北京理工大學

数学与统计学院学术报告

Scattering theory and resonances in quantum field theory

报告人： Miguel Ballesteros （墨西哥国立自治大学）

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摘要： In scattering experiments, physicists identify resonances as distinct peaks at specific energy levels within the measured scattering cross sections per solid angle. These peaks are linked to specific scattering processes, such as particle emission, absorption, or system excitation. Mathematicians, however, describe resonances as poles of an analytically continued resolvent operator, achieved through complex dilations. A key challenge is bridging these two perspectives—for example, by demonstrating that the poles of the resolvent operator correspond to the observed peaks in the scattering matrix. In quantum mechanics, this issue has been thoroughly investigated, leading to Simon's groundbreaking work [Ann. Math 1973], which offered a comprehensive solution for a wide range of pair potentials. In contrast, the equivalent problem in quantum field theory has remained unsolved for decades, even though scattering and resonance theories are well-established for numerous models. These models capture essential phenomena, such as photon emission and absorption by atoms, which are central to the origins of quantum mechanics. In this study, we introduce a first-of-its-kind formula that connects the scattering matrix to the resolvent operator in the massless Spin-Boson model.

报告人简介： Miguel Ballesteros，墨西哥国立自治大学教授，长期研究数学物理领域，在CMP,Adv Math.,JFA,庞加莱等国际权威学术期刊上发表文章三十余篇。