are not subject to the timetables above.
- The qualifying exam may satisfy the exit examination requirement for MS Plan II students.

SEMESTER COURSE LOADS

□ Full-time student:

- ❖ Enrolling for and completing a minimum of 9 graduate credit hours per semester is considered to be a full-time student
- ❖ If holding an assistantship, the minimum course load is 6 graduate credit hours per semester

□ International students

- ❖ Can no longer obtain a "W", "WP", "WF" at any time during the semester, if they fall below the 6 required courses for RAs or GAs or below 9 hours for students not holding an assistantship.

MS: PROGRAM OF STUDIES (POS)

- ❑ A student seeking a MS degree should prepare and submit a **Program of Studies (POS)**
 - ❑ Indicating the courses that will be counted toward the degree
 - ❑ Finally decide to choose Plan I or II
 - ❑ Time to get all transfer credits approved
- ❑ POS should be approved by
 - ❑ Your advisor
 - ❑ General Chair or Co-Chair of the OSE Graduate Program
 - ❑ Office of Graduate Studies (OGS)and sent to OGS by ECE Graduate Office
- ❑ This form is available online

<http://www.unm.edu/grad/forms/forms.html>

MS: THESIS/PROJECT COMMITTEE

□ Consisting of **at least three members**

- ❖ Chair must be a *regular faculty member from OSE*
- ❖ At least 2 must be *regular faculty from UNM*
- ❖ **External member:** a regular faculty member whose primary appointment is *outside of the student's home department*.
- ❖ All committee members (both internal and external to UNM) must be *approved for graduate instruction*

PS. A regular faculty is a faculty who has a tenured or tenure-track appointment

PHD: APPLICATION FOR CANDIDACY

- ❑ A student seeking a Ph.D. must prepare and submit an **Application for Candidacy** form
 - ❑ Indicating the courses that will be counted toward the degree
 - ❑ To be done during the semester in which the comprehensive examination is passed.
 - ❑ Time to get all transfer credits approved
- ❑ Application for Candidacy should be approved by
 - ❑ Your advisor
 - ❑ General Chair or Co-Chair of the OSE Graduate Program
 - ❑ OGSand sent to OGS by OSE Program Advisor
- ❑ This form is available online

<http://www.unm.edu/grad/forms/forms.html>

PHD: DISSERTATION/COMPREHENSIVE EXAM COMMITTEE

Consisting of **at least four members**

- ❖ Chair must be *a regular faculty member from OSE*
- ❖ At least 2 must be *regular faculty from UNM*
- ❖ External member: a regular faculty member whose primary appointment is *outside of the student's home department*.
- ❖ All committee members (both internal and external to UNM) must be *approved for graduate instruction*

PS. A regular faculty is a faculty who has a tenured or tenure-track appointment

REQUIRED ENROLLMENT

- ❑ A student must be enrolled for at least 1 graduate credit for the semester (including the summer session) in which **they complete degree requirements**.
- ❑ In order to qualify to sit for a master's exam **during the intersession**, the student must be registered for the following semester.

599/699 GRADES & ENROLLMENT

□ Grades

- ✓ Semester grades for 599/699 hours should be **PR (progress)**
- ✓ At the time of graduation the student's transcript will indicate that he/she earned
 - ✓ M.S.: 6 hours of thesis (599) credit (CR)
 - ✓ PhD.: 18 hours of dissertation (699) credit (CR)

□ Enrollment

- ✓ Once initiated, **continuous enrollment** (Fall and Spring semesters) in 599/699 is required until the thesis/dissertation is accepted by the Dean of Graduate Studies.
- ✓ Students who complete degree requirements during a summer session must be enrolled in a minimum of one 599/699 credit hour.

Credit/No Credit

Pass/Fail (CR/NC) Option For Graduate Students:

No more than 6 credit hours of course work in which a grade of C (2.0), C+ (2.33) or CR (grading option selected by student) was earned may be credited toward a graduate degree. Courses offered only on a CR/NC basis and required by the graduate program are excluded from this limitation.

A graduate student has the option of enrolling in courses on a Pass/Fail (CR/NC) basis. However, if a graduate student with undergraduate deficiencies is required by the major department to take a lower-division course, the pass/fail (CR/NC) option is not available to the student.

50 % INSTRUCTOR RULE

50% Instructor Rule

No more than 50% of the total degree credits can be taken with one instructor and counted toward degree credits.

e.g. 52 credits are needed for PhD. A Student may count only 26 credits with the same professor toward the PhD degree.

NOTICE OF INTENT TO GRADUATE

A Student must inform the OSE Program Advisor in writing of their **Intent to Graduate** no later than 11:00 a.m. on the last day of the semester immediately preceding the semester of graduation.

- If a student does not complete all degree requirements for graduation in a particular semester, the student must submit a new Intent to Graduate form for graduation in a subsequent semester.

POS/A4C AND INTENTION TO GRADUATE

Plan ahead & graduate in time!

Deadlines	Obtain degree at the end of semester		
	Spring	Summer	Fall
1. Submission of POS or A4C	Oct 1	Mar 1	Jul 1
2. Signup for graduate intention	Last day of Fall	Last day of Spring	Last day of Summer
3. Announce the examination	Apr 1	Jul 1	Nov 1
4. Report of exam results & deposit of thesis/dissertation	Apr 15	Jul 15	Nov 15

The earlier the better!

GPA FOR GRADUATION

- ❑ A Student must have
 - ❖ a minimum cumulative **GPA of 3.0** in *graduate-level courses* taken in graduate status at the time of degree completion
 - ❖ a minimum **GPA of 3.0** for *courses listed in their Program of Studies or Application for Candidacy*.
 - ❖ no more than 6 credit hours of course work in which a grade of C (2.0), C+ (2.33) or CR (grading option selected by student) was earned may be credited toward a graduate degree (excluding seminar courses)
 - ❑ Students may not graduate with *Incompletes* pending in any graduate course.
-

TRANSFER CREDIT & APPLIED CREDIT

❑ What can be transferred:

- The course work, graded at least a B, was taken at an accredited institution and is approved by both OSE grad committee and OGS;
- Course work that has been counted toward a previous degree may not be counted again toward any other degree except Master's course work for a doctoral degree.

❑ When to transfer:

- Listing them on the Program of Studies or the Application for Candidacy
- Transfer petitions for OSE Core Coursework Must be submitted to the OSE Committee during the first two years of studies at UNM.

❑ Applied credit:

- At most 9 credits are acceptable for transfer from non-degree to degree status

❑ A maximum of 50% of the course work requirements may consist of a combination of applied/transfer credits

ACADEMIC INTEGRITY

You are expected to maintain the highest standards of honesty and integrity in academic and professional matters.

The University of New Mexico

UNM
catalog
2008 – 2009



- ❑ The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet these standards
- ❑ Academic dishonesty includes, but is not limited to,
 - ❖ dishonesty on quizzes, tests or assignments;
 - ❖ claiming credit for work not done or done by others;
 - ❖ hindering the academic work of other students; and
 - ❖ misrepresenting academic or professional qualifications within or outside the University.

See UNM Catalog

<http://www.unm.edu/~unmreg/catalog.htm>