
Biophysics & Chemical Physics Virtual Open House

- **Overview of the programs**

- 11:00 - 11:05 Introductory Remarks: Konstantina Trivisa, IPST Director;
- 11:05 - 11:15 Biophysics (BIPH) Overview: Jeffrey Klauda & Arpita Updhyaya (Co-directors);
- 11:15 - 11: 25 Chemical Physics (CHPH) Overview: Wendell Hill (Director) & Min Ouyang (Assoc Director);
- 11:25 - 11:30 Questions & Answers;

- **Faculty Panel**

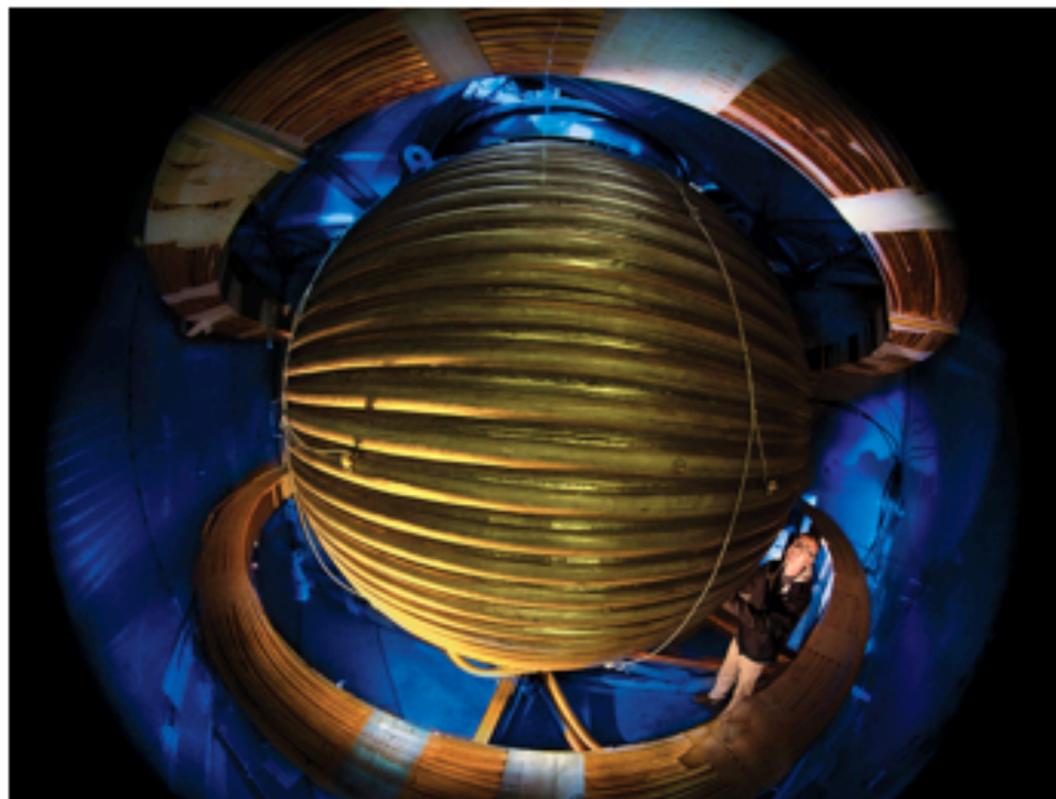
- 11:30 - 12:00 Kwaku Dayie, Christopher Jarzynski, Amy Mullin, Giuliano Scarcelli and Pratyush Tiwary;

- **Breakout Rooms**

- 12:00 - 12:30 BIPH & CHPH Alumni (no faculty);
- 12:30 - 13:00 BIPH & CHPH Current students (no faculty);

- **Closing** 13:00 - 13:05

Fall 2020 Chemical Physics Open House



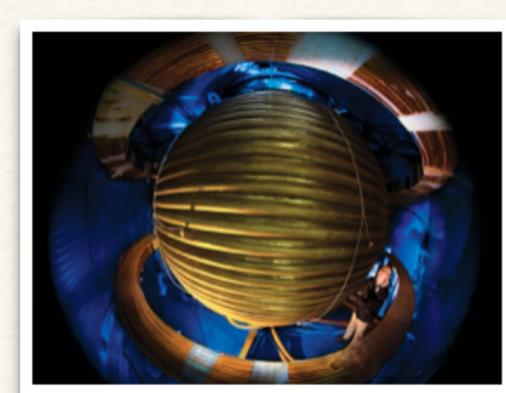
PHYSICS & CHEMISTRY CORE

Grounded in both physics and chemistry, this program is for graduate students interested in multidisciplinary, rigorous education that crosses traditional academic boundaries.

