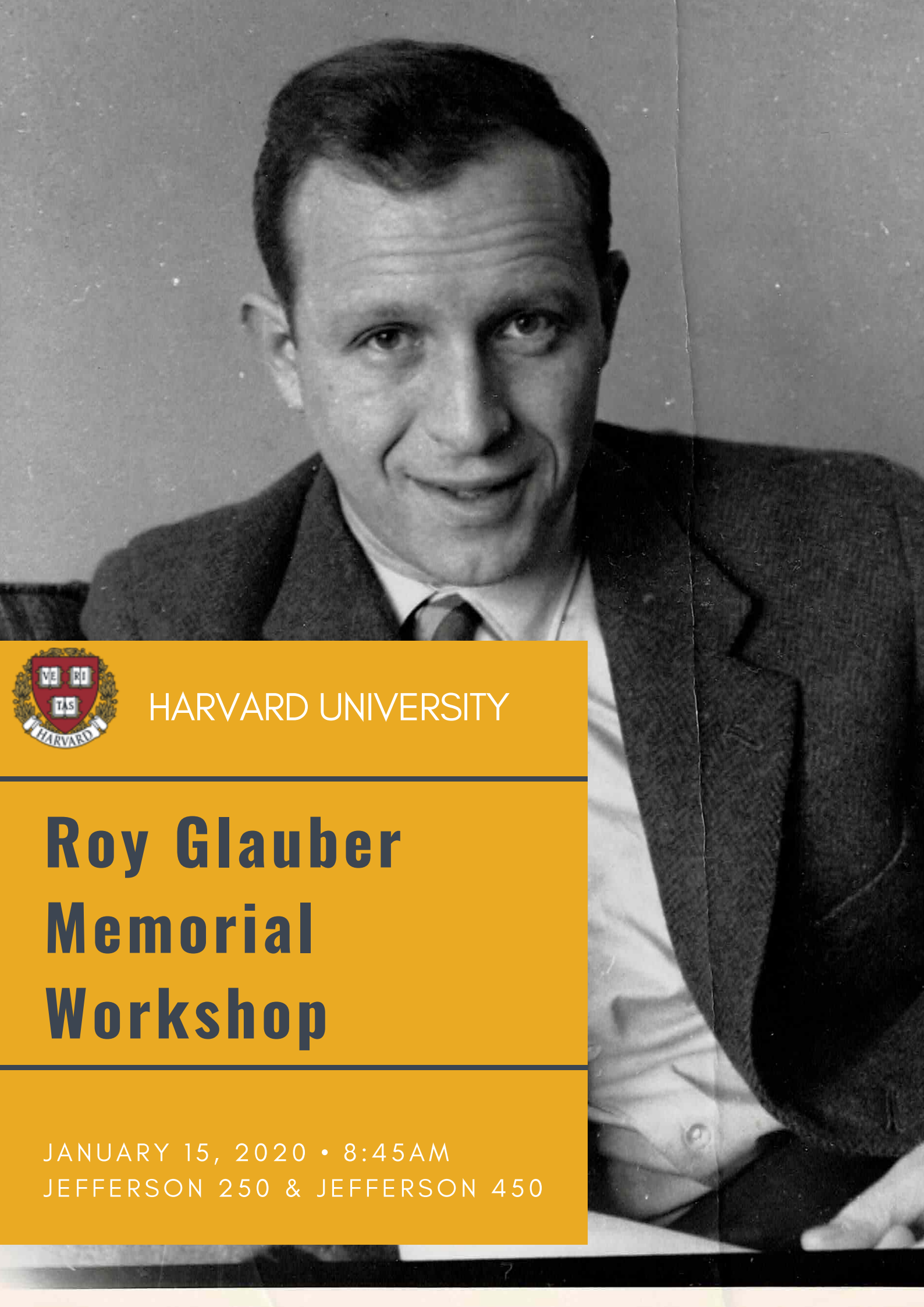


HARVARD UNIVERSITY

Roy Glauber Memorial Workshop

JANUARY 15, 2020 • 8:45AM
JEFFERSON 250 & JEFFERSON 450

PROGRAM

WEDNESDAY, JANUARY 15TH, 2020

OPENING CEREMONY - JEFFERSON 250 **8:45 - 10:30 AM**

MASTER OF CEREMONY - SUSANNE YELIN

OPENING REMARKS - SUBIR SACHDEV - DEPARTMENT CHAIR 9:00 AM

SESSION 1

DR. PETER ZOLLER 9:05 AM

DR. JUN YE 9:45 AM

COFFEE BREAK **10:30 - 10:50AM**

DR. IGNACIO CIRAC 10:50 AM

DR. CHRISTOPHER MONROE 11:00 AM

DR. STEVEN GIRVIN 12:10 PM

LUNCH - JEFFERSON 450 **1:00 - 2:00 PM**

SESSION 2 - JEFFERSON 250 2:00 - 3:30 PM

DR. NERGIS MAVALVALA 12:10 PM

DR. MARLAN SCULLY 12:10 PM

SCIENTIFIC LEGACY - JEFFERSON 450 **3:30 - 4:30 PM**

SHARED MEMORIES 3:30 PM

POSTER SESSION + RECEPTION 4:30 - 6:30 PM

Talk Title and Abstract

Dr. Peter Zoller

Quantum Optics & Quantum Many-body Physics

Add a little bit of Roy Glauber's Quantum Optics has provided us with deep insights on the quantum nature of light, and atom-light interactions. This has paved the way to the Quantum Optics of today, where quantum optical systems represent one of the most promising ways to build synthetic quantum many-body systems and study many-body dynamics with quantum optical tools. In this talk we discuss recent examples of quantum many-body systems with atoms and ions, illustrating Glauber's legacy. Our discussion will in particular focus on quantum simulation of closed and open quantum many-body systems, and the development of novel measurement protocols building on the quantum optical toolbox.

Dr. Jun Ye

Rebirth of light – coherent state meets Fermi statistics

Roy Glauber used a metaphor of seasons to describe the way science progresses, "Every field of study has its summer seasons, but must also be reborn from time to time." Roy played a pioneering role in the recent outburst of progresses in quantum science. The convergence of precision measurement and metrology with quantum matter is a good example to reflect on Roy's inspiration to the development of our field.

Talk Title and Abstract

Dr. Ignacio Cirac

Glauber Dynamics: from statistics to quantum information

