Planar refraction and lensing of nano-light in an anisotropic van der Waals material

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Refraction between isotropic media is characterized by light bending towards the normal to the boundary when passing from a low- to a high-refractive-index medium. However, refraction between anisotropic media is a more exotic phenomenon which remains barely investigated, particularly at the nanoscale. Here [1], we visualize and comprehensively study the general case of refraction of electromagnetic waves between two strongly anisotropic (hyperbolic) media, and we do it with the use of nanoscale-confined polaritons (hybrid light-matter waves) in a natural medium: a-MoO_3 [2-4]. The refracted polaritons exhibit non-intuitive directions of propagation as they traverse planar nanoprisms, enabling to unveil an exotic optical effect: bending-free refraction. Furthermore, we develop an in-plane refractive hyperlens, yielding foci as small as $\lambda_p/6$, being λ_p the polariton wavelength ($\lambda_0/50$ compared to the wavelength of free-space light). Our results set the grounds for planar nano-optics in strongly anisotropic media, with potential for effective control of the flow of energy at the nanoscale.

References

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Figures

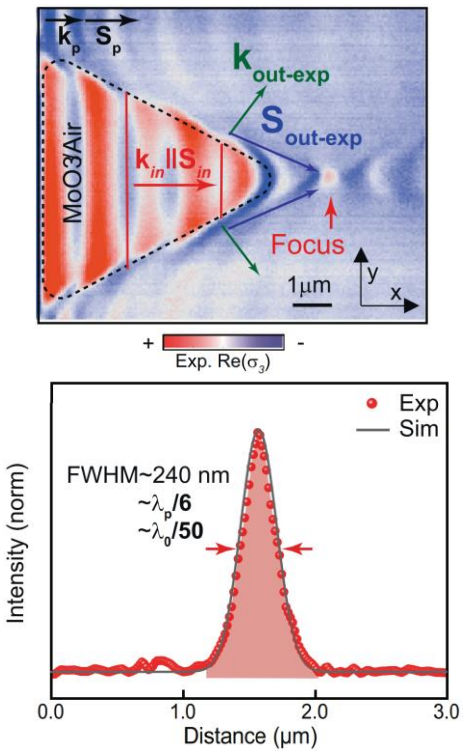

Figure 1: Sub-diffractional planar lens based on refraction of nano-light in an anisotropic vdW material.