# Abstract


## Asymptotic expression of the Helmhotz equation solution at high frequency on a convex obstacle

This thesis is concerned with new results of the waves diffraction by a strictly convex obstacle. Our objective is to produce the high frequency asymptotic expansion of the Helmholtz equation solution providing a boundary condition given by the Dirichlet to Neumann operator $ DtN $. As it is known, after using the high frequency integral equations method,
the scattered field everywhere exterior to the obstacle can be determined by computing the approach associated to the total field on the boundary of the scatterer

The original expansions were obtained by using the pseudo-differential decomposition of the operator $ DtN $ in the neighborhood of singular point this allows M. Taylor and R.B. Melrose to provide a corrected version of the Kirchhoff approximation such it is only available on the illuminated region.

This work uses first and second order approximations of the $DtN$ operator to derive new asymptotic
expressions of the normal derivative of the total field. The resulting expansions can be used to appropriately choose the ansatz in the design of high frequency numerical solvers, such as those based on integral equations, in order to produce more accurate approximation of the solutions of the Helmholtz equation on all regions of the obstacle more precisely around the shadow and deep shadow regions.



**Keywords:** Wave equation, Helmholtz equation, Dirichlet to Neumann operator, Fourier integral operator.