

Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Fundamental limitation of the spatial resolution of a perfect nanolens IVAN LARKIN, MIRANTIS, Inc., 16 Marksistskaja, Moscow, Russia, 109147, MARK STOCKMAN, Department of Physics and Astronomy, Georgia State University, Atlanta, 30303 — We have established a fundamental limitation on the ultimate spatial resolution of the perfect lens (thin metal slab) in the near field. This limitation stems from the spatial dispersion of the dielectric response of the Fermi liquid of interacting electrons in the nanolens material. Such dispersion leads to the aberrations of this lens in the wave vector space in the plane of the slab. This principally limits the resolution of this lens making it imperfect on the scale below five nanometers. This effect is different and independent from the known source of the lens imperfection due to the absorption (optical losses) in the metal and temporal dispersion that is related to the absorption by Kramers-Kronig relations. Even if the absorption is reduced or compensated by the optical gain the spatial dispersion will remain and limit the resolution. We reveal the link between this limitations and dispersion of surface plasmons. We discuss possible applications in nanoimaging, nano- photolithography, and nanospectroscopy.

Ivan Larkin
MIRANTIS, Inc., 16 Matksistskaja, Moscow, Russia

Date submitted: 30 Nov 2004

Electronic form version 1.4