DIVERSE STUDENT EXPERIENCES

Coursework and research placements are tailored to each student's background and interests.

[LEARN MORE](#)



Who are we

- A highly selective, interdisciplinary program that provides graduate students with a rigorous academic foundation in physics and chemistry while offering first-class research opportunities in disciplines ranging from physics to chemistry to material science to meteorology.
- Students carry out thesis research with Chemical-Physics faculty in numerous departments on campus, primarily within CMNS (College of Computer, Mathematical and Natural Sciences - 10 departments and 12 research institutes and centers) and the Clark School of Engineering, as well as nearby government research institutes.

- **Campus home:**
Institute for Physical Science & Technology
an interdisciplinary institution in CMNS.

- **Program administration:**
Wendell T. Hill, III, Director
IPST, Physics & JQI
wth@umd.edu;
Min Ouyang, Associate Director
Physics, Quantum Materials Center &
NanoCenter;
mouyang@umd.edu
Souad Nejjar, Program Coordinator
IPST
snejjar@umd.edu.

<https://ipst.umd.edu/graduate-programs/chemical-physics>

CHPH History & Stats

- **Alumni:** 131 — 114 PhDs and 17 Masters.
- **Current number of students:** 23 — 6 female and 17 male; 11 domestic and 12 international.
- **Typical number of applicants:** order 20.
- **Typical number of acceptance:** order 10.
- **Typical entering class size:** order 5 - 7.
- **Typical undergraduate majors:** physics and chemistry.
- **Typical number of graduating students:** order 3.
- **Post graduation employment:** academia (postdocs & faculty), government labs (e.g., NIST, NRL), Industry. (startups, to medium size to large size).
- **Most recent graduates:** software engineer (Tyba Energy), Asst Res. Prof (Naval Academy) & postdoc (UMD).



Application Process

- **General Requirements:**
 - Transcripts.
 - CV / Resume.
 - Letters of Recommendation (3).
 - GRE (waived for applicants 2021 admission).
 - TOEFL (international students).
 - Statement of purpose.
 - Description of Research / Work Experience.
 - Description of courses including textbooks used.
- **Deadline January 15, 2021.**

Basic Requirements

- **Pre-qualifier (first year)**
 - Laboratory rotations course, seminar course & several recommended courses to prepare for qual;
 - Written qualifier (end of summer after first year).
- **Post qualifier**
 - Advanced laboratory course, advanced course outside of main field of study at the 600 level or higher;
 - Admission to candidacy — scholarly paper and presentation;
 - Join a research group; *form a thesis defense team of advisors;*
- **Post-candidacy**
 - 12 credits of CHPH899 — thesis research — *annual progress reports;*
 - Written thesis and oral defense.

Typical Curriculum

- **First Year Fall Semester**

- CHPH718I (required): Chemical Physics Laboratory Rotation (1 credit);
- PHYS622 (strongly recommended): Introduction to Quantum Mechanics (4 credits);
- CHEM684 (strongly recommended): Chemical Thermodynamics (3 credits);
- Seminar course (required*): choose from several possible — CHPH, PHYS, CHEM & JQI.

- **First Year Spring Semester**

- CHPH718I (required*): Chemical Physics Laboratory Rotation (1 credit);
- PHYS623 (strongly recommended): Introduction to Quantum Mechanics (3 credits);
- CHEM687 (strongly recommended): Statistical Mechanics (3 credits);
- Seminar course (required*).

* Caveats

Typical Curriculum

- **First Year Summer**

- Join a research group; study for the qualifier;
- Qualifier given (typically) the week before fall classes start.

