# 反问题与成像团队学术报告

**报告题目：** On the universal approximation theorems for deep neural networks for ill-posed inverse problems

**报告人：** 张晔教授

深圳北理莫斯科大学、北京理工大学

**时　间：** 2025.7.4(周五)下午 14:00-15:00

**地　点：** 数学院南楼 N620

**摘　要：**
We establish universal approximation theorems for neural networks applied to general nonlinear ill-posed operator equations. In addition to the approximation error, the measurement error is also taken into account in our error estimation. We introduce the expanding neural network method as a novel iterative regularization scheme and prove its regularization properties under different a priori assumptions about the exact solutions. Within this framework, the number of neurons serves as the regularization parameter. We demonstrate that for data with high noise levels, a small network architecture is sufficient to obtain a stable solution, whereas a larger architecture may compromise stability due to overfitting. Furthermore, under standard assumptions in regularization theory, we derive convergence rate results for neural networks in the context of variational regularization. Several numerical examples are presented to illustrate the robustness of the proposed neural network-based algorithms.