the analysis of SP resonance with high spatial, and high energy, resolution. EFTEM maps have been used to observe and measure important and novel physical properties of SP resonant modes of metal nanoparticles. Comparison between experimental data and full electrodynamics simulations of a silver nanorod sitting on a silicon nitride membrane has revealed how important it is to include retardation and substrate effects in understanding fully the nature of a given SP resonant mode of the nanorod. The measurement of the decay length of a SP, the energy-dependent amplitude excitation at the ends and the analysis of $\lambda_{sp}$-compression show how EELS-based techniques (EFTEM in this case) can reveal fine-scale spatial features that are difficult to determine with other methods and can lead to a greater understanding of the nanoscale physics underlying SP resonant modes of metallic nanoparticles.

**Acknowledgments**

ON, WS, PvA and PAM acknowledge financial support from the European Union under the Framework 6 program under a contract for an Integrated Infrastructure Initiative, Reference 026019 ESTEEM. MW acknowledges financial support from the Danish Research Council for Technology and Production Sciences (FTP grant #274 – 07 – 0080).

#149870 - $15.00USD Received 24 Jun 2011; accepted 12 Jul 2011; published 26 Jul 2011