On Quantum Theory of Transport Phenomena

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February 17, 1959

Concerning my paper[1)] that has appeared in this journal under the above title, I should like first to add the following note to the part where the Einstein relation is discussed. It was Kasuya[2)] who first not only pointed out, but also explicitly showed how the Einstein relation breaks down in the case of one-electron problems. I regret that my description and references were not enough to make his priority quite clear.

Secondly I should like to make a remark as regards the general formulation of the theory. Kubo et al.[3)] and also Kasuya have started from a certain initial fluctuation from equilibrium and then calculated its decay by integrating the Liouville equation. In doing so, it is essential to discard the time variation of a macroscopic parameter such as the chemical potential, which is certainly much slower compared with microscopic relaxation times if the wave length of its space variation is very long Mathematically, as mentioned first by Kubo et al., the limit of infinite system and infinite wave length should be taken before integrating with respect to time. Now, in my paper in which a steady solution is directly sought for, one particular solution among others should be chosen either by taking account of the boundary condition explicitly or by considering how the steady state has been established. Actually I took the latter point of view; then the same sort of argument as mentioned above becomes necessary.[4)] In view of this, two ways of approach, namely the fluctuation theory of Kubo et al. on the one hand and the kinetic theory of mine on the other are not essentially different from each other and, indeed, lead to the same result.

1) S. Nakajima, Prog. Theor. Phys. **20** (1958), 948.
2) T. Kasuya, J. Phys. Soc. Japan **13** (1958), 1096; In particular see the second paper to appear in the same journal.
3) R. Kubo, M. Yokota and S. Nakajima, J. Phys. Soc. Japan **12** (1957), 1203.
4) This has been pointed out to me by Prof. R. Kubo.

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