ΓΕΝΙΚΟ ΣΕΜΙΝΑΡΙΟ ΤΜΗΜΑΤΟΣ ΦΥΣΙΚΗΣ

PHYSICS COLLOQUIUM

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17:00 -18:00

3rd Floor Seminar Room

"PT symmetry and the taming of instabilities"

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Abstract

PT-symmetric classical mechanics and PT-symmetric quantum mechanics are generalizations of conventional classical mechanics and quantum mechanics into the complex plane. Theoretical advances in PT symmetry have led to beautiful experimental results in optics, lasers, superconducting wires, atomic diffusion, NMR, microwave cavities, and electronic and mechanical simulations. Experiments on Bose-Einstein condensates are being planned and new PT-symmetric synthetic metamaterials are being developed. An advantage of extending physics into the complex domain is that theories that appear to be unstable and physically unacceptable from the narrow perspective of real analysis may become stable and physically viable in the complex domain. An example of a potential that is unstable on the real axis but stable in the complex domain is the $-x^4$ potential. The Lee Model, the Pais-Uhlenbeck model, the double-scaling limit of $\lambda\varphi^4$, and time-like Liouville theory were all thought for many decades to be invalid quantum theories suffering from instabilities (which give rise to ghost states and nonunitarity), but these are all physically acceptable PT-symmetric theories. The powerful methods of PT-symmetric quantum theory may resolve even more timely problems, such as the stability the Higgs vacuum in the Standard Model.