



# CSC Seminar

## SPEAKER

**Dr. Bernadett Stadler**

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## TITLE

**Real-time reconstruction in atmospheric tomography for Extremely Large Telescopes**

## ABSTRACT

Astronomical imaging with ground-based telescopes suffers from quickly varying distortions causing blurring and loss of contrast. Sharpness and contrast of these images are essential for astronomical observation, hence, so-called Adaptive Optics (AO) systems need to be applied. These systems are based on wavefront sensors, deformable mirrors and appropriate control algorithms. For the next generation of Extremely Large Telescopes (ELTs) the demands to the AO systems are getting much higher. As one aims to achieve a good correction over a large field of view a tomographic estimation of the 3D atmospheric wavefront disturbance is required. The reconstruction of turbulent layers in the atmosphere is ill-posed and has to be performed in real-time. In this talk we consider the Finite Element Wavelet Hybrid Algorithm (FEWHA), which is an iterative real-time reconstructor for atmospheric tomography. A dual domain discretization with wavelet and bilinear basis functions leads to sparse operators. In order to reduce the number of iterations, we apply warm restart, preconditioning and an augmented Krylov subspace method. We provide a matrix-free, parallel implementation of the algorithm on the high performance hardware of our industrial partner Microgate. The algorithm is evaluated via numerical simulations for the MORFEO instrument of the ELT of the European Southern Observatory.

Friday, September 16, 2022 at 2 pm  
seminar room Prigogine