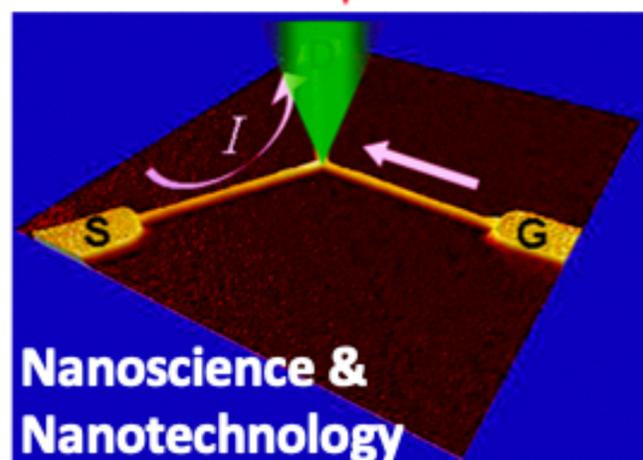
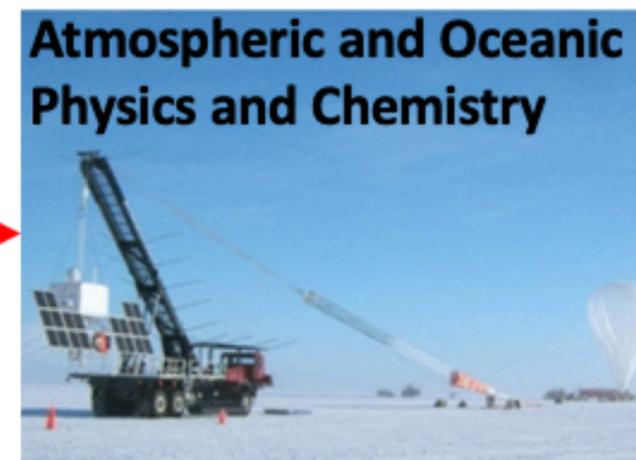
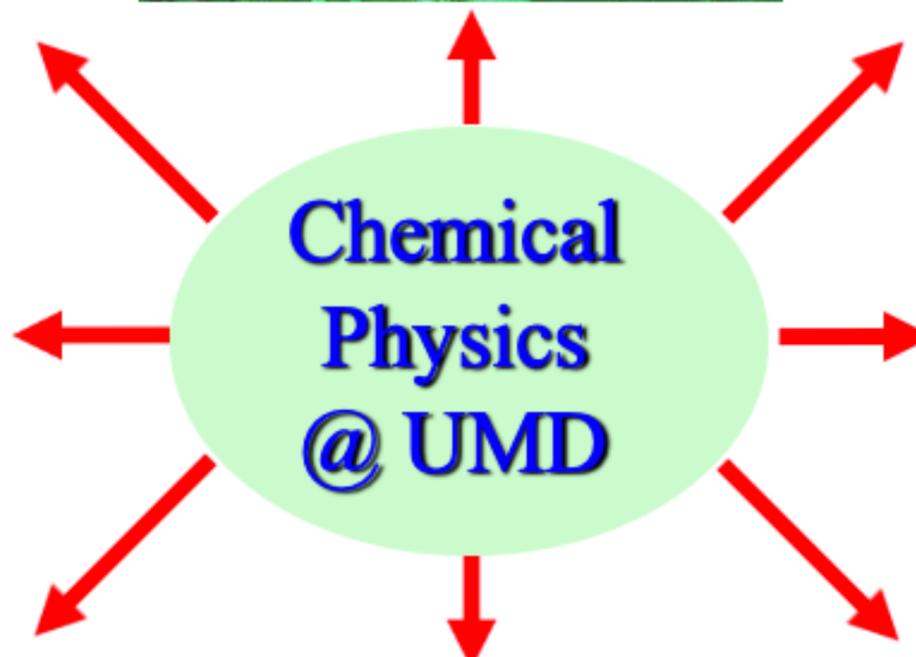
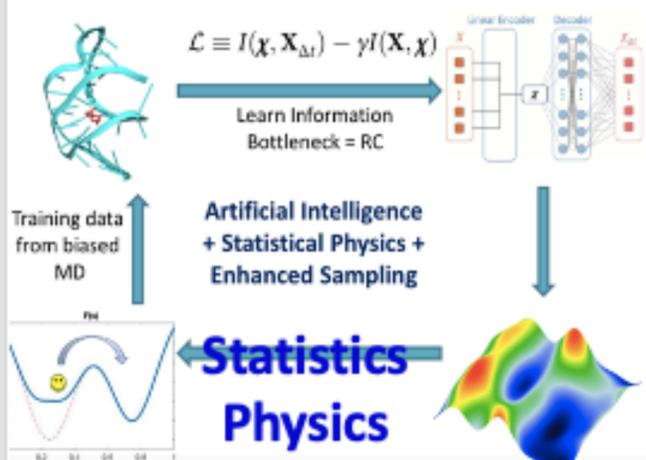
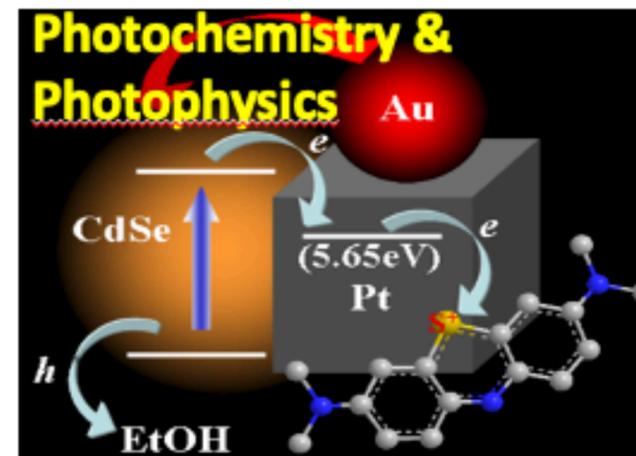
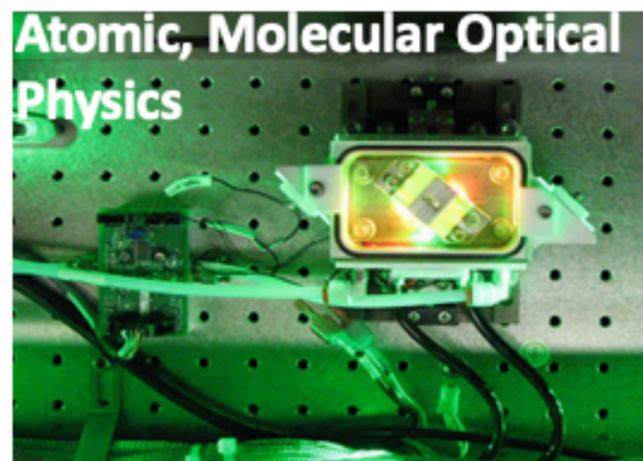
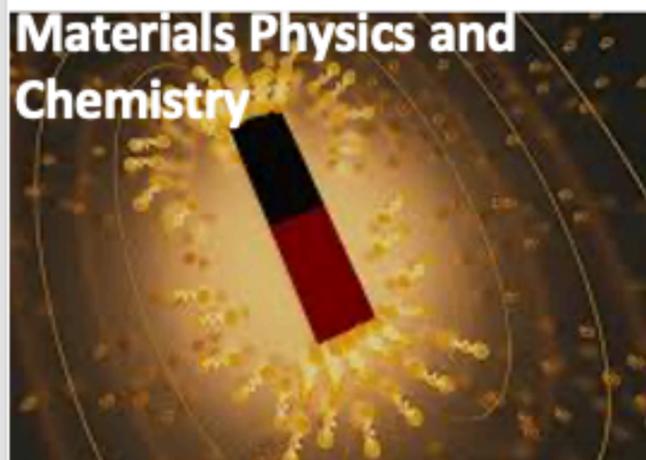
- **Second Year**

