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VARIOUS ELECRICAL-AND-THERMOELECTRIC LAWS, RELATIONS, AND COEFFICIENTS IN NEW n(p)-TYPE DEGENERATE "COMPENSATED" Ge(1-x)Si(x) [Si(1-x)Ge(x)]-CRYSTALLINE ALLOYS, ENHANCED BY OUR STATIC DIELECTRIC CONSTANT LAW, ACCURATE FERMI ENERGY, AND ELECRICAL CONDUCTIVITY MODEL (XVI)

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ABSTRACT

In $\mathbf{n^+(p^+) - p(n)}$ $\mathbf{X(x)} \equiv$ **Ge(1-x)Si(x)** [$\mathbf{Y(x)} \equiv$ **Si(1-x)Ge(x)**]-crystalline alloys, $0 \leq x \leq 1$, taking into account their different values of energy-band-structure parameters, as given in Table 1, and also basing on the same physical model and mathematical treatment method, as used in our recent works[1, 2, 3], various electrical-and-thermoelectric laws, relations, and coefficients, enhanced by our static dielectric constant law given in Equations (1a, 1b), which is due to the effects of the size of donor (acceptor) d(a)-radius $r_{d(a)}$ and the x-concentration, by our accurate Fermi energy, as given in Eq. (11), and finally by our electrical conductivity model, as given in Eq. (14), are now investigated. One notes that, for x=0, their obtained numerical results are reduced to those obtained in the n(p)-type degenerate **Ge(Si)-crystals.**[4,5] So, some remarkable results can be cited as follows. In Tables 5n(5p), for a given impurity-density N and with increasing temperature T, and then in Tables 6n(6p), for a given T and with decreasing N, the reduced Fermi-energy $\xi_{n(p)}$ decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows by: (increase: ↗, decrease: ↘).

Furthermore, one notes in these Tables that, for any given x, $r_{d(a)}$ and N (or T), with increasing T (or decreasing N) one obtains: (i) for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, while the numerical results of the Seebeck coefficient S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of the figure of merit ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_{n(p)} = 1$, the numerical results of S, ZT, the Mott figure of merit $(ZT)_{Mott}$, the first Van-Cong coefficient VC1, and the Thomson coefficient Ts, present the same results: $-1.322 \times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $1.105 \times 10^{-4}\frac{V}{K}$, and $1.657 \times 10^{-4}\frac{V}{K}$, respectively, and finally (iii) for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, $(ZT)_{Mott} = 1$. It seems that these same obtained results could represent **a new law in the thermoelectric properties, obtained in the degenerate case ($\xi_{n(p)} \geq 0$)**.

KEYWORDS: Electrical conductivity, Seebeck coefficient (S), Figure of merit (ZT), First Van-Cong coefficient (VC1), Second Van-Cong coefficient (VC2), Thomson coefficient (Ts), Peltier coefficient (Pt).

INTRODUCTION

In the $\mathbf{n^+(p^+) - p(n)\ X(x)} \equiv$ **Ge(1-x)Si(x)** [$\mathbf{Y(x)} \equiv$ **Si(1-x)Ge(x)]**- crystalline alloys, $0 \leq x \leq 1$, x being the concentration, the electrical-and-thermoelectric laws, relations, and various coefficients, enhanced by our static dielectric constant law, $\varepsilon(r_{d(a)}, x)$, $r_{d(a)}$ being the donor (acceptor) d(a)-radius, given in Equations (1a, 1b), by our accurate Fermi energy, $E_{Fn(Fp)}$, given in Eq. (11), and also by our electrical conductivity model, in Eq. (14), are now investigated, by basing on the same physical model and same mathematical treatment method, as those used in our recent works.[1, 2, 3] It should be noted here that for x=0, these obtained numerical results may be reduced to those given in the n(p)-type degenerate **Ge**[**Si**]-**crystals**.[4, 5, 6-13] Then, some remarkable results could be noted in the following.

(1) As observed in Equations (3, 5, 6), the critical impurity density $N_{CDn(CDp)}$, defined by the generalized Mott criterium in the metal-insulator transition (**MIT**), is just the density of electrons (holes), localized in the exponential conduction (valence)-band tail (**EBT**), $N^{EBT}_{CDn(CDp)}$, being obtained with a precision of the order of 2.89×10^{-7}, as given in our recent works.[2, 3] Therefore, the effective electron (hole)-density can be defined as:

$N^* \equiv N - N_{CDn(CDp)} \simeq N - N_{CDn(CDp)}^{EBT}$, N being the total impurity density, as that observed in the compensated crystals.

(2) The ratio of the inverse effective screening length $k_{sn(sp)}$ to Fermi wave number $k_{Fn(kp)}$ at 0 K, $R_{sn(sp)}(N^*)$, defined in Eq. (7), is valid at any N^*.

(3) The Fermi energy for any N and T, $E_{Fn(Fp)}$, determined in Eq. (11) with a precision of the order of 2.11×10^{-4} [9], affecting all the expressions of electrical-and-thermoelectric coefficients.

(4) Our expressions for the electrical conductivity, σ, and for the Seebeck coefficient, S, determined respectively in Equations (14, 19) are the basic expressions, used to determine all the electrical-and-thermoelectric coefficients.

(5) In Tables 5n(5p) given Appendix 1, for a given impurity density $\mathbf{N}$ and with increasing temperature T, and further in Tables 6n(6p) given Appendix 1, for a given $\mathbf{T}$ and with decreasing N, the reduced Fermi-energy $\xi_{n(p)}$ decreases, giving rise to the variations of various thermoelectric coefficients, as indicated by the arrows by: (increase: ↗, decrease: ↘). Furthermore, one notes in these Tables that, for any given x, $r_{d(a)}$ and N (or T), with increasing T (or decreasing N), one obtains: (i) for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, while the numerical results of the Seebeck coefficient S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of the figure of merit ZT show a same maxi**mum** $(ZT)_{max.} = 1$, (ii) for $\xi_{n(p)} = 1$, the numerical results of S, ZT, the Mott figure of merit $(ZT)_{Mott}$, the first Van-Cong coefficient VC1, and the Thomson coefficient Ts, present the same results: $-1.322 \times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $1.105 \times 10^{-4}\frac{V}{K}$, and $1.657 \times 10^{-4}\frac{V}{K}$, respectively, and finally (iii) for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, $(ZT)_{Mott} = 1$. It seems that these same results could represent **a new law in the thermoelectric properties, obtained in the degenerate case ($\xi_{n(p)} \geq 0$)**.

OUR STATIC DIELECTRIC CONSTANT LAW AND GENERALIZED MOTT CRITERIUM IN THE METAL-INSULATOR TRANSITION

First of all, in $\mathbf{n^+(p^+) - p(n)}$ **X(x) ≡Ge(1-x)Si(x) [Y(x) ≡Si(1-x)Ge(x)]-** crystalline alloys at T=0 K, we denote the donor (acceptor) d(a)-radius by $r_{d(a)}$, the corresponding intrinsic one by: $\mathbf{r_{do(ao)}} = \mathbf{r_{Ge(Ge)}}[\mathbf{r_{Si(Si)}}]$, the effective averaged numbers of equivalent conduction (valence)-bands by: $g_{c(v)}$, the unperturbed relative effective electron (hole) mass in conduction (valence) bands by: $m_{c(v)}(x)/m_o$, m_o being the free electron mass, the unperturbed relative static dielectric constant by: $\varepsilon_o(x)$, and the intrinsic band gap by: $E_{go}(x)$. Then, their values are reported in Table 1 in Appendix 1.

Therefore, we can define the effective donor (acceptor)-ionization energy in absolute values as:

$E_{do(ao)}(x) = \frac{13600 \times [m_{c(v)}(x)/m_o]}{[\varepsilon_o(x)]^2}$ meV, and then, the isothermal bulk modulus, by: $B_{do(ao)}(x) \equiv \frac{E_{do(ao)}(x)}{\left(\frac{4\pi}{3}\right) \times (r_{do(ao)})^3}$.

Our Static Dielectric Constant Law

Here, the changes in all the energy-band-structure parameters, expressed in terms of the effective relative dielectric constant $\varepsilon(r_{d(a)}, x)$, developed as follows.

At $r_{d(a)} = r_{do(ao)}$, the needed boundary conditions are found to be, for the impurity-atom volume $V = (4\pi/3) \times (r_{d(a)})^3$, $V_{do(ao)} = (4\pi/3) \times (r_{do(ao)})^3$, for the pressure p, $p_o = 0$, and for the deformation potential energy (or the strain energy) α, $\alpha_o = 0$. Further, the two important equations, used to determine the α -variation, $\Delta\alpha \equiv \alpha - \alpha_o = \alpha$, are defined by: $\frac{dp}{dV} = -\frac{B}{V}$ and $p = -\frac{d\alpha}{dV}$, giving rise to: $\frac{d}{dV}\left(\frac{d\alpha}{dV}\right) = \frac{B}{V}$. Then, by an integration, one gets:

$[\Delta\alpha(r_{d(a)}, x)]_{n(p)} = B_{do(ao)}(x) \times (V - V_{do(ao)}) \times \ln\left(\frac{V}{V_{do(ao)}}\right) = E_{do(ao)}(x) \times \left[\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 - 1\right] \times \ln\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 \geq 0.$

Furthermore, we also showed that, as $r_{d(a)} > r_{do(ao)}$ ($r_{d(a)} < r_{do(ao)}$), the compression (dilatation) gives rise to the increase (the decrease) in the energy gap $E_{gn(gp)}(r_{d(a)}, x)$, and the effective donor (acceptor)-ionization energy $E_{d(a)}(r_{d(a)}, x)$ in absolute values, obtained in the effective Bohr model, which is represented respectively by: $\pm [\Delta\alpha(r_{d(a)}, x)]_{n(p)}$,

$$E_{gno(gpo)}(r_{d(a)}, x) - E_{go}(x) = E_{d(a)}(r_{d(a)}, x) - E_{do(ao)}(x) = E_{do(ao)}(x) \times \left[\left(\frac{\varepsilon_o(x)}{\varepsilon(r_{d(a)})}\right)^2 - 1\right] = +[\Delta\alpha(r_{d(a)}, x)]_{n(p)}$$

,

for $r_{d(a)} \geq r_{do(ao)}$, and for $r_{d(a)} \leq r_{do(ao)}$,

$$E_{gno(gpo)}(r_{d(a)},x) - E_{go}(x) = E_{d(a)}(r_{d(a)},x) - E_{do(ao)}(x) = E_{do(ao)}(x) \times \left[\left(\frac{\varepsilon_o(x)}{\varepsilon(r_{d(a)})}\right)^2 - 1\right] = -\left[\Delta\alpha(r_{d(a)},x)\right]_{n(p)}$$

.