In the broad scientific community, Roy Glauber is known for his pioneering work that established the field of Quantum Optics. However, he also made extraordinary contributions in other fields, like Scattering Theory or Quantum Statistical Mechanics. In this talk I will briefly review his paper on time-dependent statistics of the Ising model, which describes the dissipative dynamics of a set of spins. This work opened up a new field of research, which is nowadays called Glauber Dynamics, and has influenced several generations of scientists. I will also review how Glauber Dynamics can help to solve problems in the field Quantum Information and Computation, as well as the description of many-body quantum systems in thermal equilibrium through tensor networks.

Dr. Christopher Monroe

Matrix elements of the displacement operator and quantum computers

Following Roy Glauber's seminal treatment of coherent states in quantum mechanics, he went on to show many properties of the bosonic operators at the foundation of coherent states. In his 1969 manuscript entitled "Ordered Expansions in Boson Amplitude Operators," Glauber and Kevin Cahill calculated the matrix elements of the coherent displacement operator. The calculation was obscure at the time, but became the basis for one of the leading architectures for quantum computers.

Talk Title and Abstract

Dr. Steven Girvin

Circuit QED: Non-linear quantum optics and quantum information processing with microwave photons and artificial atoms

'Circuit quantum electrodynamics' is the theory of non-linear quantum optics extended to the study of microwave photons strongly interacting with 'artificial atoms' (Josephson junction qubits) embedded in superconducting electrical circuits. Roy Glauber taught us how to understand destructive photo-detection events in which the absorption of an optical photon triggers a photomultiplier. Recent remarkable experimental progress now allows us to make quantum non-demolition (QND) measurements of microwave photon number as well as photon number parity and super-parity. These advances in our ability to measure and manipulate the quantum states of microwaves are leading to novel applications ranging from accelerating dark matter searches to quantum error correction that has successfully extended the lifetime of quantum information. It is also now possible to use QND boson-sampling techniques to carry out quantum simulations of the vibronic sidebands in the optical spectra of molecules. This talk will present an elementary introduction to the basic concepts underlying circuit QED and describe several recent novel experiments demonstrating these newfound capabilities.