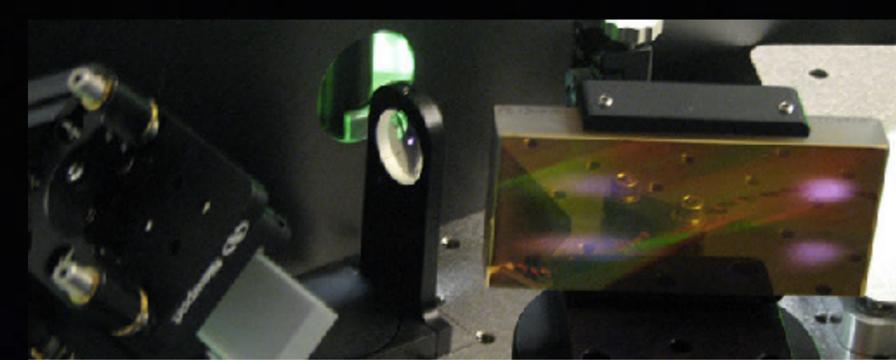
- Advanced laboratory course (required): choose from several possible;
- Advanced course (required): must be outside your field of study at the 600 or higher level;
- Prepare scholarly paper and presentation.

- **Third - Final Years**

- Admission to Candidacy; 12 credits of research credits; thesis and oral defense.

