Calculation of thermal conductivity coefficients of electrons in magnetized dense matter

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The solution of Boltzmann equation for plasma in magnetic field, with arbitrarily degenerate electrons and non-degenerate nuclei, is obtained by Chapman-Enskog method [1]. Functions, generalizing Sonin polynomials are used for obtaining an approximate solution. Fully ionized plasma is considered. The tensor of the heat conductivity coefficients in non-quantized magnetic field is calculated. For non-degenerate and strongly degenerate plasma the asymptotic analytic formulas are obtained, which are compared with results of previous authors. The Lorentz approximation, with neglecting of electron-electron encounters, is asymptotically exact for strongly degenerate plasma.

We obtain, for the first time, in three polynomial approximation, with account of electron-electron collisions, analytical expressions for the heat conductivity tensor for non-degenerate electrons, in presence of a magnetic field. Account of the third polynomial improved substantially the precision of results. In two polynomial approximation our solution coincides with the published results.

For strongly degenerate electrons we obtain, for the first time, an asymptotically exact analytical solution for the heat conductivity tensor in presence of a magnetic field. This solution has considerably more complicated dependence on the magnetic field than those in previous publications, and gives several times smaller relative value of a thermal conductivity across the magnetic field at $\omega\tau \sim 0.8$.

References

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