Therefore, one obtains the expressions for relative dielectric constant $\varepsilon(r_{d(a)},x)$ and energy band gap $E_{gn(gp)}(r_{d(a)},x)$, as :

(i)-for $r_{d(a)} \geq r_{do(ao)}$, since $\varepsilon(r_{d(a)},x) = \frac{\varepsilon_o(x)}{\sqrt{1+\left[\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 - 1\right] \times \ln\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3}} \leq \varepsilon_o(x)$, being a **new** **$\varepsilon(r_{d(a)},x)$-law**,

$$E_{gno(gpo)}(r_{d(a)},x) - E_{go}(x) = E_{d(a)}(r_{d(a)},x) - E_{do(ao)}(x) = E_{do(ao)}(x) \times \left[\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 - 1\right] \times \ln\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 \geq 0, \quad (1a)$$

according to the increase in both $E_{gn(gp)}(r_{d(a)},x)$ and $E_{d(a)}(r_{d(a)},x)$, with increasing $r_{d(a)}$ and for a given x, and

(ii)-for $r_{d(a)} \leq r_{do(ao)}$, since $\varepsilon(r_{d(a)},x) = \frac{\varepsilon_o(x)}{\sqrt{1-\left[\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 - 1\right] \times \ln\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3}} \geq \varepsilon_o(x)$, with a condition, given by: $\left[\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 - 1\right] \times \ln\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 < 1$, being a **new $\varepsilon(r_{d(a)},x)$-law**,

$$E_{gno(gpo)}(r_{d(a)},x) - E_{go}(x) = E_{d(a)}(r_{d(a)},x) - E_{do(ao)}(x) = -E_{do(ao)}(x) \times \left[\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 - 1\right] \times \ln\left(\frac{r_{d(a)}}{r_{do(ao)}}\right)^3 \leq 0, \quad (1b)$$

corresponding to the decrease in both $E_{gno(gpo)}(r_{d(a)},x)$ and $E_{d(a)}(r_{d(a)},x)$, with decreasing $r_{d(a)}$ and for a given x.

It should be noted that, in the following, all the electrical-and-thermoelectric properties strongly depend on this **new $\varepsilon(r_{d(a)},x)$-law.**

Furthermore, the effective Bohr radius $a_{Bn(Bp)}(r_{d(a)},x)$ is defined by:

$$a_{Bn(Bp)}(r_{d(a)},x) \equiv \frac{\varepsilon(r_{d(a)},x) \times \hbar^2}{m_{c(v)}(x) \times m_o \times q^2} = 0.53 \times 10^{-8}\ \text{cm} \times \frac{\varepsilon(r_{d(a)},x)}{m_{c(v)}(x)}. \quad (2)$$

Generalized Mott Criterium in the MIT

Now, it is interesting to remark that the critical total donor (acceptor)-density in the MIT at T=0 K, $N_{CDn(NDp)}(r_{d(a)},x)$, was given by the Mott's criterium, with an empirical parameter, $M_{n(p)}$, as[2, 3]:

$$N_{CDn(CDp)}(r_{d(a)},x)^{1/3} \times a_{Bn(Bp)}(r_{d(a)},x) = M_{n(p)},\ M_{n(p)} = 0.25, \tag{3}$$

depending thus on our **new $\boldsymbol{\varepsilon(r_{d(a)},x)}$-law**.

This excellent one can be explained from the definition of the reduced effective Wigner-Seitz (**WS**) radius $r_{sn(sp),M}$, in the Mott's criterium, being characteristic of interactions, by :

$$r_{sn(sp),M}(N,r_{d(a)},x) \equiv \left(\frac{3}{4\pi N}\right)^{1/3} \times \frac{1}{a_{Bn(Bp)}(r_{d(a)},x)} = 1.1723 \times 10^8 \times \left(\frac{1}{N}\right)^{1/3} \times \frac{m_{c(v)}(x) \times m_o}{\varepsilon(r_{d(a)},x)}, \tag{4}$$

being equal to, in particular, at N= $N_{CDn(CDp)}(r_{d(a)},x)$: $r_{sn(sp),M}\left(N_{CDn(CDp)}(r_{d(a)},x), r_{d(a)},x\right)$= **2.4813963**, for any $(r_{d(a)},x)$-values. Then, from Eq. (4), one also has:

$$N_{CDn(CDp)}(r_{d(a)},x)^{1/3} \times a_{Bn(Bp)}(r_{d(a)},x) = \left(\frac{3}{4\pi}\right)^{\frac{1}{3}} \times \frac{1}{2.4813963} = \mathbf{0.25} = (\mathbf{WS})_{n(p)} = \mathbf{M}_{n(p)} \tag{5}$$

explaining thus the existence of the Mott's criterium.

Furthermore, by using $M_{n(p)} = 0.25$, according to the empirical Heisenberg parameter $\boldsymbol{\mathcal{H}_{n(p)} = 0.47137}$, as those given in our previous work [2, 3], we have also showed that $N_{CDn(CDp)}$ is just **the density of electrons (holes) localized in the exponential conduction (valence)-band tail, $\boldsymbol{N^{EBT}_{CDn(CDp)}}$**, with a precision of the order of $\mathbf{2.89 \times 10^{-7}}$.[2, 3]

It shoud be noted that the values of $M_{n(p)}$ and $\mathcal{H}_{n(p)}$ could be chosen so that those of $N_{CDn(CDp)}$ and $N^{EBT}_{CDn(CDp)}$ are found to be in good agreement with their experimental results.

Therefore, the density of electrons (holes) given in parabolic conduction (valence) bands can be defined, as that given in compensated materials:

$$N^*(N,r_{d(a)},x) \equiv N - N_{CDn(NDp)}(r_{d(a)},x) = N^*, \text{ for a presentation simplicity.} \tag{6}$$

In summary, as observed in our previous papers [2, 3], one remarks that, for a given x and an increasing $r_{d(a)}$, $\varepsilon(r_{d(a)},x)$ decreases, while $E_{gno(gpo)}(r_{d(a)},x)$, $N_{CDn(NDp)}(r_{d(a)},x)$ and

$N^{EBT}_{CDn(CDp)}(r_{d(a)},x)$ increase, affecting strongly all electrical-and-thermoelectric properties, as those observed in following Sections.

PHYSICAL MODEL

In $n^{+}(p^{+}) - p(n)$ **X(x) [Y(x)]**- crystalline alloys, if denoting the Fermi wave number by: $k_{Fn(Fp)}(N^*) \equiv \left(\frac{3\pi^2 N^*}{g_{c(v)}}\right)^{\frac{1}{3}}$, the reduced effective Wigner-Seitz (**WS**) radius $r_{sn(sp)}$, characteristic of interactions, being given in Eq. (4), in which N is replaced by N^*, is now defined by:

$\gamma \times r_{sn(sp)}(N^*) \equiv \frac{k^{-1}_{Fn(Fp)}}{a_{Bn(Bp)}} < 1$, $r_{sn(sp)}(N, r_{d(a)}, x) \equiv \left(\frac{3g_{c(v)}}{4\pi N^*}\right)^{1/3} \times \frac{1}{a_{Bn(Bp)}(r_{d(a)},x)}$, being proportional to $N^{*-1/3}$. Here, $\gamma = (4/9\pi)^{1/3}$, $k^{-1}_{Fn(Fp)}$ means the averaged distance between ionized donors (acceptors), and $a_{Bn(Bp)}(r_{d(a)},x)$ is determined in Eq. (2).

Then, the ratio of the inverse effective screening length $k_{sn(sp)}$ to Fermi wave number $k_{Fn(kp)}$ at 0 K is defined by:

$$R_{sn(sp)}(N^*) \equiv \frac{k_{sn(sp)}}{k_{Fn(Fp)}} = \frac{k^{-1}_{Fn(Fp)}}{k^{-1}_{sn(sp)}} = R_{snWS(spWS)} + \left[R_{snTF(spTF)} - R_{snWS(spWS)}\right] e^{-r_{sn(sp)}} < 1, \quad (7)$$

being valid at any N^*.

Here, these ratios, $R_{snTF(spTF)}$ and $R_{snWS(spWS)}$, can be determined as follows.

First, for $N \gg N_{CDn(NDp)}(r_{d(a)},x)$, according to the **Thomas-Fermi (TF)-approximation**, the ratio $R_{snTF(spTF)}(N^*)$ is reduced to

$$R_{snTF(spTF)}(N^*) \equiv \frac{k_{snTF(spTF)}}{k_{Fn(Fp)}} = \frac{k^{-1}_{Fn(Fp)}}{k^{-1}_{snTF(spTF)}} = \sqrt{\frac{4\gamma r_{sn(sp)}}{\pi}} \ll 1, \quad (8)$$

being proportional to $N^{*-1/6}$.

