Scattering in a medium behind a lens can be used to improve the focusing resolution to beyond the diffraction limit of that lens. Because the position of the focus can be chosen, the disordered system even acts as a zoom lens. Surprisingly, the shape of the focus is not affected by experimental limitations of the wavefront modulator: the focus is always exactly as sharp as is theoretically possible.

Disordered scattering has already been applied to improve resolution and bandwidth in imaging and communication with ultrasound, radio waves and microwaves, with significant subwavelength effects. As our results demonstrate for the first time, similar resolution improvements can be obtained in photonics. Useful optical superresolution will be achieved with our method on plasmonic nanostructures. We anticipate that disorder-assisted focusing, combined with a method for scanning the focus, will lead to improvements in the imaging resolution of microscopy in inhomogeneous media.