OIST OKINAWA INSTITUTE OF SCIENCE AND TECHNOLOGY
沖縄科学技術大学院大学

THEORETICAL SCIENCES VISITING PROGRAM

TSVP TALK

Non-Hermitian Quantum Systems:

Qubits, Decoherence, Information, Entropy and Beyond

2026 Thu. APR. 09

15:00–16:00

HYBRID L4E48, ZOOM

For zoom and other details scan QR code or visit oist.jp/visiting-program

The focus of this talk will be on significant recent efforts devoted to non-Hermitian quantum phenomena in the context of photonics and related fields. More than 25 years ago it was shown by Bender and Boettcher that a non-Hermitian system with balanced gain and loss, or parity-time reversal (PT) symmetry, could still possess all eigenvalues as real below a threshold value of gain/loss. Subsequently, this prediction was experimentally verified in photonic waveguides and several other physical settings. After a pedagogical introduction to the subject, I will provide several examples that illustrate a variety of unusual properties of non-Hermitian systems. Specifically, I will consider decoherence, entanglement entropy and Fisher information for both PT-symmetric and anti-PT-symmetric qubits and compare these properties with the corresponding attributes of a Hermitian qubit. I will also consider a discrete system, that of a PT-symmetric Kagome photonic lattice, in which dispersionless flat bands emerge. The latter are responsible for long-lived chiral structures and localization in the lattice. Such photonic lattices are beginning to find applications in optical beam engineering, image processing and active metamaterials. Additionally, I will discuss a few other examples including the stability of driven non-Hermitian Hamiltonians with different periodicities using Floquet theory. Finally, I will emphasize the potential quantum computing and quantum information processing applications of non-Hermitian systems.

Avadh Saxena Los Alamos National Lab

Avadh Saxena is former Group Leader of the Condensed Matter and Complex Systems group (T-4) at Los Alamos National Lab, New Mexico, USA where he has been since 1990. He is also an affiliate of the Center for Nonlinear Studies at Los Alamos. His main research interests include phase transitions, optical, electronic, vibrational, transport and magnetic properties of functional materials, device physics, soft condensed matter, non-Hermitian quantum mechanics, geometry, topology and nonlinear phenomena & materials harboring topological defects such as solitons, polarons, excitons, breathers, skyrmions and hopfions. A year ago, he published a book on “Phase Transitions from a Materials Perspective” (Cambridge University Press, 2025). He is an Affiliate Professor at the Royal Institute of Technology (KTH), Stockholm, Sweden and holds adjunct professor positions at the University of Barcelona, Spain, University of Crete, Greece, Virginia Tech and the University of Arizona, Tucson. He is Scientific Advisor to National Institute for Materials Science (NIMS), Tsukuba, Japan. He is a Fellow of Los Alamos National Lab, a Fellow of the American Physical Society (APS), a Fellow of the Japan Society for the Promotion of Science (JSPS) and a member of the Sigma Xi Scientific Research Society, Materials Research Society (MRS), APS and American Ceramic Society (ACerS).

oist.jp/visiting-program

CONTACT Office of the Dean of Research tsvp@oist.jp