Secondly, for $N \ll N_{CDn(NDp)}(r_{d(a)})$, according to the **Wigner-Seitz (WS)-approximation**, the ratio $R_{snWS(snWS)}$ is respectively reduced to

$$R_{sn(sp)WS}(N^*) \equiv \frac{k_{sn(sp)WS}}{k_{Fn}} = 0.5 \times \left(\frac{3}{2\pi} - \gamma \frac{d\left[r^2_{sn(sp)} \times E_{CE}(N^*)\right]}{dr_{sn(sp)}}\right), \quad (9)$$

Where $E_{CE}(N^*)$ is the majority-carrier correlation energy (CE), being determined by:

$$E_{CE}(N^*) = \frac{-0.87553}{0.0908 + r_{sn(sp)}} + \frac{\frac{0.87553}{0.0908 + r_{sn(sp)}} + \left(\frac{2[1-\ln(2)]}{\pi^2}\right) \times \ln(r_{sn(sp)}) - 0.093288}{1 + 0.03847728 \times r^{1.67378876}_{sn(sp)}}.$$

Furthermore, in the highly degenerate case, the physical conditions are found to be given by:

$$\frac{k_{Fn(Fp)}^{-1}}{a_{Bn(Bp)}} < \frac{\eta_{n(p)}}{E_{Fno(Fpo)}} \equiv \frac{1}{A_{n(p)}} < \frac{k_{Fn(Fp)}^{-1}}{k_{sn(sp)}^{-1}} \equiv R_{sn(sp)} < 1,\ \eta_{n(p)}(N^*) \equiv \frac{\sqrt{2\pi \times (\frac{N^*}{g_{c(v)}})}}{\varepsilon(r_{d(a)})} \times q^2 k_{sn(sp)}^{-1/2}, \quad (10)$$

Which gives: $A_{n(p)}(N^*) = \frac{E_{Fno(Fpo)}(N^*)}{\eta_{n(p)}(N^*)}$, $E_{Fno(Fpo)}(N^*) \equiv \frac{\hbar^2 \times k_{Fn(Fp)}^2(N^*)}{2 \times m_{c(v)}(x) \times m_o}$.

FERMI ENERGY AND FERMI-DIRAC DISTRIBUTION FUNCTION

Fermi Energy

Here, for a presentation simplicity, we change all the sign of various parameters, given in the $p^+ - X(x)$- crystalline alloy in order to obtain the same one, as given in the $n^+ - X(x)$-crystalline alloy, according to the reduced Fermi energy $E_{Fn(Fp)}$, $\xi_{n(p)}(N, r_{d(a)}, x, T) \equiv \frac{E_{Fn(Fp)}(N, r_{d(a)}, x, T)}{k_B T} > 0 (< 0)$, obtained respectively in the degenerate (non-degenerate) case.

For any $(N, r_{d(a)}, x, T)$, the reduced Fermi energy $\xi_{n(p)}(N, r_{d(a)}, x, T)$ or the Fermi energy $E_{Fn(Fp)}(N, r_{d(a)}, x, T)$, obtained in our previous paper [9], obtained with a precision of the order of 2.11×10^{-4}, is found to be given by:

$$\xi_{n(p)}(u) \equiv \frac{E_{Fn(Fp)}(u)}{k_B T} = \frac{G(u) + Au^B F(u)}{1 + Au^B} \equiv \frac{V(u)}{W(u)},\ A = 0.0005372 \text{ and } B = 4.82842262, \quad (11)$$

Where u is the reduced electron density, $u(N, r_{d(a)}, x, T) \equiv \frac{N^*}{N_{c(v)}(T,x)}$, $N_{c(v)}(T,x) = 2g_{c(v)} \times \left(\frac{m_{c(v)}(x) \times m_o \times k_B T}{2\pi \hbar^2}\right)^{\frac{3}{2}}$ (cm^{-3}), $F(u) = au^{\frac{2}{3}}\left(1 + bu^{-\frac{4}{3}} + cu^{-\frac{8}{3}}\right)^{-\frac{2}{3}}$, $a = [3\sqrt{\pi}/4]^{2/3}$, $b = \frac{1}{8}\left(\frac{\pi}{a}\right)^2$, $c = \frac{62.3739855}{1920}\left(\frac{\pi}{a}\right)^4$, and $G(u) \simeq Ln(u) + 2^{-\frac{3}{2}} \times u \times e^{-du}$; $d = 2^{3/2}\left[\frac{1}{\sqrt{27}} - \frac{3}{16}\right] > 0$.

So, in the non-degenerate case ($u \ll 1$), one has: $E_{Fn(Fp)}(u) = k_B T \times G(u) \simeq k_B T \times Ln(u)$ as **$u \to 0$, the limiting non-degenerate condition**, and in the very degenerate case ($u \gg 1$), one gets: $E_{Fn(Fp)}(u \gg 1) = k_B T \times F(u) = k_B T \times au^{\frac{2}{3}}\left(1 + bu^{-\frac{4}{3}} + cu^{-\frac{8}{3}}\right)^{-\frac{2}{3}} \simeq \frac{\hbar^2 \times k_{Fn(Fp)}^2(N^*)}{2 \times m_{c(v)}(x) \times m_o}$ as **$u \to \infty$, the limiting degenerate condition**. In other words, $\xi_{n(p)} \equiv \frac{E_{Fn(Fp)}}{k_B T}$ is accurate, and it also verifies the correct limiting conditions.

In particular, at T=0K, since $u^{-1} = 0$, Eq. (11) is reduced to: $E_{Fno(Fpo)}(N^*) \equiv \frac{\hbar^2 \times k^2_{Fn(Fp)}(N^*)}{2 \times m_{c(v)}(x) \times m_o}$, being proportional to $(N^*)^{2/3}$, and also equal to 0 at $N^* = 0$, according to the MIT.

In the following, it should be noted that all the electrical-and-thermoelectric properties strongly depend on such the accurate expression of $\xi_{n(p)}(N, r_{d(a)}, x, T)$.[9]

Fermi-Dirac Distribution Function (FDDF)

The Fermi-Dirac distribution function (FDDF) is given by: $f(E) \equiv (1 + e^{\gamma})^{-1}$, $\gamma \equiv (E - E_{Fn(Fp)})/(k_B T)$.

So, the average of E^p, calculated using the FDDF-method, as developed in our previous works[1, 6] is found to be given by:

$$\langle E^p \rangle_{FDDF} \equiv G_p(E_{Fn(Fp)}) \times E^p_{Fn(Fp)} \equiv \int_{-\infty}^{\infty} E^p \times \left(-\frac{\partial f}{\partial E}\right) dE, \quad -\frac{\partial f}{\partial E} = \frac{1}{k_B T} \times \frac{e^{\gamma}}{(1+e^{\gamma})^2}.$$

Further, one notes that, at 0 K, $-\frac{\partial f}{\partial E} = \delta(E - E_{Fno(Fpo)})$, $\delta(E - E_{Fno(Fpo)})$ being the Dirac delta (δ)-function. Therefore, $G_p(E_{Fno(Fpo)}) = 1$.

Then, at low T, by a variable change $\gamma \equiv (E - E_{Fn(Fp)})/(k_B T)$, one has:

$$G_p(E_{Fn(Fp)}) \equiv 1 + E^{-p}_{Fn(Fp)} \times \int_{-\infty}^{\infty} \frac{e^{\gamma}}{(1+e^{\gamma})^2} \times (k_B T\gamma + E_{Fn(Fp)})^p d\gamma = 1 + \sum_{\mu=1,2,\dots}^{p} C_p^{\beta} \times (k_B T)^{\beta} \times E^{-\beta}_{Fn(Fp)} \times I_{\beta},$$

Where $C_p^{\beta} \equiv p(p-1)\dots(p-\beta+1)/\beta!$ and the integral I_{β} is given by:

$I_{\beta} = \int_{-\infty}^{\infty} \frac{\gamma^{\beta} \times e^{\gamma}}{(1+e^{\gamma})^2} d\gamma = \int_{-\infty}^{\infty} \frac{\gamma^{\beta}}{(e^{\gamma/2} + e^{-\gamma/2})^2} d\gamma$, vanishing for old values of β. Then, for even values of $\beta = 2n$, with n=1, 2, …, one obtains.

$$I_{2n} = 2\int_0^{\infty} \frac{\gamma^{2n} \times e^{\gamma}}{(1+e^{\gamma})^2} d\gamma .$$

Now, using an identity $(1 + e^{\gamma})^{-2} \equiv \sum_{s=1}^{\infty} (-1)^{s+1} s \times e^{\gamma(s-1)}$, a variable change: $s\gamma = -t$, the Gamma function: $\int_0^{\infty} t^{2n} e^{-t} dt \equiv \Gamma(2n+1) = (2n)!$, and also the definition of the Riemann's zeta function: $\zeta(2n) \equiv 2^{2n-1}\pi^{2n}|B_{2n}|/(2n)!$, B_{2n} being the Bernoulli numbers, one finally gets: $I_{2n} = (2^{2n} - 2) \times \pi^{2n} \times |B_{2n}|$. So, from above Eq. of $\langle E^p \rangle_{FDDF}$, we get in the degenerate case the following ratio:

$$G_p(E_{Fn(Fp)}) \equiv \frac{\langle E^p \rangle_{FDDF}}{E^p_{Fn(Fp)}} = 1 + \sum_{n=1}^{p} \frac{p(p-1)\dots(p-2n+1)}{(2n)!} \times (2^{2n}-2) \times |B_{2n}| \times y^{2n} \equiv G_{p\geq 1}(y), \quad (12)$$

Where $y \equiv \frac{\pi}{\xi_{n(p)}(N^*,T)} = \frac{\pi k_B T}{E_{Fn(Fp)}(N^*,T)}$.

