Supporting Information for:
Super-Dispersive Off-Axis Meta-Lenses for Compact High Resolution Spectroscopy

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S1. Schematic of a unit cell of the meta-lens

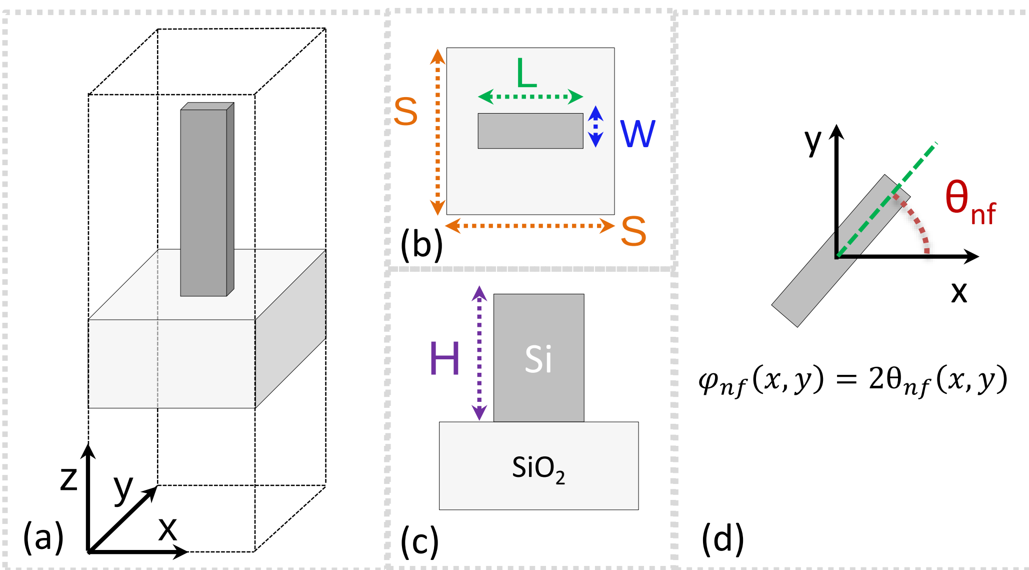

Figure S1. Nanofins parameters. (a) Schematic of a unit cell of the meta-lens consisting of a silicon nanofin on a glass substrate. (b) Top-view of the unit cell showing the width (*W*) and length (*L*) of the nanofin. Unit cell is a square with side-length S = *500 nm*. (c) Schematic diagram showing the height of the silicon nanofin. For all meta-lens designs, height (*H*) of the nanofins is 1500 nm. (d) Required phase is achieved via rotated nanofins.

