A Born approximation for the Calderón problem

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Abstract

We address the problem of reconstructing a scalar conductivity from the Dirichlet-to-Neumann map on the boundary of a domain in Euclidean space (the reconstruction aspect of the Calderón problem). It is well-known that, under suitable assumptions on the conductivity, this problem can be reduced to the analysis and reconstruction of the potential of a Schrödinger operator $-\Delta + V$ on the sphere. This problem is rather involved in general, from both the analytical and numerical points of view. Here we introduce an object that is obtained in terms of certain matrix elements of the Dirichlet-to-Neumann map – the Born approximation – which is reminiscent of an approximation for the potential that has been extensively studied in the context of inverse scattering theory. We will show a number of interesting analytical properties of the Born approximation, in particular how it can approximate in a suitable sense the potential in the Calderón problem and recover its singularities. This is based on joint works with Juan Antonio Barceló, Carlos Castro, Thierry Daudé, Cristóbal Meroño and François Nicoleau.