Then, some usual results of $G_{p\geq 1}(y)$ are given in Table 2 in Appendix 1, being needed to determine all the following electrical-and-thermoelectric properties.

ELECTRICAL-AND-THERMOELECTRIC PROPERTIES

Here, if denoting, for majority electrons (holes), the electrical conductivity by $\sigma(N, r_{d(a)}, x, T)$ expressed in $ohm^{-1} \times cm^{-1}$, the thermal conductivity by $\kappa(N, r_{d(a)}, x, T)$ in $\frac{W}{cm \times K}$, and the Lorenz number L defined by: $L = \frac{\pi^2}{3} \times \left(\frac{k_B}{q}\right)^2 = 2.4429637 \left(\frac{W \times ohm}{K^2}\right) = 2.4429637 \times 10^{-8}\ (V^2 \times K^{-2})$, then the well-known Wiedemann-Frank law states that the ratio, $\frac{\kappa}{\sigma}$, is proportional to the temperature T(K), as:

$$\frac{\kappa(N, r_{d(a)}, x, T)}{\sigma(N, r_{d(a)}, x, T)} = L \times T. \quad (13)$$

We now determine the general form of σ in the following.

First of all, it is expressed in terms of the kinetic energy of the electron (hole), $E_k \equiv \frac{\hbar^2 \times k^2}{2 \times m_{c(v)}(x) \times m_o}$, or the wave number k, as:

$$\sigma(k) \equiv \frac{q^2 \times k}{\pi \times \hbar} \times \frac{k}{k_{sn(sp)}} \times [k \times a_{Bn(Bp)}] \times \left(\frac{E_k}{\eta_{n(p)}}\right)^{1/2},$$

which is thus proportional to ${E_k}^2$.

Then, for $\underline{E \geq 0}$, we obtain: $\langle E^2 \rangle_{FDDF} \equiv G_2(y = \frac{\pi k_B T}{E_{Fn(Fp)}}) \times E^2_{Fn(Fp)}$, and $G_2(y) = \left(1 + \frac{y^2}{3}\right) \equiv G_2(N, r_{d(a)}, x, T)$, with $y \equiv \frac{\pi}{\xi_{n(p)}}$, $\xi_{n(p)} = \xi_{n(p)}(N, r_{d(a)}, x, T)$ for a presentation simplicity. Therefore, one obtains [1]:

$$\sigma(N, r_{d(a)}, x, T) \equiv \left[\frac{q^2}{\pi \times \hbar} \times \frac{k_{Fn(Fp)}(N^*)}{R_{sn(sp)}(N^*)} \times [k_{Fn(Fp)}(N^*) \times a_{Bn(Bp)}(r_{d(a)})] \times \sqrt{A_{n(p)}(N^*)}\right] \times \left[G_2(N, r_{d(a)}, x, T) \times \left(\frac{E_{Fn(Fp)}(N, r_{d(a)}, x, T)}{E_{Fno(Fpo)}(N^*)}\right)^2\right] \left(\frac{1}{ohm \times cm}\right),$$

$$\frac{q^2}{\pi \times \hbar} = 7.7480735 \times 10^{-5}\ ohm^{-1},\ A_{n(p)}(N^*) = \frac{E_{Fno(Fpo)}(N^*)}{\eta_{n(p)}(N^*)},\ R_{sn(sp)}(N^*) \equiv \frac{k_{sn(sp)}}{k_{Fn(Fp)}}, \quad (14)$$

Which can be used to define the resistivity as: $\rho(N, r_{d(a)}, x, T) \equiv 1/\sigma(N, r_{d(a)}, x, T)$, noting again that $N^* \equiv N - N_{CDn(NDp)}(r_{d(a)}, x)$. This $\sigma(N, r_{d(a)}, x, T)$-result is an essential one in this paper, being used to determine other electrical-and-thermoelectric properties.

In Eq. (14), one notes that at T= 0 K, $\sigma(N, r_{d(a)}, x, T = 0K)$ is proportional to $E^2_{Fno(Fpo)}$, or to $(N^*)^{\frac{4}{3}}$. Thus, $\sigma(N = N_{CDn(NDp)}, r_{d(a)}, x, T = 0K) = 0$ at $N^* = 0$, at which the metal-insulator transition (MIT) occurs.

Electrical Coefficients

The relaxation time τ is related to σ by[1]:

$\tau(N, r_{d(a)}, x, T) \equiv \sigma(N, r_{d(a)}, x, T) \times \frac{m_{c(v)}(x)\times m_o}{q^2\times(N^*/g_{c(v)})}$. Therefore, the mobility μ is given by:

$$\mu(N, r_{d(a)}, x, T) \equiv \mu(N^*, r_{d(a)}, T) = \frac{q\times\tau(N, r_{d(a)}, x, T)}{m_{c(v)}(x)\times m_o} = \frac{\sigma(N, r_{d(a)}, x, T)}{q\times(N^*/g_{c(v)})} \ \left(\frac{cm^2}{V\times s}\right). \tag{15}$$

Here, at T= 0K, $\mu(N^*, r_{d(a)}, T)$ is thus proportional to $(N^*)^{1/3}$, since $\sigma(N^*, r_{d(a)}, T = 0K)$ is proportional to $(N^*)^{4/3}$. Thus, $\mu(N^* = 0, r_{d(a)}, T = 0K) = 0$ at $N^* = 0$, at which the metal-insulator transition (MIT) occurs.

Then, since τ and σ are both proportional to $E_{Fn(Fp)}(N^*, T)^2$, as given above, the Hall factor is defined by:

$r_H(N, r_{d(a)}, x, T) \equiv \frac{\langle\tau^2\rangle_{FDDF}}{[\langle\tau\rangle_{FDDF}]^2} = \frac{G_4(y)}{[G_2(y)]^2}$, $y \equiv \frac{\pi}{\xi_{n(p)}(N, r_{d(a)}, x, T)} = \frac{\pi k_B T}{E_{Fn(Fp)}(N, r_{d(a)}, x, T)}$, and therefore, the Hall mobility yields:

$$\mu_H(N, r_{d(a)}, x, T) \equiv \mu(N, r_{d(a)}, x, T) \times r_H(N^*, T) \ \left(\frac{cm^2}{V\times s}\right), \tag{16}$$

Noting that, at T=0K, since $r_H(N, r_{d(a)}, x, T) = 1$, one then gets: $\mu_H(N, r_{d(a)}, x, T) \equiv \mu(N, r_{d(a)}, x, T)$.

Our generalized Einstein relation

Our generalized Einstein relation is found to be defined as[1]:

$$\frac{D(N, r_{d(a)}, x, T)}{\mu(N, r_{d(a)}, x, T)} \equiv \frac{N^*}{q} \times \frac{dE_{Fn(Fp)}}{dN^*} \equiv \frac{k_B\times T}{q} \times \left(u\frac{d\xi_{n(p)}(u)}{du}\right) = \sqrt{\frac{3\times L}{\pi^2}} \times T \times \left(u\frac{d\xi_{n(p)}(u)}{du}\right), \ \frac{k_B}{q} = \sqrt{\frac{3\times L}{\pi^2}} \tag{17}$$

Where $D(N, r_{d(a)}, x, T)$ is the diffusion coefficient, $\xi_{n(p)}(u)$ is defined in Eq. (11), and the mobility $\mu(N, r_{d(a)}, x, T)$ is determined in Eq. (15). Then, by differentiating this function

$\xi_{n(p)}(u)$ with respect to u, one thus obtains $\frac{d\xi_{n(p)}(u)}{du}$. Therefore, Eq. (17) can also be rewritten as:

$$\frac{D(N, r_{d(a)}, x, T)}{\mu(N, r_{d(a)}, x, T)} = \frac{k_B \times T}{q} \times u \frac{V'(u) \times W(u) - V(u) \times W'(u)}{W^2(u)},$$

Where $W'(u) = ABu^{B-1}$ and $V'(u) = u^{-1} + 2^{-\frac{3}{2}} e^{-du}(1 - du) + \frac{2}{3} A u^{B-1} F(u) \left[\left(1 + \frac{3B}{2}\right) + \frac{4}{3} \times \frac{bu^{-\frac{4}{3}} + 2cu^{-\frac{8}{3}}}{1 + bu^{-\frac{4}{3}} + cu^{-\frac{8}{3}}}\right]$.

One remarks that: (i) as $u \to 0$, one has: $W^2 \simeq 1$ and $u[V' \times W - V \times W'] \simeq 1$, and therefore: $\frac{D_{n(p)}(u)}{\mu} \simeq \frac{k_B \times T}{q}$, and (ii) as $u \to \infty$, one has: $W^2 \approx A^2 u^{2B}$ and $u[V' \times W - V \times W'] \approx \frac{2}{3} a u^{2/3} A^2 u^{2B}$, and therefore, in this **highly degenerate case** and at T=0K, the **above generalized Einstein relation** is reduced to the **usual Einstein one**: $\frac{D(N, r_{d(a)}, x, T=0\,K)}{\mu(N, r_{d(a)}, x, T=0\,K)} \approx \frac{2}{3} E_{Fno(Fpo)}(N^*)/q$. In other words, **Eq. (17) verifies the correct limiting conditions**.

Furthermore, in the present degenerate case ($u \gg 1$), Eq. (17) gives:

$$\frac{D(N, r_{d(a)}, x, T)}{\mu(N, r_{d(a)}, x, T)} \simeq \frac{2}{3} \times \frac{E_{Fno(Fpo)}(u)}{q} \times \left[1 + \frac{4}{3} \times \frac{\left(bu^{-\frac{4}{3}} + 2cu^{-\frac{8}{3}}\right)}{\left(1 + bu^{-\frac{4}{3}} + cu^{-\frac{8}{3}}\right)}\right], \quad (18)$$

Where $a = [3\sqrt{\pi}/4]^{2/3}$, $b = \frac{1}{8}\left(\frac{\pi}{3}\right)^2$ and $c = \frac{62.3739855}{1920}\left(\frac{\pi}{3}\right)^4$.

