

Duke Kunshan University

Zu Chongzhi Distinguished Lecture Series

昆山杜克大学祖冲之数学名家讲坛

## Non-equilibrium almost-stationary states and linear response for gapped quantum systems

Prof. Dr. Stefan Teufel, The University of Tübingen

Venue: DKU Academic Building 3107

Date: 1:30-2:30pm, Thursday, 11 October 2018

### Abstract:

I will present a new result on the validity of linear response theory at zero temperature for perturbations of gapped Hamiltonians describing interacting fermions on a lattice. As an essential innovation, the result requires the spectral gap assumption only for the unperturbed Hamiltonian and applies to a large class of perturbations that close the spectral gap.

This justification of linear response theory is based on a novel extension of the adiabatic theorem to situations where a time-dependent perturbation closes the gap. According to the standard version of the adiabatic theorem, when the perturbation is switched on adiabatically and as long as the gap does not close, the initial ground state evolves into the ground state of the perturbed operator. The new adiabatic theorem states that for perturbations that are either slowly varying potentials or small quasi-local operators, once the perturbation closes the gap, the adiabatic evolution follows non-equilibrium almost-stationary states (NEASS) that we construct explicitly.

### About the speaker:

Prof. Dr. Stefan Teufel studied physics at the Ludwig-Maximilians-Universität in Munich, where he also received his doctorate in mathematics. After postdocs at Rutgers University and the Technical University of Munich, he was appointed lecturer at the University of Warwick, England. Since 2005 he has been Full Professor of Mathematics at the University of Tübingen.

<https://www.math.uni-tuebingen.de/arbeitsbereiche/maphy/personen/StefanTeufel>



Kunshan has a special tie with mathematics in its history as the great mathematician and engineering Zu Chongzhi completed the calculation of the eight-bit approximation of the Pi during his appointment as the magistrate of Lou county (former name of Kunshan) around 464 AD. The eight-bit approximation of the Pi (between 3.1415926 and 3.1415927) and the approximate fraction (i.e. 'density') are among the highest mathematical achievements in ancient China, leading the world for nearly a thousand years. Hence, we name after Chongzhi Zu for the center in memorial of this great scientist.

约公元464年，伟大的数学家和科学家祖冲之调至娄县（今昆山）担任县令，在那里完成了圆周率 $\pi$ 精确到小数点第7位的计算，所以昆山与数学的特殊关系源远流长。 $\pi$ 精确到小数第7位（3.1415926和3.1415927之间）和近似分数（即：密率）是中国古代数学成就最璀璨的明珠之一，领先世界接近一千年。因此，我们将中心以祖冲之命名，以纪念这一伟大的科学家。