S2. Measurements set-up

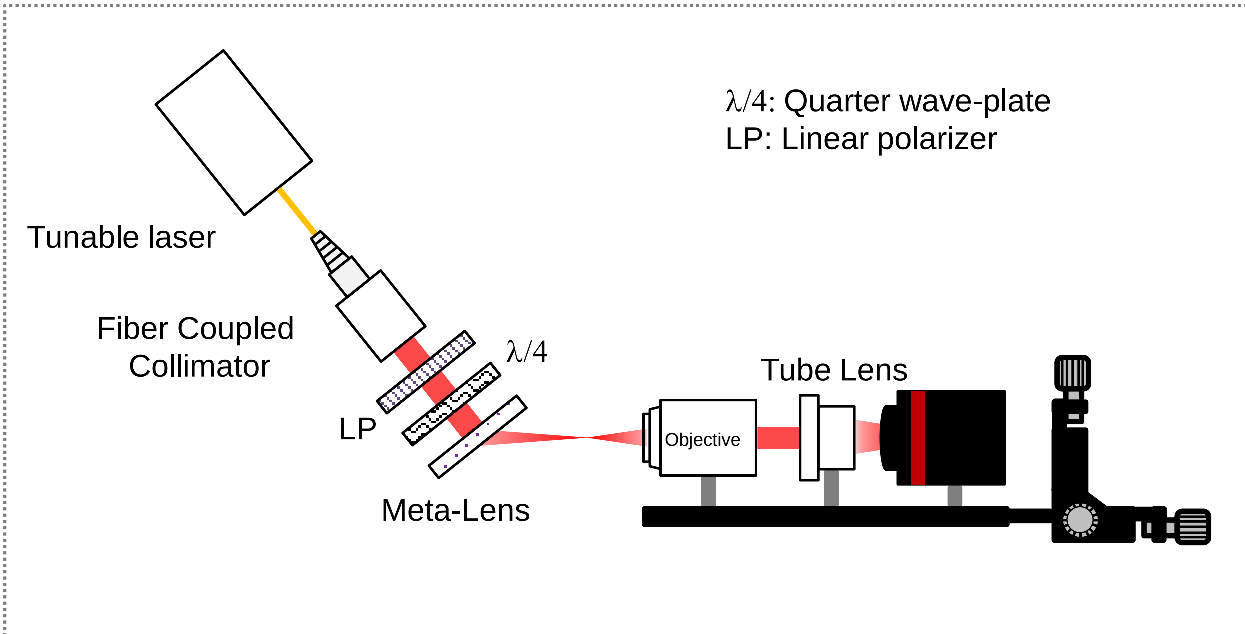

Figure S2. Sketch of the experimental setup. The laser beam from a fiber-coupled tunable laser is collimated by means of a fiber collimator (Thorlabs RC12APC-P01) with a beam size of 1 cm × 1 cm. Objectives with 20× and 50× from Mitutoyo were selectively used in the experiments. For spectral resolution and beam profile characterizations, we used a tunable laser (HP-Agilent,8168-F) with linewidth of ~1 pm. Circularly polarized incident light was generated by pairing a linear polarizer and a quarter-waveplate. For the efficiency measurements, the tunable laser was replaced by a supercontinuum laser with a linewidth of ~15 nm.

S3. Simulated efficiency for different diffraction angles

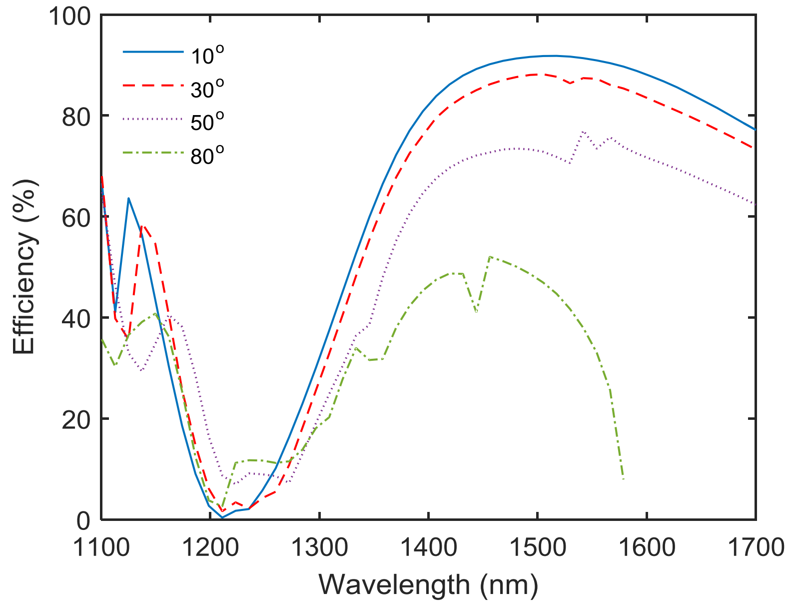

Figure S3. Simulated efficiency for different diffraction angles. For these simulations, nanofins are arranged in such a way that they act as a blazed grating with diffraction angles noted in the legend. Efficiency remains high (more than 70%) even for a large angle of 50 degrees.

