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December 15, 1982

Dr. George L. Trigg, Editor
Physical Review Letters
1 Research Road
Box 1000
Ridge, New York 11961

Re: Manuscript: LY 2004
Authors: Y. Alhassid, F. Gursey
and F. Iachello

Dear Dr. Trigg,

Thanks for your letter of December 3, 1982. We have corrected, in the enclosed copies, the misprints as required by the first referee.

We would like to thank the second referee for his constructive criticism about the absence of any explanation of the practical physical importance of the methods developed in the manuscript. We have accordingly revised the introduction and the conclusions of the paper so that its physical motivation and applicability would be made clearer.

We also would like to take this opportunity to comment in some detail about the motivation behind that manuscript. Group theory was undoubtedly proven to be a useful tool in many fields of physics. Most applications use symmetry groups to explain level degeneracy and to implement generalized Wigner-Eckart theorems (selection rules are special case). Less known are dynamical groups which contain the symmetry group but include additional operations useful in generating the spectrum and wave functions and allow algebraic evaluation of certain matrix elements. Recently, the idea of dynamical groups has proven to be useful in the description of bound state problems in a variety of physical systems. These include the collective spectra of nuclei (see ref. 1) and the rotation-vibration spectra of molecules (ref. 2). These applications were restricted however to bound states and it was not known how to generalize them to scattering problems (except for the Coulomb problem) or to periodic potentials. We have succeeded to accomplish the first steps toward such an extension and the purpose of that letter is to explain the method in the context of the Pöschl-Teller potential. However, a much larger family of potentials can be treated by similar techniques as shown in references 14,15. Some of them, like the Morse potential are of practical importance to atom-atom collisions. In work which is in progress, we intend to apply these techniques to study dissociation of molecules, atom-atom scattering and nucleus-nucleus collisions.

The periodic potentials discussed in the present paper are interesting by themselves. Many systems in solid state physics have a one dimensional behaviour. The known solvable crystals - the Kronig -Penney and Scarf potentials are singular and not very realistic. However by realizing the group theoretical origin of the Scarf potential, we were able to generalize it to more realistic cases as the ones in the manuscript.

We believe that the new approach presented in the manuscript can stimulate applications far beyond the specific examples discussed in it and that therefore it is of interest to the general physics community. We appreciate the criticism of the second referee as it has certainly improved our paper and hope that in its revised form he will find it suitable for publication in the Physical Review Letters.

Sincerely,

Yoram Alhassid

Yoram Alhassid

YA/pd
cc: F.I.
F.G.