



The Hong Kong Polytechnic University Department of Applied Mathematics

Colloquium

Nucleation of Quasicrystals By Prof. Lei ZHANG Peking University

Abstract

Despite the fact that tremendous efforts have been made on the study of quasicrystals since their discovery in 1984, nucleation of quasicrystals, viz. the emergence of a quasicrystal from a crystalline phase, still presents an unsolved and challenging problem. The difficulties lie in that quasicrystals and crystals are incommensurate structures in general, so there are no obvious epitaxial relations between them. In this talk, we proposed a saddle dynamics method to solve this problem by applying the Landau theory of phase transitions. We obtained the accurate critical nuclei and transition pathways connecting crystalline and quasicrystalline phases. The results reveal that phase transitions between the crystalline and quasicrystalline phases could follow two possible pathways, corresponding to a one-stage phase transition and a two-stage phase transition involving a metastable lamellar quasicrystalline state, respectively. The proposed computational methodology not only reveals the mechanism of nucleation of quasicrystals, but also paves the way to investigate a wide range of physical problems undergoing the first-order phase transitions.

Bibliography

Prof. ZHANG Lei is an associate professor at the Beijing International Center for Mathematical Research, Peking University. He obtained his PhD degree in Mathematics from Penn State University in 2009. After that, he worked in UC Irvine as a visiting Assistant Professor during 2009-2012. During 2012-2013, he worked in City University of Hong Kong as an Assistant Professor, and then he moved to Peking University in 2013. Prof. Zhang's research lies in broad areas of computational and applied mathematics, including scientific computing, rare events and saddle point algorithm, math Biology, computational systems biology, computational materials science, and so on. His academic achievements have been published in internationally renowned academic journals such as Acta Numerica, Proceedings of the National Academy of Sciences, Physics Review Letters, Cell Systems, SIAM Journals, and so on. Prof. Zhang has received a number of prestigious awards, including NSFC Excellent Youth Award and Royal Society - Newton Advanced Fellowship. He serves on the editorial board of several internationally renowned journals, including SIAM J. App. Math., Mathematica Numerica Sinica, CSIAM Transactions on Applied Mathematics, Discrete and Continuous Dynamical Systems, Series B.

Date: 24 February 2022 (Thursday) Time: 15:00-16:00 (Hong Kong Standard Time GMT +8) Venue: Online Talk via Zoom (Meeting ID: 926 6827 1325) Speaker: Prof. Lei Zhang, Peking University Host: Dr. Zhi Zhou, The Hong Kong Polytechnic University Click to join: https://polyu.zoom.us/j/92668271325?pwd=dXpiWWljTXYvQlgyLzdFT3M3ODlmdz09