S4. Dispersive characteristics: experiment versus simulation

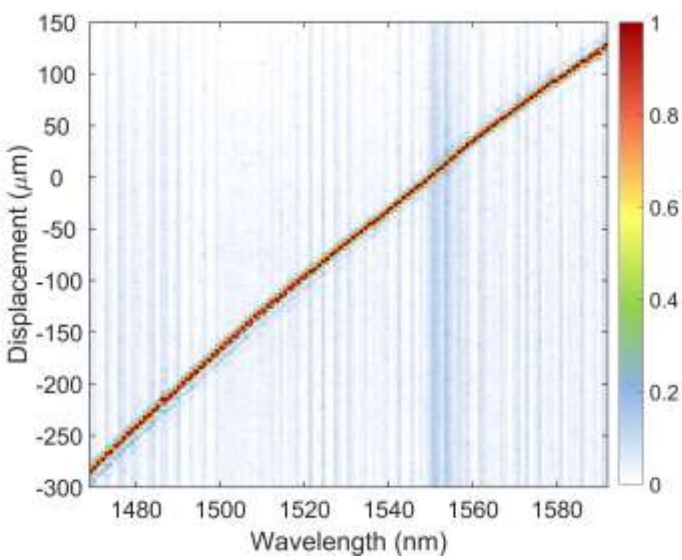

Figure S4. Dispersive characteristics. Displacement of the focal line along the *x*'-axis as a function of wavelength. Color map (experiment) and dashed line (simulation) are overlaid for the entire wavelength range.

S5. Focal length as a function of wavelength

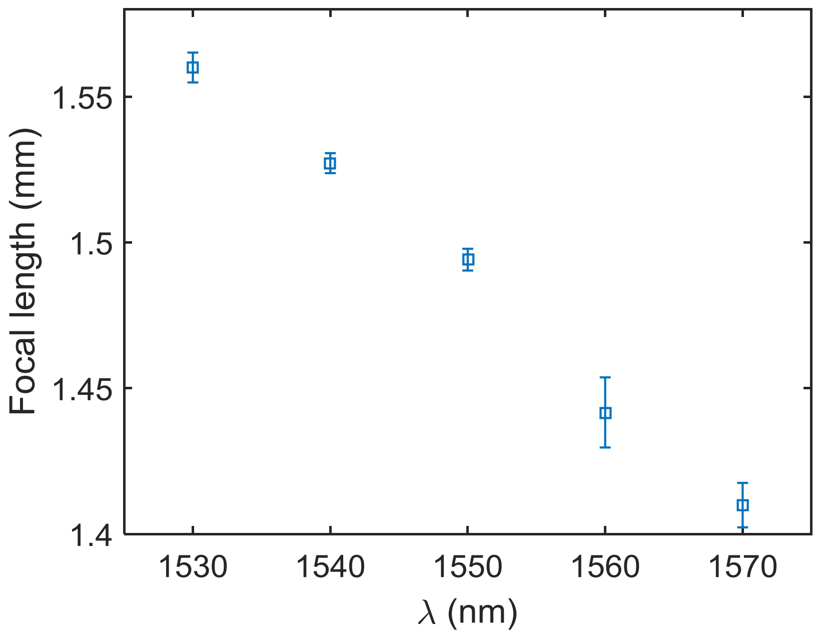

Figure S5. Focal length of the meta-lens at different wavelengths. Focal length as a function of wavelength for the meta-lens with $f = 1.5\ mm$ and $\alpha = 45°$. Each experimental point is an average over 10 measurements.

S6. Curve fitting example

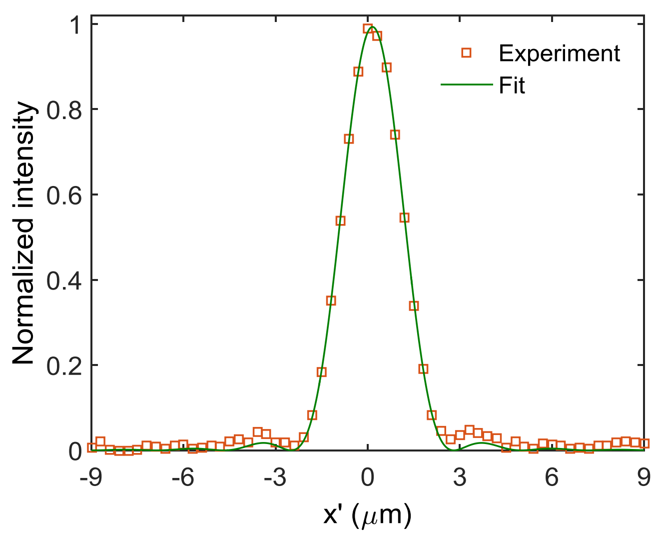

Figure S6. Beam profile along x'-axis at focal line. Intensity profile of the focal line at wavelength λ = 1550 nm. Symmetric focal line is achieved despite focusing at a very large angle of 80°. The fit is an Airy disk function.