In Tables 3n(3p) given in Appendix 1, for given x, $N > N_{CDn(CDp)}$ and T(=4.2 K and 77 K), and from Equations (14, 15, 16, 17), the numerical results of the coefficients: σ, μ, μ_H and D are found to be decreased with increasing $r_{d(a)}$, respectively.

Thermoelectric Coefficients

First of all, from Eq. (14), obtained for $\sigma(N, r_{d(a)}, x, T)$, the well-known Mott definition for the thermoelectric power or for the Seebeck coefficient, S, is found to be given by:

$$S(N, r_{d(a)}, x, T) \equiv \frac{-\pi^2}{3} \times \frac{k_B}{q>0} \times k_B T \times \left.\frac{\partial \ln \sigma(E)}{\partial E}\right]_{E=E_{Fn(Fp)}} = \frac{-\pi^2}{3} \times \frac{k_B}{q} \times \frac{\partial \ln \sigma(\xi_{n(p)})}{\partial \xi_{n(p)}}.$$

Then, using Eq. (11), for the degenerate case, $\xi_{n(p)} \geq 0$, one gets, by putting

$$F_S(N, r_{d(a)}, x, T) \equiv \left[1 - \frac{y^2}{3 \times G_2\left(y = \frac{\pi}{\xi_{n(p)}}\right)}\right],$$

$$S(N, r_{d(a)}, x, T) \equiv \frac{-\pi^2}{3} \times \frac{k_B}{q} \times \frac{2F_{Sb}(N^*,T)}{\xi_{n(p)}} = -\sqrt{\frac{3\times L}{\pi^2}} \times \frac{2\times\xi_{n(p)}}{\left(1+\frac{3\times\xi_{n(p)}^2}{\pi^2}\right)} =$$

$$-2\sqrt{L} \times \frac{\sqrt{(ZT)_{Mott}}}{1+(ZT)_{Mott}} \left(\frac{V}{K}\right) < 0, \quad (ZT)_{Mott} = \frac{\pi^2}{3\times\xi_{n(p)}^2}, \qquad (19)$$

according to:

$$\frac{\partial S}{\partial \xi_{n(p)}} = \sqrt{\frac{3\times L}{\pi^2}} \times 2 \times \frac{\frac{3\times\xi_{n(p)}^2}{\pi^2} - 1}{\left(1+\frac{3\times\xi_{n(p)}^2}{\pi^2}\right)^2} = \sqrt{\frac{3\times L}{\pi^2}} \times 2 \times \frac{(ZT)_{Mott}\times[1-(ZT)_{Mott}]}{[1+(ZT)_{Mott}]^2}.$$

Here, one notes that: (i) as $\xi_{n(p)} \to +\infty$ or $\xi_{n(p)} \to +0$, one has a same limiting value of S: $S \to -0$, (ii) at $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, since $\frac{\partial S}{\partial \xi_{n(p)}} = 0$, one therefore gets: a minimum $(S)_{min.} = -\sqrt{L} \simeq -1.563 \times 10^{-4} \left(\frac{V}{K}\right)$, and (iii) at $\xi_{n(p)} = 1$ one obtains: $S \simeq -1.322 \times 10^{-4} \left(\frac{V}{K}\right)$.

Further, the figure of merit, ZT, is found to be defined by:

$$ZT(N, r_{d(a)}, x, T) \equiv \frac{S^2 \times \sigma \times T}{\kappa} = \frac{S^2}{L} = \frac{4\times(ZT)_{Mott}}{[1+(ZT)_{Mott}]^2}. \qquad (20)$$

Here, one notes that: (i) $\frac{\partial(ZT)}{\partial \xi_{n(p)}} = 2 \times \frac{S}{L} \times \frac{\partial S}{\partial \xi_{n(p)}}$, $S < 0$, (ii) at $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, since $\frac{\partial(ZT)}{\partial \xi_{n(p)}} = 0$, one gets: a maximum $(ZT)_{max.} = 1$, and $(ZT)_{Mott} = 1$, and (iii) at $\xi_{n(p)} = 1$, one obtains: $ZT \simeq 0.715$ and $(ZT)_{Mott} = \frac{\pi^2}{3} \simeq 3.290$.

Finally, the first Van-Cong coefficient, VC1, can be defined by:

$$VC1(N, r_{d(a)}, x, T) \equiv -N^* \times \frac{dS}{dN^*} \left(\frac{V}{K}\right) = N^* \times \frac{\partial S}{\partial \xi_{n(p)}} \times -\frac{\partial \xi_{n(p)}}{\partial N^*},$$ being equal to 0 for

$$\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}}, \qquad (21)$$

and the second Van-Cong coefficient, VC2, as:

$$VC2(N, r_{d(a)}, x, T) \equiv T \times VC1 \ (V), \qquad (22)$$

the Thomson coefficient, Ts, by:

$$Ts(N, r_{d(a)}, x, T) \equiv T \times \frac{dS}{dT} \left(\frac{V}{K}\right) = T \times \frac{\partial S}{\partial \xi_{n(p)}} \times \frac{\partial \xi_{n(p)}}{\partial T},$$ being equal to 0 for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}}$, (23)

and the Peltier coefficient, Pt, as:

$$Pt(N, r_{d(a)}, x, T) \equiv T \times S \text{ (V)}. \qquad (24)$$

One notes here that in next Tables 5n(p) and 6n(p) given in Appendix 1, obtained with such given physical conditions N (or T) for the decreasing $\xi_{n(p)}$, since $VC1(N, r_{d(a)}, x, T)$ and $Ts(N, r_{d(a)}, x, T)$ are expressed in terms of $\frac{-dS}{dN^*}$ and $\frac{dS}{dT}$, one has: $[VC1, Ts] < 0$ for $\xi_{n(p)} > \sqrt{\frac{\pi^2}{3}}$, $[VC1, Ts] = 0$ for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}}$, and $[VC1, Ts] > 0$ for $\xi_{n(p)} < \sqrt{\frac{\pi^2}{3}}$, stating also that for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}}$:

(i) S, determined in Eq. (19), thus presents **a same minimum** $(S)_{min.} = -\sqrt{L} \simeq -1.563 \times 10^{-4} \left(\frac{V}{K}\right)$,

(ii) ZT, determined in Eq. (20), therefore presents **a same maximum:** $(ZT)_{max.} = 1$, since the variations of ZT are expressed in terms of $[VC1, Ts] \times S$, $S < 0$.

Furthermore, it is interesting to remark that the (VC2)-coefficient is related to our generalized Einstein relation (17) by:

$$\frac{k_B}{q} \times VC2(N, r_{d(a)}, x, T) \equiv -\frac{\partial S}{\partial \xi_{n(p)}} \times \frac{D(N, r_{d(a)}, x, T)}{\mu(N, r_{d(a)}, x, T)} \left(\frac{V^2}{K}\right), \quad \frac{k_B}{q} = \sqrt{\frac{3 \times L}{\pi^2}}, \qquad (25)$$

according, in this work, with the use of our Eq. (21), to:

$$VC2(N, r_{d(a)}, x, T) \equiv -\frac{D(N, r_{d(a)}, x, T)}{\mu(N, r_{d(a)}, x, T)} \times 2 \times \frac{(ZT)_{Mott} \times [1 - (ZT)_{Mott}]}{[1 + (ZT)_{Mott}]^2} \text{ (V)}.$$

Of course, our relation (25) is reduced to: $\frac{D}{\mu}$, VC1 and VC2, being determined respectively by Equations (17, 21, 22).

Now, in the degenerate n(p)-type $X(x)-$ alloy, and for N> $N_{CDn(CDp)}$, and for T=3K (80K), the numerical results of various thermoelectric coefficients are reported in Tables 4n(4p) in Appendix 1, noting that their variations with increasing $r_{d(a)}$ are represented by the arrows: ↗ (increase), and ↘ (decrease), respectively.

Then, in Tables 5n(5p) given Appendix 1 for a given N and with increasing T, and in Tables 6n(6p) given Appendix 1 for a given T and with decreasing N, the reduced Fermi-energy

$\xi_{n(p)}$ decreases, and various thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘).

CONCLUDING REMARKS

Here, some concluding remarks are given as follows.

(1) In $\mathbf{n^+(p^+) - p(n)\, X(x)[Y(x)]}$ - crystalline alloys, $0 \le x \le 1$, the electrical-and-thermoelectric laws, relations, and various coefficients are found to be enhanced by our static dielectric constant law, $\varepsilon(r_{d(a)}, x)$, being, for a given x, decreased with increasing $r_{d(a)}$, as that given in our recent works [2, 3], by our accurate Fermi energy, $E_{Fn(Fp)}$, being given in Eq. (11), and in particular by our electrical conductivity model, being given in Eq. (14).

(2) The generalized Mott criterium in the MIT is expressed in Equations (3, 5, 6), stating that the critical impurity density $N_{CDn(CDp)}$ is just the density of electrons (holes), localized in the exponential conduction (valence)-band tail, $N_{CDn(CDp)}^{EBT}$, obtained with a precision of the order of $\mathbf{2.89 \times 10^{-7}}$, as that given in our previous works [2, 3], and the effective electron (hole)-density can be defined by: $N^* \equiv N - N_{CDn(CDp)} \simeq N - N_{CDn(CDp)}^{EBT}$, as that observed in the compensated crystals. This should be **a new result**.

