Title: Quantum Physics for Everyone

Professor Michael G. Raymer, Professor of Physics, University of Oregon

Outline for 12 online sessions for the CIQM Online Community.

Max enrollment: 30

Goals of course – be able to explain the Nine Key Concepts of Quantum Information Science (QIS), as defined in the NSF report, and to apply some basic math tools for predicting outcomes of quantum experiments.

Time commitment of students: 18-24 hours of live online participation, plus time reading, plus time problem solving. (no formal exams or grading)

Dates: Mondays and Thursdays-July 6th – August 13th

Monday, 2 hour lecture

Thursday, 1-2 hour discussion (may include experimental demonstrations).

Time:10 am PT (1 pm ET).

Required Text: Quantum Mechanics for Everyone (preferably the paperback, or if necessary, the e-book)

Readings: the NSF/OSTP Report “Key Concepts for Future QIS Learners”

at [https://qis-learners.research.illinois.edu](https://urldefense.com/v3/__https%3A/qis-learners.research.illinois.edu__;!!C5qS4YX3!WFDCKL45CqKr4CjUAryfGc3jWIF4374PzEz-INlVw2bNHZlgt7aV5l19RC1gyYqz$).

Experimental demonstrations will be provided voluntarily by the company qutools.

They are not meant to be promotional of any product sold by them, and we greatly appreciate their willingness to provide the demonstrations.

Before each session, assigned reading should be read, and if technology permits, on-line questions about the reading answered.

Other readings to be assigned.

Distribution of materials to students in advance: at least three plastic polarizers and a laser pointer for each student.

Lecture Session Topics: (tentative)

|  |  |
| --- | --- |
| Mondays 2 hour sessions | Thursdays 1 or 2 hour sessions |
| July 6 Introduction – What is quantum information science? Discuss course goals. – The discreteness of light detection. | July 9 1 hr DiscussionExperimental demo optional |
|  |  |
| July 13 Polarization of light – classical and quantum states | July 16 1 hr DiscussionExperimental demo optional |
|  |  |
| July 20 Using photon polarization for secure data transmission – qubits | July 23 1 hr DiscussionExperimental demo optional |
|  |  |
| July 27 Quantum superposition – Single-photon Interferometers– the need for quantum coherence | July 30 1 hr DiscussionExperimental demo optional |
|  |  |
| Aug 3 Quantum entanglement –  – Bell tests demonstrating entanglement | Aug 6 1 hr DiscussionExperimental demo optional |
|  |  |
| Aug 10 Quantum computing | Aug 13 1 hr DiscussionExperimental demo optional |