Research Activities in the Chemical Physics Program

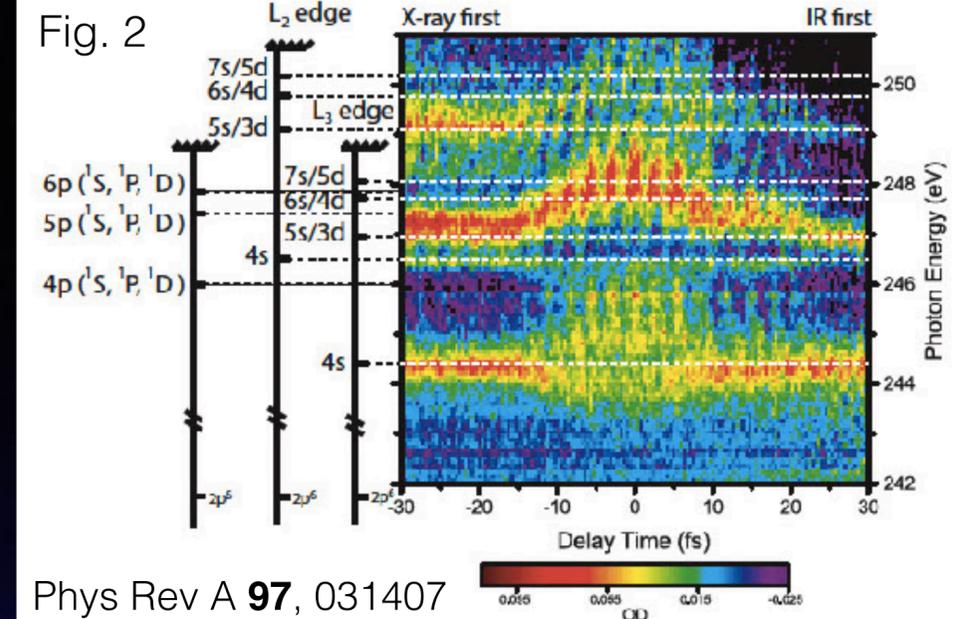
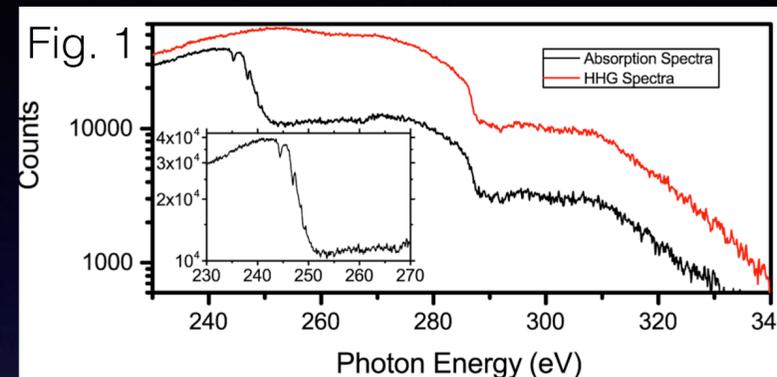




Wendell Hill's AMO Lab

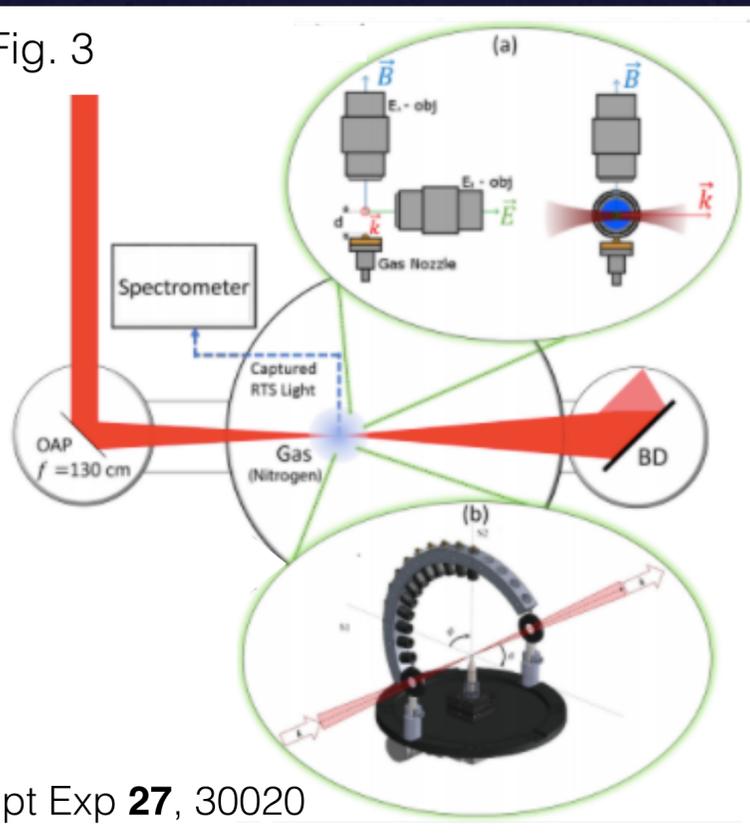
Quantum dynamics under extreme conditions

