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On a Method for Solving the Inverse Problem in Potential Scattering

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Abstract. A method for solving the inverse problem in the non-relativistic elastic scattering theory, using the analytic and asymptotic properties of the scattering amplitude is proposed and the influence of the discontinuity parameters of the scattering amplitude on the properties of the resulting potentials is discussed. The case with spherically symmetric forces and without bound states is considered. The possibility for solving the inverse problem by this method, leading to the singular repulsive potentials is mentioned.

I. Introduction

The present investigations in the non-relativistic potential scattering can be divided into two groups, i) the direct investigations where a definite class of potentials is assumed and the properties of some investigated scattering functions are to be determined and, ii) the inverse investigations proceeding from the known scattering quantities and the acting forces in the Schrödinger (or Schrödinger-like) equation are to be found.

In the first mentioned group of investigations, usually the characteristic properties of one of the following functions are determined: the scattering amplitude $A(k, \cos\vartheta)$ (k is the c.m. momentum and ϑ the c.m. scattering angle), the partial wave scattering amplitude $A_l(k)$ (l is the physical angular momentum), the Regge function $A(\lambda, k)$ (λ is the complex angular momentum), the Jost function $f_l(k)$ and/or $f(\lambda, k)$, the conical amplitude, etc., in general an arbitrary scattering function or its coefficients in a series expansion. In this direction, there were investigated e.g. the analytic properties of the various scattering amplitudes in various complex domains, the validity of the Mandelstam representation for the scattering amplitude or of an integral representation for the Jost function or for the conical amplitude or for the Regge parameters, customarily, considering the class of Yukawa forces [1]. Some survey papers deal with these problems (see e.g. [2]).

In the second of the above mentioned group of investigations one proceeds from the known properties of the scattering amplitude or of any function whose properties are derivable from the latter, and the