(3) The ratio of the inverse effective screening length $k_{sn(sp)}$ to Fermi wave number $k_{Fn(kp)}$ at 0 K, $R_{sn(sp)}(N^*)$, defined in Eq. (7), is valid for any density N^*. This should be **a new result**.

(4) In Tables 5n(5p) given Appendix 1, for a given impurity density N and with increasing temperature T, and then in Tables 6n(6p) given Appendix 1, for a given **T** and with decreasing N, the reduced Fermi-energy $\xi_{n(p)}$ decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows by: (increase: ↗, decrease: ↘). One remarks in these Tables that, for any given x, $r_{d(a)}$ and N (or T), with increasing T (or decreasing N), one obtains: (i) for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, while the numerical results of the Seebeck coefficient S present a **same minimum** $\mathbf{(S)_{min.} = -\sqrt{L} \simeq -1.563 \times 10^{-4} \left(\frac{V}{K}\right)}$, those of the figure of merit ZT show a **same maximum** $\mathbf{(ZT)_{max.} = 1}$, (ii) for $\xi_{n(p)} = 1$, the numerical results of S, ZT, the Mott figure of merit $(ZT)_{Mott}$, the Van-Cong coefficient VC1, and the Thomson coefficient Ts, present the same results: $\mathbf{-1.322 \times 10^{-4} \frac{V}{K}}$, **0.715, 3.290,**

$\mathbf{1.105 \times 10^{-4} \frac{V}{K}}$, and $\mathbf{1.657 \times 10^{-4} \frac{V}{K}}$, respectively, and finally (iii) for $\xi_{n(p)} = \sqrt{\frac{\pi^2}{3}} \simeq 1.8138$, $\mathbf{(ZT)_{Mott} = 1}$. It seems that these same results could represent **a new law in the thermoelectric properties, obtained in the degenerate case**.

(5) Finally, our electrical-and-thermoelectric relation is given in Eq. (25) by:
$\frac{k_B}{q} \times VC2(N, r_{d(a)}, x, T) \equiv -\frac{\partial S}{\partial \xi_{n(p)}} \times \frac{D(N, r_{d(a)}, x, T)}{\mu(N, r_{d(a)}, x, T)} \left(\frac{V^2}{K}\right)$, $\frac{k_B}{q} = \sqrt{\frac{3 \times L}{\pi^2}}$, according, in this work, to: $VC2(N, r_{d(a)}, x, T) \equiv -\frac{D(N, r_{d(a)}, x, T)}{\mu(N, r_{d(a)}, x, T)} \times 2 \times \frac{(ZT)_{Mott} \times [1-(ZT)_{Mott}]}{[1+(ZT)_{Mott}]^2}$ (V), being reduced to: $\frac{D}{\mu}$, VC1 and VC2, determined respectively in Equations (17, 21, 22). This should be **a new result**.

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APPENDIX 1

Table 1: In these X(x)-and-Y(x) crystalline alloys, their different values of energy-band-structure parameters, for a given x, are given in the following.

In the $\mathbf{X(x) \equiv Ge_{1-x}Si_x}$ **-crystalline alloy**, in which $r_{do(ao)} = r_{Ge(Ge)}$ =**0.122** nm (**0.122** nm), we have[2, 3]: $g_{c(v)}(x) = 6(2) \times x + 4(2) \times (1-x)$, $m_{c(v)}(x)/m_o = 0.37353\ (0.54038) \times x + 0.12\ (0.3) \times (1-x)$, $\varepsilon_o(x) = 11.4 \times x + 15.8 \times (1-x)$, $E_{go}(x) = 1.17 \times x + 0.7412 \times (1-x)$.

In the $\mathbf{Y(x) \equiv Si_{1-x}Ge_x}$ **-crystalline alloy**, in which $r_{do(ao)} = r_{Si(Si)}$ =**0.117** nm (**0.117** nm), we have [2]: $g_{c(v)}(x) = 4(2) \times x + 6(2) \times (1-x)$, $m_{c(v)}(x)/m_o = 0.12\ (0.3) \times x + 0.37353\ (0.54038) \times (1-x)$, $\varepsilon_o(x) = 15.8 \times x + 11.4 \times (1-x)$, $E_{go}(x) = 0.7412 \times x + 1.17 \times (1-x)$.

Table 2: Expressions for $G_{p\geq 1}(y \equiv \frac{\pi}{\xi_{n(p)}})$, due to the Fermi-Dirac distribution function, noting that $G_{p=1}(y \equiv \frac{\pi k_B T}{E_{Fn(Fp)}} = \frac{\pi}{\xi_{n(p)}}) = 1$, used to determine the electrical-and-thermoelectric coefficients.

$G_{3/2}(y)$	$G_2(y)$	$G_{5/2}(y)$	$G_3(y)$	$G_{7/2}(y)$	$G_4(y)$	$G_{9/2}(y)$
$\left(1+\frac{y^2}{8}+\frac{7y^4}{640}\right)$	$\left(1+\frac{y^2}{3}\right)$	$\left(1+\frac{5y^2}{8}-\frac{7y^4}{384}\right)$	$\left(1+y^2\right)$	$\left(1+\frac{35y^2}{24}+\frac{49y^4}{384}\right)$	$\left(1+2y^2+\frac{7y^4}{15}\right)$	$\left(1+\frac{21y^2}{8}+\frac{147y^4}{128}\right)$

Table 3n:

In the $\mathbf{X(x) \equiv Ge_{1-x}Si_x}$**-crystalline alloy**, one notes that, for given x, $N > N_{CDn}$ and T(=4.2 K and 77 K), the functions: σ, μ, μ_H, D, expressed respectively in $\left(\frac{10^5}{ohm \times cm}, \frac{10^3 \times cm^2}{V \times s}, \frac{10^3 \times cm^2}{V \times s}, \frac{10^2 \times cm^2}{s}\right)$, decrease with increasing r_d.

Donor	P	As	Sb	Sn
r_d (nm) ↗	0.110	0.118	0.136	0.140
For x=**0**, the values of (σ, μ, μ_H, D) at **4.2K**				
N (10^{19} cm^{-3})				
1	3.16, 7.924, 7.928, 2.95	2.97, 7.454, 7.458, 2.77	2.68, 6.740, 6.744, 2.50	2.53, 6.367, 6.370, 2.36
4	10.8, 6.731, 6.731, 6.32	10.1, 6.306, 6.307, 5.92	9.06, 5.663, 5.664, 5.32	8.52, 5.327, 5.327, 5.00
6	15.5, 6.470, 6.471, 7.97	14.5, 6.057, 6.057, 7.46	13.0, 5.430, 5.430, 6.68	12.2, 5.103, 5.103, 6.28
10	24.7, 6.183, 6.183, 10.7	23.1, 5.782, 5.782, 10.0	20.7, 5.174, 5.175, 8.96	19.4, 4.857, 4.857, 8.41
For x=**0.5**, the values of (σ, μ, μ_H, D) at **4.2K**				
N (10^{19} cm^{-3})				
1	0.71, 2.346, 2.354, 0.35	0.67, 2.233, 2.241, 0.33	0.61, 2.060, 2.068, 0.30	0.58, 1.969, 1.976, 0.29
4	2.21, 1.748, 1.749, 0.68	2.09, 1.654, 1.654, 0.64	1.90, 1.510, 1.510, 0.59	1.80, 1.434, 1.435, 0.56
6	3.10, 1.627, 1.627, 0.83	2.92, 1.536, 1.537, 0.79	2.65, 1.399, 1.399, 0.72	2.51, 1.326, 1.327, 0.68
10	4.77, 1.498, 1.499, 1.08	4.50, 1.412, 1.412, 1.02	4.07, 1.281, 1.281, 0.92	3.85, 1.212, 1.213, 0.87
For x=**1**, the values of (σ, μ, μ_H, D) at **4.2K**				
N (10^{19} cm^{-3})				
1	0.22, 1.223, 1.242, 0.09	0.20, 1.175, 1.194, 0.08	0.16, 1.102, 1.124, 0.07	0.14, 1.066, 1.089, 0.06
4	0.81, 0.825, 0.826, 0.18	0.76, 0.787, 0.788, 0.17	0.69, 0.728, 0.730, 0.15	0.65, 0.697, 0.698, 0.15
6	1.13, 0.745, 0.746, 0.22	1.07, 0.710, 0.711, 0.20	0.97, 0.655, 0.656, 0.19	0.92, 0.626, 0.627, 0.18
10	1.71, 0.662, 0.662, 0.27	1.62, 0.629, 0.629, 0.26	1.48, 0.578, 0.579, 0.24	1.40, 0.552, 0.552, 0.22

For **x=0**, the values of (σ, μ, μ_H, D) at **77 K**

N (10^{19} cm^{-3})				
4	10.9, 6.817, 7.013, 6.39	10.2, 6.387, 6.570, 5.98	9.18, 5.735, 5.900, 5.37	8.63, 5.395, 5.550, 5.05
6	15.6, 6.518, 6.628, 8.01	14.6, 6.101, 6.204, 7.50	13.1, 5.470, 5.563, 6.72	12.3, 5.141, 5.227, 6.32
10	24.8, 6.206, 6.259, 10.3	23.2, 5.803, 5.853, 10.0	20.8, 5.194, 5.238, 8.98	19.5, 4.876, 4.917, 8.43

For **x=0.5**, the values of (σ, μ, μ_H, D) at **77 K**

N (10^{19} cm^{-3})				
4	2.37, 1.879, 2.172, 0.72	2.24, 1.778, 2.055, 0.68	2.04, 1.624, 1.878, 0.62	1.93, 1.542, 1.785, 0.59
6	3.23, 1.697, 1.855, 0.86	3.05, 1.603, 1.752, 0.81	2.77, 1.459, 1.596, 0.74	2.62, 1.384, 1.514, 0.70
10	4.88, 1.531, 1.604, 1.10	4.59, 1.443, 1.512, 1.04	4.16, 1.309, 1.372, 0.94	3.94, 1.239, 1.299, 0.89

