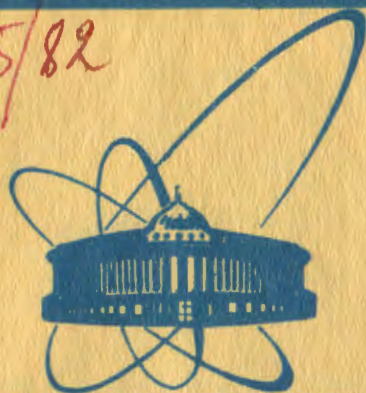


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**ABOUT ONE NEWELL'S RESULT  
AND THE QUANTUMMECHANICAL CHECK  
OF THE MICROCANONICAL DISTRIBUTION**

**1981**

1. The microcanonical distribution hypothesis in classical statistical mechanics states the equilibrium particle density for the given value  $\lambda$  of the energy,  $\rho(\mathbf{p}, \mathbf{x}, \lambda)$ , to be

$$\rho(\mathbf{p}, \mathbf{x}, \lambda) \sim \delta(H(\mathbf{p}, \mathbf{x}) - \lambda), \quad (1)$$

where  $H(\mathbf{p}, \mathbf{x})$  is the energy expressed in terms of the coordinates  $\mathbf{x}$  and momenta  $\mathbf{p}$ .

The Schrödinger equation written in the Abstract corresponds to

$$H(\mathbf{p}, \mathbf{x}) = \sum_1^k p_i^2 + Q(\mathbf{x}_1, \mathbf{x}_2, \dots, \mathbf{x}_k). \quad (2)$$

Let us define the function  $\rho(\mathbf{x}, \lambda)$  as

$$\rho(\mathbf{x}, \lambda) = \int \rho(\mathbf{p}, \mathbf{x}, \lambda) d^k \mathbf{p}. \quad (3)$$

Then eqs. (1), (2), (3) imply

$$\rho(\mathbf{x}, \lambda) \sim [\lambda - Q(\mathbf{x})]^{k/2-1}. \quad (4)$$

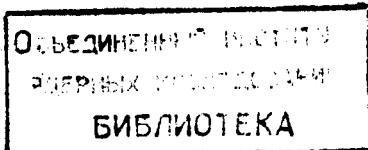
The function  $\rho(\mathbf{x}, \lambda)$  from the quantum-mechanical point of view is something like

$$\sum_{\lambda - \epsilon < \lambda_n < \lambda} |\psi_n(\mathbf{x})|^2 / \epsilon$$

(where the interval  $\lambda - \epsilon, \lambda$  contains many levels,  $\epsilon \ll \lambda$ ) and can be obtained by taking the derivative of eq. (a) with respect to  $\lambda$ .

Thus, eq. (a) really leads to eq. (4).

1.1. So, the microcanonical distribution statement, which is the unproved hypothesis of the classical statistical mechanics, can be checked in quantum mechanics.



2. It is a pleasure to note that the Newell's derivation of eq. (a) is remarkably simple.

#### REFERENCES

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