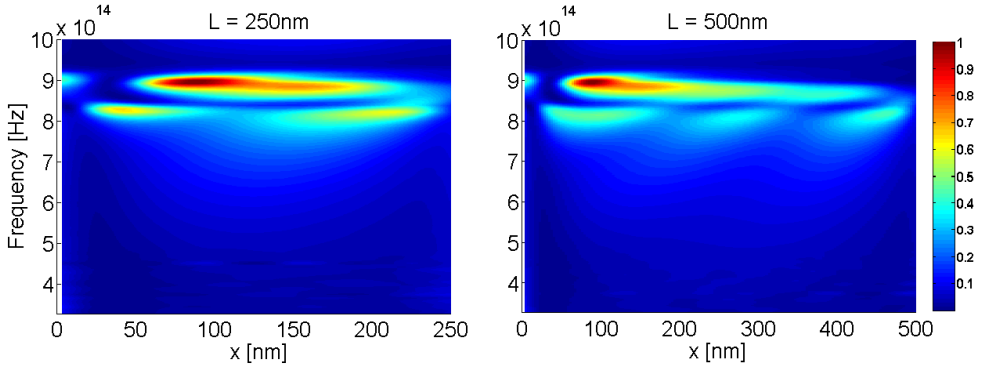

Fig. 11. Field distribution along the line of observation points 40nm above particles of lengths L = 250nm and 500nm. Even for these short lengths, the standing wave surface plasmon at around 820THz (also in Fig. 9) is still present.

5. Summary

We have studied the onset of plasmon delocalization (i.e. the transition from a situation where the decay length of a travelling surface plasma wave is greater than its propagation distance to a situation where it is smaller) both for even and odd propagating modes in a 2D silver nanoparticle of increasing length L. A Fourier analysis performed 40nm above and along the length of the particle showed clear excitation of both propagating modes for the largest length L = 20μm studied. Using this method, together with far-field scattering spectra results, and the field distribution profile 40nm above the particle, we showed clearly the transition from localized to delocalized modes as the particle length was increased. In particular, we showed for finite lengths that the even propagating mode is nothing but a superposition of numerous high order modes, these modes being just standing wave plasmons. The odd mode was also shown to be the superposition of many standing wave modes. Due to its long range nature, however, it was found to be predominantly a single standing wave at the frequency of most efficient excitation (approximately 820THz) and to broaden to the usual continuum of the odd mode as the particle length was increased.

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