For **x=1**, the values of (σ, μ, μ_H, D) at **77 K**

N (10^{19} cm^{-3})				
4	1.00, 1.020, 1.457, 0.22	0.95, 0.975, 1.398, 0.21	0.86, 0.907, 1.310, 0.19	0.81, 0.871, 1.264, 0.18
6	1.28, 0.847, 1.070, 0.23	1.21, 0.807, 1.022, 0.22	1.11, 0.747, 0.949, 0.21	1.05, 0.715, 0910, 0.20
10	1.82, 0.705, 0.804, 0.29	1.73, 0.670, 0.764, 0.27	1.58, 0.617, 0.704, 0.25	1.49, 0.589, 0.673, 0.24

In the $\mathbf{Y(x)} \equiv \mathbf{Si_{1-x}Ge_x}$, one notes that, for given x, $N > N_{CDn}$ and T(=4.2 K and 77 K), the functions: σ, μ, μ_H, D, expressed respectively in $\left(\frac{10^3}{ohm\times cm}, \frac{10^3\times cm^2}{V\times s}, \frac{10^3\times cm^2}{V\times s}, \frac{10^1\times cm^2}{s}\right)$, decrease with increasing r_d.

Donor	P	As	Sb	Sn
r_d (nm) ↗	0.110	0.118	0.136	0.140

For x=**0**, the values of (σ, μ, μ_H, D) at **4.2K**

N (10^{19} cm^{-3})				
4	0.78, 0.798, 0.799, 1.73	0.76, 0.782, 0.783, 1.69	0.63, 0.682, 0.683, 1.43	0.58, 0.644, 0.645, 1.33
6	1.09, 0.720, 0.721, 2.09	1.06, 0.705, 0.706, 2.04	0.89, 0.612, 0.613, 1.74	0.83, 0.577, 0.578, 1.62
10	1.64, 0.638, 0.638, 2.64	1.61, 0.625, 0.625, 2.59	1.36, 0.539, 0.539, 2.21	1.27, 0.507, 0.507, 2.06

For x=**0.5**, the values of (σ, μ, μ_H, D) at **4.2K**

N (10^{19} cm^{-3})				
4	2.12, 1.680, 1.681, 6.55	2.07, 1.641, 1.642, 6.40	1.75, 1.397, 1.398, 5.42	1.63, 1.307, 1.308, 5.06
6	2.97, 1.562, 1.562, 8.01	2.90, 1.525, 1.525, 7.82	2.44, 1.291, 1.291, 6.60	2.78, 1.205, 1.206, 6.15
10	4.57, 1.436, 1.437, 10.4	4.46, 1.401, 1.401, 10.1	3.74, 1.179, 1.179, 8.50	3.48, 1.098, 1.098, 7.91

For x=**1**, the values of (σ, μ, μ_H, D) at **4.2K**

N (10^{19} cm^{-3})				
4	10.3, 6.426, 6.426, 60.4	10.0, 6.252, 6.252, 58.7	8.26, 5.162, 5.162, 48.5	7.62, 4.767, 4.768, 44.8
6	14.8, 6.173, 6.173, 76.0	14.4, 6.004, 6.004, 73.9	11.9, 4.942, 4.943, 60.8	10.9, 4.559, 4.559, 56.1
10	23.6, 5.894, 5.895, 102	22.9, 5.730, 5.731, 99.2	18.8, 4.702, 4.702, 81.4	17.3, 4.331, 4.331, 74.9

For **x=0**, the values of (σ, μ, μ_H, D) at **77 K**

N (10^{19} cm^{-3})				
4	0.96, 0.988, 1.415, 2.11	0.94, 0.969, 1.391, 2.06	0.79, 0.853, 1.241, 1.78	0.73, 0.810, 1.189, 1.68
6	1.23, 0.818, 1.036, 2.30	1.21, 0.802, 1.016, 2.25	1.02, 0.699, 0.891, 1.93	0.95, 0.661, 0.846, 1.80
10	1.75, 0.680, 0.775, 2.78	1.71, 0.666, 0.759, 2.72	1.45, 0.575, 0.657, 2.32	1.36, 0.542, 0.620, 2.17

For **x=0.5**, the values of (σ, μ, μ_H, D) at **77 K**

$N\ (10^{19}\ cm^{-3})$				
4	2.28, 1.806, 2.088, 6.92	2.23, 1.765, 2.041, 6.76	1.88, 1.503, 1.739, 5.73	1.76, 1.407, 1.629, 5.35
6	3.10, 1.629, 1.781, 8.27	3.03, 1.590, 1.739, 8.07	2.55, 1.347, 1.473, 6.82	2.38, 1.258, 1.376, 6.36
10	4.67, 1.467, 1.538, 10.5	4.56, 1.431, 1.500, 10.3	3.82, 1.204, 1.262, 8.65	3.56, 1.121, 1.176, 8.04

For **x=1**, the values of (σ, μ, μ_H, D) at **77 K**

$N\ (10^{19}\ cm^{-3})$				
4	10.4, 6.508, 6.695, 61.0	10.1, 6.332, 6.514, 59.3	8.36, 5.228, 5.378, 48.9	7.72, 4.828, 4.967, 45.2
6	14.9, 6.219, 6.324, 76.4	14.5, 6.048, 6.150, 74.3	11.9, 4.979, 5.063, 61.2	11.0, 4.593, 4.670, 56.4
10	23.7, 5.917, 5.967, 102	23.0, 5.752, 5.801, 99.5	18.9, 4.720, 4.760, 81.6	17.4, 4.347, 4.384, 75.2

Table 3p:
In the $X(x) \equiv \mathbf{Ge_{1-x}Si_x}$**-crystalline alloy**, one notes that, for given x, $N > N_{CDp}$ and T(=4.2 K and 77 K), the functions: σ, μ, μ_H, D, expressed respectively in $\left(\frac{10^5}{ohm \times cm}, \frac{10^3 \times cm^2}{V \times s}, \frac{10^3 \times cm^2}{V \times s}, \frac{10 \times cm^2}{s}\right)$, decrease with increasing r_a.

Acceptor	Ga	Mg	In	Cd
r_a (nm) ↗	0.126	0.140	0.144	0.148

For x=**0**, the values of (σ, μ, μ_H, D) at **4.2K**

$N\ (10^{19}\ cm^{-3})$				
3	3.20, 1.366, 1.366, 6.62	2.78, 1.196, 1.197, 5.77	2.60, 1.124, 1.125, 5.40	2.42, 1.050, 1.050, 5.02
5	4.95, 1.255, 1.255, 8.61	4.30, 1.094, 1.094, 7.48	4.02, 1.025, 1.025, 7.00	3.72, 0.954, 0.954, 6.50
8	7.44, 1.171, 1.171, 11.0	6.43, 1.016, 1.016, 9.55	6.00, 0.950, 0.950, 8.92	5.56, 0.882, 0.882, 8.27
10	9.03, 1.136, 1.136, 12.4	7.80, 0.983, 0.983, 10.7	7.28, 0.919, 0.919, 10.0	6.74, 0.852, 0.852, 9.29

For x=**0.5**, the values of (σ, μ, μ_H, D) at **4.2K**

$N\ (10^{19}\ cm^{-3})$				
3	1.50, 0.699, 0.699, 2.28	1.29, 0.624, 0.625, 1.99	1.20, 0.593, 0.593, 1.86	1.10, 0.560, 0.561, 1.72
5	2.33, 0.621, 0.621, 2.94	2.02, 0.550, 0.550, 2.57	1.89, 0.520, 0.520, 2.41	1.75, 0.489, 0.489, 2.24
8	3.47, 0.563, 0.564, 3.71	3.02, 0.496, 0.496, 3.24	2.82, 0.468, 0.468, 3.04	2.62, 0.438, 0.438, 2.83
10	4.19, 0.540, 0.540, 4.15	3.64, 0.474, 0.474, 3.62	3.41, 0.447, 0.447, 3.39	3.16, 0.418, 0.418, 3.16

For x=**1**, the values of (σ, μ, μ_H, D) at **4.2K**

$N\ (10^{19}\ cm^{-3})$				
3	0.65, 0.436, 0.436, 0.87	0.49, 0.406, 0.407, 0.70	0.41, 0.395, 0.396, 0.62	0.32, 0.387, 0.389, 0.52
5	1.13, 0.367, 0.367, 1.19	0.94, 0.334, 0.334, 1.01	0.85, 0.320, 0.320, 0.93	0.74, 0.306, 0.307, 0.84
8	1.76, 0.321, 0.321, 1.52	1.50, 0.288, 0.288, 1.32	1.39, 0.275, 0.275, 1.23	1.26, 0.261, 0.261, 1.14
10	2.15, 0.303, 0.303, 1.70	1.85, 0.271, 0.271, 1.48	1.71, 0.257, 0.258, 1.39	1.57, 0.244, 0.244, 1.28

For x=**0**, the values of (σ, μ, μ_H, D) at **77K**

$N\ (10^{19}\ cm^{-3})$				
3	3.36, 1.432, 1.581, 6.86	2.91, 1.255, 1.386, 5.98	2.73, 1.179, 1.304, 5.61	2.54, 1.102, 1.219, 5.22
5	5.07, 1.285, 1.354, 8.77	4.40, 1.120, 1.180, 7.62	4.11, 1.050, 1.106, 7.13	3.81, 0.977, 1.030, 6.62
8	7.53, 1.186, 1.220, 11.1	6.51, 1.029, 1.058, 9.64	6.08, 0.962, 0.990, 9.01	5.63, 0.893, 0.919, 8.35
10	9.12, 1.146, 1.171, 12.5	7.87, 0.993, 1.014, 10.8	7.35, 0.927, 0.947, 10.1	6.80, 0.860, 0.878, 9.36

