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Efimov physics and few-body approximation in nuclear, atomic and molecular physics

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Abstract content

The main difficulties in the research of few-body problems are bounded with the really many-channels and multidimensional nature of the these problem, impossible applied many well-known theories such as adiabatic, impulse, coupled channels, etc.

For this reason we proposed new method for the investigation of the different few-body processes used the mathematically rigorous formalism based on the treatment of collision processes as many body processes, using Faddeev-Yakubovsky equations [1] (FYE) in integral and differential forms. In particular techniques based on FYE have been used successfully in studies of the dynamics of few-particle systems (bound-state properties and elastic, reactive and breakup scattering) [2]. That is why we applied this formalism for the theoretical investigation of the dynamics of the different processes in atomic and chemical physics. [2].

Calculation of low-energy characteristics in scattering processes like scattering length, effective range parameter, amplitude, cross section etc. The investigation the theory of quasimolecule (electron + molecule), the ionization mechanism in quasimolecule and the main characteristics of quasimolecule autoionization states, determination of the bound between these states, the resonance states, potential energy surface (PES) and dynamics of the chemical reaction.

The scattering atoms with two ($O + CS$, $H + H_2$, $O + N_2$, $O + O_2$) and few atomic ($O + CF_3J$, $O + CS_2$, $O + OSC$, $HCl + HCl$) molecules, the many particles interactions, orientations of the reacting molecules etc. on the reactions dynamic, the connection between the interactions in FYE and PES, the investigation of the resonances, virtual states and threshold phenomena in chemical reactions.

The studying the unusual dynamical threshold phenomena in chemical reactions such as Efimov states based on FYE. This research may be obtain the information of the reaction mechanism, PES etc. and may have a strong influence on the scattering observable. Hence the careful studying of these states may be provide better understanding of the control and management of the chemical reaction processes.

References

- [1] L.D.Faddeev and S.P.Merkuriev Quantum scattering theory for several particles systems, 1983 Kluwer, London, 399 p.
- [2] S.A.Pozdneev Application on the quantum theory of few-body scattering to the calculation of the different processes in nuclear, atomic and molecular physics, 2001 Moscow, Janus-K, 412 p.