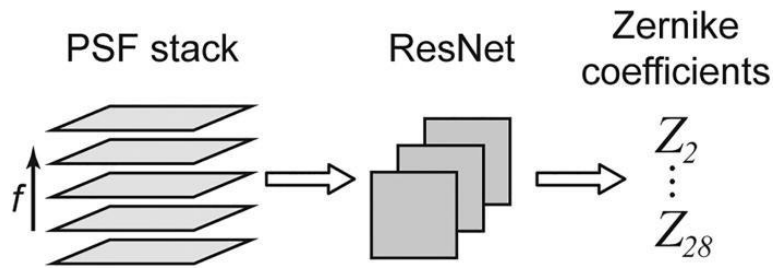


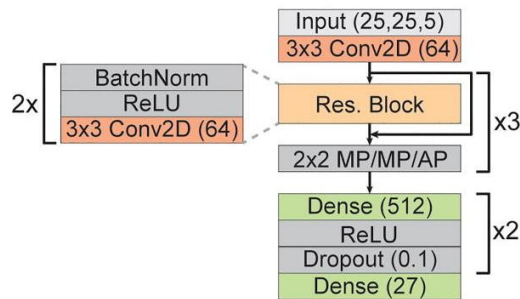
Accurate phase retrieval of complex 3D point spread functions with deep residual neural networks



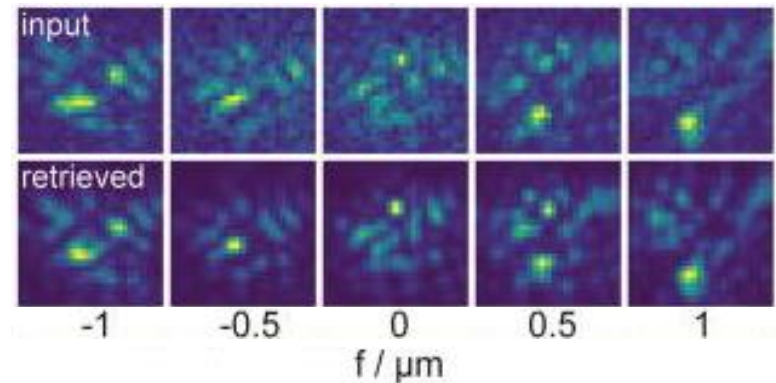
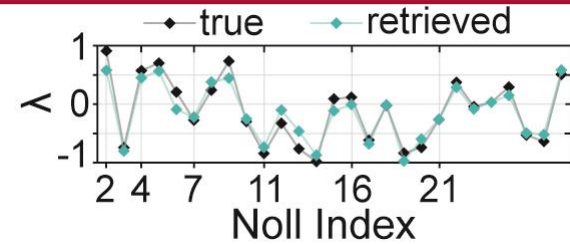
The **reconstruction of phase information from intensity information** (“phase retrieval”) is a central problem in optics. Conventional algorithms are often computationally demanding and thus slow. In our work, we developed a **deep residual neural network** which performs **rapid phase retrieval with high accuracy**.



The deep residual neural network receives **five slices from a 3D point spread function (PSF)**. It returns the predicted Zernike coefficients of order 1 to 6 (Z_2 to Z_{28}).



The architecture of the deep residual neural network. Note the **residual blocks** which introduce skip connections.



Using accurate PSF simulations, we verified that the network **predictions and the ground truth agreed**. Consequently, the **true and retrieved PSFs match each other very well**.