お茶の水女子大学理学部物理学教室

2. 重イオン深部非弾性衝突の非平衡統計力学

—特に巨大共鳴について —

小 沢 一 美

Investigations on the deep inelastic heavy ion collision are viewed from a standpoint of the nonequilibrium statistical mechanics. A characteristic of this phenomena is the large dissipation of kinetic energy of the relative colliding motion of the two heavy ions into energies of nuclear intrinsic motion, so that this relative motion can be treated as a kind of Brownian motion.

Previous theories assuming the stochastic single-particle excitation are investigated, and the theory of Hofmann and Siemens (1979) is reformulated, by using the method of Shibata and Hashitsume (1978), to express their result in a new form of the Langevin equation describing the relative motion.

And the theories based on the collective surface-oscillation mode excitation (the giant resonance) by Brogria et al. (1974~) are examined, and more accurate model is proposed. First, based on this new model and by using the quasi-linear response theory by Takigawa et al. (1981), a Fokker-Planck type equation for the relative motion of heavy ions is derived. According to this equation one can picture the collision phenomena as a diffusion-type process in the phase space of relative motion. This viewpoint is lacking in the theory of Brogria et al. Second, using the Brink's method of inferring the form of a Langevin equation from the path-integral expression, the Langevin equation correpond-ing to the new model is derived. Third, equations of motion for the new model can be treated exactly, so that some ambiguous points remaining in the treatment by Brogria et al. are clarified. Especially, after the method of Magalinskii (1960), the Langevin equation for the relative motion is derived. And by comparing it with the one obtained by the method of Brink, the character of fluctuations in the relative motion for the new model is made clear.

3。 二次光学過程の基礎理論

安 尾 典 子

A formalism is given to the second order optical process. In the first case, a stationary response is considered. Namely, a time dependent transition probability per unit time is calculated with the use of a S-matrix in a finite time interval. Then we get a time independent stationary transition probability after taking a limit of t (the time) infinity. In an actual calculation of polarization matrix elements, an adiabatic approximation is introduced. To obtain explicit expressions, the matrix elements are expanded in terms of displacements of nuclear coordinates. In the simplest case of a model adiabatic Hamiltonian, the transition probability for the Raman scattering is related with a correlation function of the nuclear displacements. This formula is the basis of the method of "susceptibility" which has been used frequently for analyses of experiments. A simple model calculation is given to the Raman spectrum of KDP.

In the second part, non-stationary response is considered. This is done by a generalization of the first stationary case.

In an Appendix we add a method of Hamano who ingeniously used the time-convolutionless expansion formalism. The method corresponds to the transient case and should be compared with our method.