# Optimal configurations for linear point scatterers

Abstract:

The main aim of this thesis is to find the optimal configurations for a collection of N linear point scatterers in three dimensions under illumination of an incoming plane wave in order to maximize the cross section associated to the scattered wave. For this purpose, we apply the Green's matrix formalism in order to calculate the scattering cross section, first for the cases of two and three scatterers. We find that multiple scattering can either increase or decrease the scattering cross section, i.e., depending on the positions of the scatterers, the cross section can be larger or smaller as compared to the case of independent scatterers. By numerical optimization, we then find the best configurations up to N <22 scatterers. These turn out to be one-dimensional configurations aligned in a row parallel to the direction of the incoming light. We observe that the maximum cross section appears to grow quadratically as a function of the number of scatterers for large $N$. Furthermore, we analyze the symmetry properties of the optimal configurations for even and odd numbers of scatterers, and their stability with respect to small changes of the scatterers' positions. To characterize what distinguishes an optimal from a non-optimal configuration, we finally examine the cross section in terms of scattering resonances.