Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Optical propagation via dipolar coupling in metal nanoparticle chains WILLES H. WEBER, APS, GEORGE W. FORD, University of Michigan, Ann Arbor — Electromagnetic propagation in metal nanoparticle chains offers the potential for nano-sized integrated optical circuits. Dispersion relations for dipolar modes propagating along such a chain are calculated by solving the full Maxwell equations, including radiation damping. The nanoparticles are treated as point dipoles, which means the results are valid only for $a/d \leq 1/3$, where a is the particle radius and d the spacing.[1] The discrete modes for a finite chain are first calculated, then these are mapped onto the dispersion relations appropriate for the infinite chain. Computed results are given for a chain of 50-nm diameter Ag spheres spaced by 75 nm.[2] We find large deviations from previous quasistatic results:[3] Transverse modes interact strongly with the light line. Longitudinal modes develop a bandwidth more than twice as large, resulting in a group velocity that is more than doubled. All modes for which $k_{mode} \leq \omega/c$ show strongly enhanced decay due to radiation damping. These features are consistent with recent calculations by Citrin.[4]
[1] S. Y. Park and D. Stroud, Phys. Rev. B **69**, 125418 (2004). [2] W. H. Weber and G. W. Ford, Phys. Rev. B **70**, 125429 (2004). [3] M. L. Brongersma, J. W. Hartman, and H. A. Atwater, Phys. Rev. B **62**, 16356 (2000). [4] D. S. Citrin, Nano Lett. **4**, 1561 (2004).

Willes H. Weber
APS

Date submitted: 29 Nov 2004 Electronic form version 1.4