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Inverse Problems in Adaptive Optics: Reconstruction methods for wavefront sensing and atmospheric tomography

The image quality of ground based astronomical telescopes suffers from turbulences in the atmosphere. Adaptive Optics (AO) systems use wavefront sensor measurements of incoming light from guide stars to determine an optimal shape of deformable mirrors (DM) such that the image of the scientific object is corrected after reflection on the DM(s). The operation of the AO systems of the new generation of large astronomical telescopes under construction requires new mathematical methods that achieve reconstruction in real time. In the talk we will in particular focus on methods for wavefront reconstruction from pyramid sensor data and an analysis of the atmospheric tomography operator.