Addendum

Nonuniversal critical phenomena along the lambda line of ^4He

II. Thermal conductivity in three dimensions

V. Dohm

Institut für Theoretische Physik, Technische Hochschule Aachen,
Federal Republic of Germany

Z. Phys. B – Condensed Matter **61**, 193–204 (1985)

The analytic expressions for the two-loop diagrams shown in Fig. 1 have been determined previously for arbitrary k and ω but have been published, for the sake of brevity, only for $\omega=0$. In this Addendum we present the complete expressions for arbitrary ω because they are nontrivial and relevant for reasons to be discussed elsewhere. The analytic expressions for the sums of the four types of diagrams shown in Fig. 1 will be denoted by $D_v(k, i\omega)$ where $v=1, 2, 3, 4$ refers to the corresponding type (v) of diagrams. In the notation of Appendix A, $D_v(k, i\omega)$ can be written as

$$D_v(k, i\omega) = \int_{p_1} \int_{p_2} B_v(\mathbf{p}_1, \mathbf{p}_2, \mathbf{k}, i\omega) \cdot \frac{16a(\mathbf{k}, \mathbf{p}_2)}{\Gamma^* p_2^+ + \Gamma p_2^- - i\omega} + \text{c.c.} \quad (1)$$

Here +c.c. means that the same expression must be added with $\Gamma, \Gamma^*, i\omega$ replaced by $\Gamma^*, \Gamma, -i\omega$, respectively, but leaving the sign of $i\omega$ unaltered. The integrands $B_v(\mathbf{p}_1, \mathbf{p}_2, \mathbf{k}, i\omega)$ are given by

$$B_1 = -\frac{4\tilde{u}b_3^*}{(p_1^2 + \tau)p_2^-} \left(\frac{2\Gamma^*}{\Gamma^* p_2^+ + \Gamma p_2^- - i\omega} + \frac{1}{p_2^-} \right), \quad (2)$$

$$B_2 = -\frac{b_3^*}{p_1^- (\Gamma^* p_1^+ + \Gamma p_1^- - i\omega)} \left(\frac{2b_4^*}{p_2^-} + \frac{2b_4}{p_2^+} \right), \quad (3)$$

$$B_3 = \frac{\chi\gamma^2 \mathbf{b}_3}{p_{12}^+ (p_2^+)^2} + \frac{\chi\gamma b_3^*}{p_{12}^+ (\Gamma^* p_2^+ + \Gamma p_2^- - i\omega)} \cdot \left(\frac{\mathbf{b}_3^*}{p_2^-} + \frac{\mathbf{b}_3}{p_2^+} \right) + \frac{\chi b_3^*}{p_{12}^+ (\Gamma^* p_{12}^+ + \Gamma p_2^- + \lambda\chi^{-1} p_1^2 - i\omega)} \cdot \left[\left(\frac{\mathbf{b}_3^*}{p_2^-} + \frac{\mathbf{b}_3}{p_2^+} \right) \frac{b_3^* p_2^+}{\Gamma^* p_2^+ + \Gamma p_2^- - i\omega} - \frac{\gamma \mathbf{b}_3^*}{p_2^-} \right], \quad (4)$$

and

$$B_4 = \frac{\chi\gamma b_3^*}{p_{12}^- (\Gamma^* p_{12}^+ + \Gamma p_{12}^- - i\omega)} \left(\frac{b_3^*}{p_2^-} + \frac{b_3}{p_2^+} \right) + \frac{\chi b_3 b_3^*}{p_2^+ p_{12}^- (\Gamma^* p_2^+ + \Gamma p_{12}^- + \lambda\chi^{-1} p_1^2 - i\omega)} \cdot \left(\frac{b_3^* p_{12}^+}{\Gamma^* p_{12}^+ + \Gamma p_{12}^- - i\omega} - \gamma \right) + \frac{\chi b_3 (b_3^*)^2}{p_2^- (\Gamma^* p_{12}^+ + \Gamma p_2^- + \lambda\chi^{-1} p_1^2 - i\omega) (\Gamma^* p_{12}^+ + \Gamma p_{12}^- - i\omega)}. \quad (5)$$

For $\omega=0$ these expressions agree with (A 16)–(A 20) except for the overall factor χ in (4) and (5) that was omitted in (A 19) and (A 20). We add the following comment. In (1) the factor $a(\mathbf{k}, \mathbf{p}_2)$ arises from the external vertex connected with the external $\tilde{m}$ leg. The other external vertex (connected with the external m leg) yields the overall factor b_3^* in B_1, B_2 , and B_4 whereas in B_3 it yields those factors b_3 and b_3^* that have been printed in bold type. Finally we correct a misprint in Eq. (B 3) where $2\gamma D$ should read $8\gamma D$.

Furthermore the term $-\zeta_p$ in Eq. (3.20) should read $-\text{Re}\{w\zeta_p\}/w'$.

V. Dohm
Institut für Theoretische Physik
Technische Hochschule Aachen
Sommerfeldstrasse
D-5100 Aachen
Federal Republic of Germany