Ultrafast: Photoinduced charge separation in molecules is the first step in many chemical processes and central to our understanding of electron correlation and the energy exchange between electronic and nuclear motion. Catalysis, photosynthesis, photovoltaics and radiation damage in biomolecules all depend on this dynamics. We study these processes with femtosecond and attosecond pulses. Figures 1 and 2 are examples near the Ar L-edge, i.e., the displacing of 2p electrons.



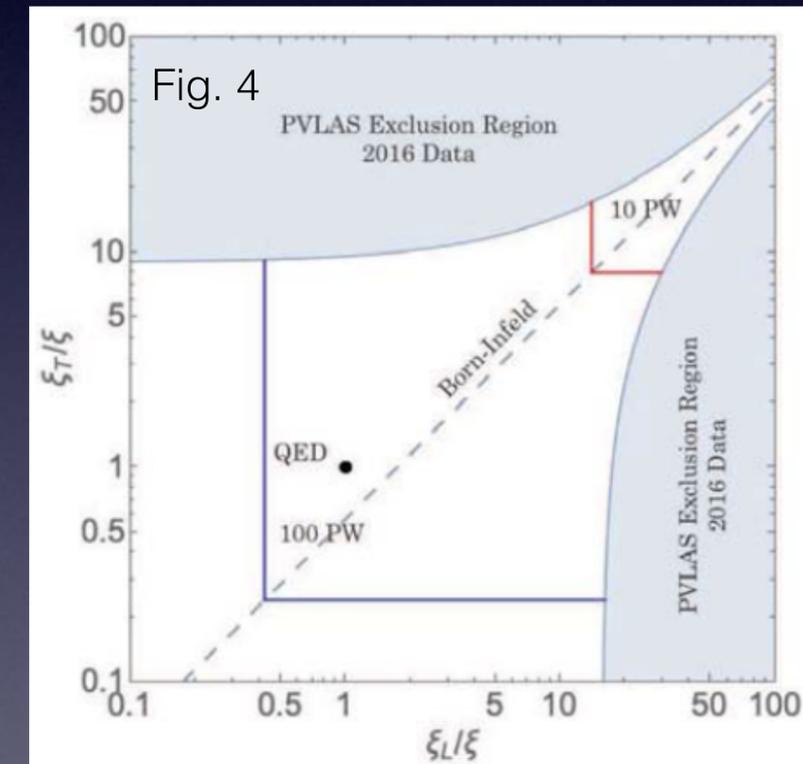
Phys Rev A **97**, 031407

Fig. 3



Opt Exp **27**, 30020

Ultraintense: Petawatt-class lasers have placed us at the threshold of a new era where novel experiments of nonlinear aspects of electrodynamics -- quantum electrodynamics (QED) -- will be possible. We are developing technology to study virtual electron-positron pairs, the birefringence of the quantum vacuum and testing QED from the photon side. Figure 3 shows a potential technology for measuring extreme intensities while Fig. 4 indicates the predicted strength of the birefringence of the quantum vacuum.



J Phys: Conf. Series **869**, 012015

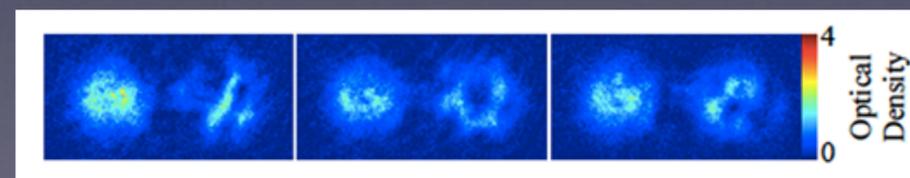


Fig. 5. Phys Rev A **93**, 063619

Ultracold: Ultracold atoms have revolutionized how some key questions in physics and chemistry are being addressed by providing a platform to study longstanding problems that are difficult, if not impossible to study otherwise. We are interested in exploiting these degenerate ensembles of gases (see for example, Fig. 5) to study fundamental questions related to the time-scale for tunneling.