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 \( k_{\text{mode}} \leq \omega/c \) show strongly enhanced decay due to radiation damping. These features are consistent with recent calculations by Citrin.\(^4\)