Talk Title and Abstract

Dr. Nergis Mavalvala

Gravitational waves: from first detections to mapping out the observable Universe

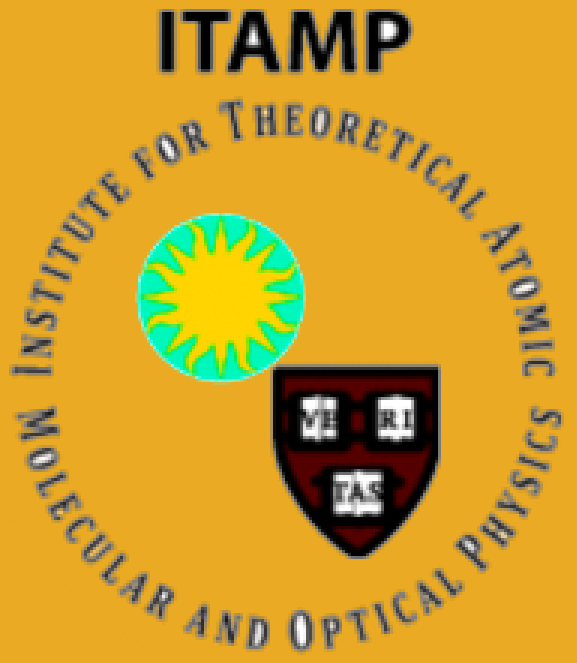
The first ever detections of gravitational waves from colliding black holes and neutron stars have launched a new era of gravitational wave astrophysics. Due to their exquisite precision, these detectors also provide opportunities for studying quantum phenomena on unprecedented scales. The sensitivity of current interferometric gravitational wave detectors is almost entirely limited by quantum noise. I will explore the quantum limit and describe experimental progress toward circumventing it.

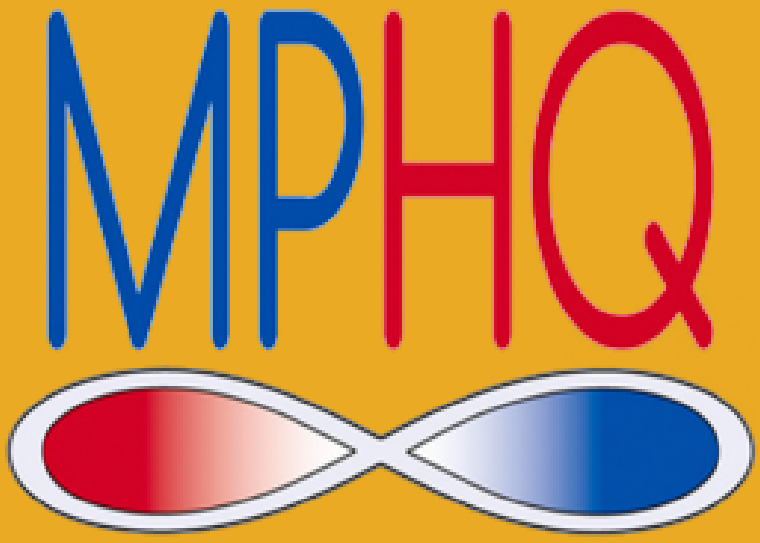
Dr. Marlan Scully

Following Glauber and Bogoliubov: From Bose Einstein Condensation to Unruh Hawking Radiation

Professor Roy Glauber, our guide in so many fields of thought, has taught us that good physics unifies and unites seemingly different fields. Nowhere is this more apparent than in the studies of Bose Einstein Condensation (BEC) in weakly interacting gases. There we use a combination of Bogoliubov transformations and quantum master equations to calculate the fluctuations in an interacting Bose gas [1,2]. In other work we use Bogoliubov transformations in the analysis of Unruh acceleration radiation [3,4] and Hawking black hole radiation [5]. In these studies we show how the Bogoliubov transformations on the one hand and virtual transitions on the other provide complementary insights.

HARVARD UNIVERSITY
Department of Physics





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