Pulse compression and time delay of stimulated Raman scattering components in $Ba(NO_3)_2$ powder

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Temporal compression of stimulated Raman scattering (SRS) components was registered for random Raman lasing in Ba(NO3)2 powder consisting of micron-sized particles. SRS was excited in the 2 mm layer of barium nitrate powder by a Nd:YAG laser second harmonic radiation with a wavelength of 532 nm and pulse duration of 30 ps. Pumping light was focused into the sample. Under this excitation SRS occurred in non-stationary regime. For SRS registration we used monochromator and streak camera with a resolution of 4 ps. We registered radiation at the wavelength of exciting light (elastic scattering), 2 Stokes components and 1 anti-Stokes component. Elastic scattering pulse was longer than exciting pulse (38 ps) and all SRS pulses were shorter: duration of the first Stokes pulse was 32 ps, second Stokes 22 ps and first anti-Stokes 19 ps. Both elastic scattering ans SRS were delayed in time compared to the exciting pulse. It is consistent with the theory of non-stationary regime for bulk media. For the first Stokes component the delay time is few tens of picoseconds and it increases linearly with the increasing of the exciting radiation energy because of the substance nonlinear refractive index growth.

Scalar particle with the Cox structure and polarizability, in presence of the uniform magnetic field

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Within the general method by Gel'fand – Yaglom, starting with the extended set of representations of the Lorentz group, for a spin 0 particle, we construct a relativistic generalized system of the first order equations for a spin 0 particle with two additional characteristics, Cox structure and polarizability. In tensor form, we take into account the presence of external electromagnetic fields. After eliminating the accessory variables of the complete wave function, we derive the minimal 5-component form of equations, the last includes two additional interaction terms which are interpreted as related to Cox structure and polarizability. Applying the matrix form of the derived system we extend this approach to space-time models with pseudo-Riemannian structure within the tetrad method. We specify this equations to the cylindrical coordinates, and in presence of the external uniform magnetic field. After separating the variables, we derive the system of 5 first order differential equations in polar coordinate. This system may be reduced to a second order equation for a primary function, which is solved in terms of the confluent hypergeometric functions. We derive a formula for energy values, it depends on two additional characteristics, Cox structure and polarizability.
We develop alternative method of studying the problem that is based on the method by Fedorov – Gronskiy. Within this approach, the complete 5-component wave function is presented as some of three projective constituents, dependence of each constituent on the polar coordinate is determined by only one function. We find expression for this basic function $F_i(r)$ in terms of confluent hypergeometric equations; at this there arises a quantization rule for some spectral parameter. Within the method by Fedorov – Gronskiy, additionally arises algebraic homogenous system of 5 equations, its solutions determine the structure of 5-component wave functions. From this algebraic system there arises the formula for energy levels, that includes the previously introduced spectral parameter with the known quantization rule. The final formula for energies turns out to be the same for both methods.

Temperature reversal of the ratchet motion direction due to tunnel effect

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We consider a pulsating ratchet with a spatially periodic double-well potential profile undergoing shift fluctuations by half a period. In such a ratchet, the motion direction is determined by the answer the question: “For which of the barriers surrounding the shallow potential well the probability of