S7. Ray-tracing for meta-lens designed at α=80°

Chromatic aberration broadens the focal spot, which restricts the bandwidth of operation. The bandwidth of operation can be increased by either stitching several meta-lenses together or adding extra optical components to correct the aberrations[1].

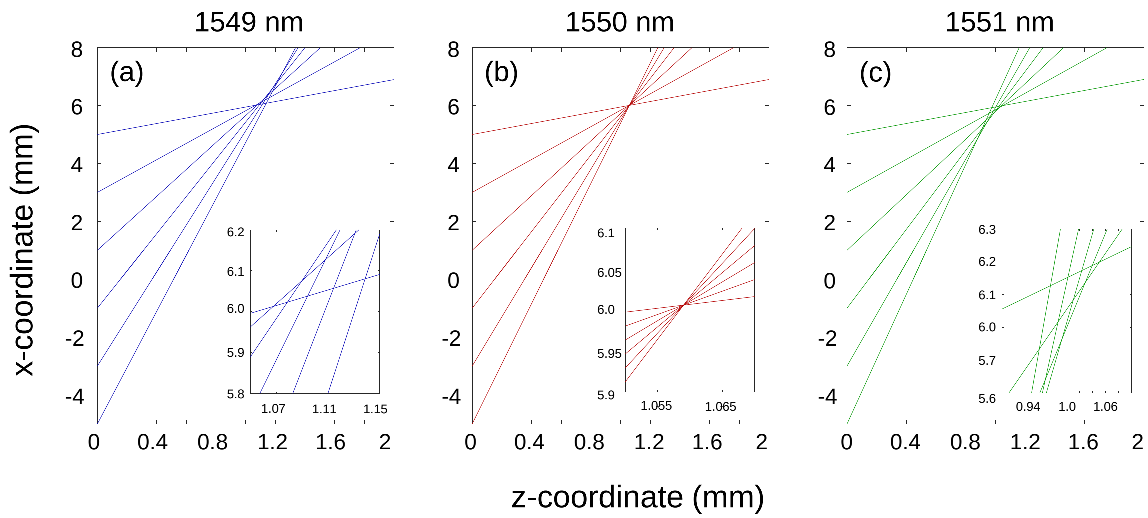

Figure S7. Ray-tracing simulation for the meta-lens with *f = 6.1 mm* and α = 80°. For wavelengths away from the design wavelength (λ_d=*1550 nm*) chromatic aberrations manifest themselves in broadening the focal spot.

S8. Definition of numerical aperture

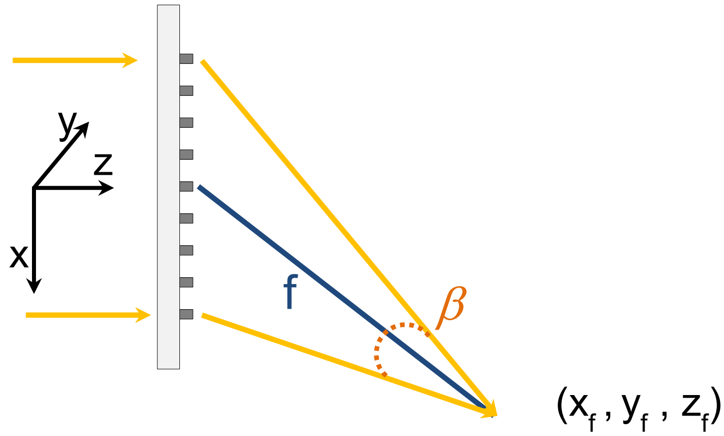

Figure S8. Definition of numerical aperture of an off-axis focusing meta-lens. Numerical aperture is given by $NA = \sin\left(\frac{\beta}{2}\right)$. The angle β can be easily deduced using trigonometry once the lens dimensions, focal length, and focusing angle are given.

Reference

1. McClure, J., Anastigmatic imaging spectrograph. US Patent 8,773,659: **2014**.