For x=**0.5**, the values of (σ, μ, μ_H, D) at **77K**

N (10^{19} cm^{-3})				
3	1.66, 0.774, 0.940, 2.47	1.44, 0.695, 0.851, 2.16	1.34, 0.662, 0.815, 2.02	1.24, 0.628, 0.779, 1.88
5	2.45, 0.652, 0.723, 3.05	2.13, 0.579, 0.644, 2.67	1.99, 0.548, 0.610, 2.51	1.84, 0.516, 0.575, 2.33
8	3.56, 0.578, 0.612, 3.79	3.10, 0.509, 0.539, 3.31	2.90, 0.480, 0.509, 3.10	2.69, 0.450, 0.477, 2.89
10	4.27, 0.550, 0.574, 4.21	3.71, 0.484, 0.505, 3.68	3.48, 0.455, 0.475, 3.45	3.23, 0.426, 0.445, 3.21

For x=**1**, the values of (σ, μ, μ_H, D) at **77K**

5	1.26, 0.407, 0.496, 1.28	1.05, 0.375, 0.467, 1.11	0.96, 0.363, 0.459, 1.03	0.86, 0.353, 0.455, 0.94
8	1.85, 0.337, 0.373, 1.58	1.58, 0.304, 0.339, 1.38	1.46, 0.290, 0.325, 1.28	1.34, 0.276, 0.311, 1.19
10	2.23, 0.313, 0.338, 1.75	1.92, 0.281, 0.304, 1.53	1.78, 0.267, 0.290, 1.43	1.63, 0.253, 0.276, 1.32

In the $\mathbf{Y(x) \equiv Si_{1-x}Ge_x}$, one notes that, for given x, $N > N_{CDp}$ and T(=4.2 K and 77 K), the functions: σ, μ, μ_H, D, expressed respectively in $\left(\frac{10^5}{ohm \times cm}, \frac{10^2 \times cm^2}{V \times s}, \frac{10^2 \times cm^2}{V \times s}, \frac{10 \times cm^2}{s}\right)$, decrease with increasing r_a.

Acceptor	Ga	Mg	In	Cd
r_a (nm) ↗	0.126	0.140	0.144	0.148

For x=**0**, the values of (σ, μ, μ_H, D) at **4.2K**

N (10^{19} cm^{-3})				
7	1.50, 3.241, 3.242, 1.37	1.16, 2.792, 2.793, 1.10	1.03, 2.646, 2.648, 1.00	0.90, 2.509, 2.511, 0.90
8	1.70, 3.124, 3.125, 1.47	1.32, 2.677, 2.678, 1.18	1.19, 2.532, 2.533, 1.08	1.05, 2.393, 2.394, 0.98
10	2.07, 2.946, 2.947, 1.65	1.64, 2.507, 2.507, 1.34	1.49, 2.362, 2.363, 1.23	1.33, 2.223, 2.224, 1.12

For x=**0.5**, the values of (σ, μ, μ_H, D) at **4.2K**

N (10^{19} cm^{-3})				
7	3.00, 5.612, 5.613, 3.36	2.43, 4.668, 4.669, 2.75	2.24, 4.355, 4.356, 2.54	2.04, 4.050, 4.051, 2.34
8	3.35, 5.463, 5.464, 3.59	2.72, 4.532, 4.533, 2.94	2.51, 4.223, 4.224, 2.71	2.29, 3.923, 3.924, 2.50
10	4.05, 5.233, 5.234, 4.01	3.29, 4.323, 4.324, 3.28	3.03, 4.021, 4.022, 3.03	2.78, 3.728, 3.728, 2.79

For x=**1**, the values of (σ, μ, μ_H, D) at **4.2K**

N (10^{19} cm^{-3})				
7	6.39, 11.53, 11.53, 9.92	5.16, 9.359, 9.360, 8.02	4.75, 8.641, 8.642, 7.39	4.35, 7.944, 7.945, 6.78
8	7.18, 11.31, 11.31, 10.6	5.79, 9.163, 9.164, 8.60	5.32, 8.454, 8.455, 7.92	4.87, 7.765, 7.766, 7.26
10	8.72, 10.97, 10.97, 12.0	7.01, 8.858, 8.858, 9.66	6.45, 8.162, 8.162, 8.89	5.90, 7.487, 7.487, 8.14

For x=**0**, the values of (σ, μ, μ_H, D) at **77K**

N (10^{19} cm^{-3})				
7	1.60, 3.447, 3.908, 1.44	1.24, 2.997, 3.457, 1.16	1.11, 2.858, 3.332, 1.06	0.98, 2.734, 3.236, 0.96
8	1.78, 3.284, 3.643, 1.53	1.40, 2.833, 3.182, 1.24	1.26, 2.689, 3.043, 1.13	1.12, 2.556, 2.923, 1.03
10	2.15, 3.052, 3.293, 1.69	1.71, 2.606, 2.832, 1.38	1.55, 2.461, 2.685, 1.27	1.39, 2.323, 2.548, 1.16

For x=**0.5**, the values of (σ, μ, μ_H, D) at **77K**

N (10^{19} cm^{-3})				
7	3.09, 5.789, 6.190, 3.44	2.51, 4.821, 5.166, 2.82	2.31, 4.500, 4.828, 2.60	2.11, 4.188, 4.500, 2.40
8	3.44, 5.606, 5.930, 3.66	2.79, 4.655, 4.932, 3.00	2.57, 4.339, 4.601, 2.77	2.36, 4.032, 4.281, 2.55
10	4.13, 5.333, 5.562, 4.07	3.35, 4.408, 4.601, 3.33	3.09, 4.101, 4.283, 3.08	2.83, 3.803, 3.974, 2.83

For x=**1**, the values of (σ, μ, μ_H, D) at **77K**

N (10^{19} cm^{-3})				
7	6.49, 11.71, 12.11, 10.0	5.24, 9.503, 9.830, 8.12	4.82, 8.774, 9.077, 7.48	4.42, 8.067, 8.347, 6.86
8	7.27, 11.45, 11.78, 10.7	5.86, 9.281, 9.548, 8.68	5.39, 8.562, 8.810, 8.00	4.94, 7.865, 8.094, 7.33
10	8.80, 11.07, 11.30, 12.1	7.08, 8.942, 9.133, 9.73	6.51, 8.239, 8.416, 8.96	5.96, 7.558, 7.721, 8.20

Table 4n:

In the $\mathbf{X(x) \equiv Ge_{1-x}Si_x}$ **-crystalline alloy** and for T=3K and 80K, the numerical results of various thermoelectric coefficients are reported. Further, their variations with increasing $r_{d(a)}$ are represented by the arrows: ↗ (increase), and ↘ (decrease).

Donor		P	As	Sb	Sn
For **x=0** and **N=**$\mathbf{5 \times 10^{18}}$ $\mathbf{cm^{-3}}$, one has:					
$\xi_{n(T=3K)}$	↘	135.639	135.549	135.374	135.258
$\xi_{n(T=80K)}$	↘	5.326	5.323	5.317	5.312
$\kappa_{(T=3K)}$ $\left(\frac{10^{-5}\times W}{cm\times K}\right)$	↘	12.770	12.032	10.907	10.316
$\kappa_{(T=80K)}$ $\left(\frac{10^{-4}\times W}{cm\times K}\right)$	↘	41.665	39.264	35.610	33.688
$-S_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.179	4.182	4.187	4.191
$-S_{(T=80K)}$ $\left(\frac{10^{-5}\times V}{K}\right)$	↘	9.539	9.543	9.552	9.559
$-VC1_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	2.785	2.786	2.790	2.793
$-VC1_{(T=80K)}$ $\left(\frac{10^{-5}\times V}{K}\right)$	↘	4.698	4.699	4.702	4.704
$-VC2_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	8.355	8.360	8.371	8.378
$-VC2_{(T=80K)}$ $\left(\frac{10^{-3}\times V}{K}\right)$	↘	3.759	3.759	3.761	3.763
$-Ts_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.177	4.180	4.185	4.189
$-Ts_{(T=80K)}$ $\left(\frac{10^{-5}\times V}{K}\right)$	↘	7.048	7.049	7.053	7.056
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	1.254	1.255	1.256	1.259
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	7.631	7.634	7.642	7.647
$ZT_{(T=3K)}$ (10^{-4})	↗	7.150	7.159	7.178	7.190
$ZT_{(T=80K)}$ (10^{-1})	↗	3.724	3.728	3.735	3.740
For **x=0.5** and **N=**$\mathbf{1.8 \times 10^{19}}$ $\mathbf{cm^{-3}}$, one has:					
$\xi_{n(T=3K)}$	↘	131.492	131.153	130.495	130.057
$\xi_{n(T=80K)}$	↘	5.174	5.161	5.137	5.121
$\kappa_{(T=3K)}$ $\left(\frac{10^{-5}\times W}{cm\times K}\right)$	↘	8.402	7.947	7.245	6.871
$\kappa_{(T=80K)}$ $\left(\frac{10^{-4}\times W}{cm\times K}\right)$	↘	27.696	26.216	23.940	22.729
$-S_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.311	4.322	4.344	4.359
$-S_{(T=80K)}$ $\left(\frac{10^{-5}\times V}{K}\right)$	↘	9.759	9.777	9.814	9.838
$-VC1_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	2.873	2.880	2.894	2.904
$-VC1_{(T=80K)}$ $\left(\frac{10^{-5}\times V}{K}\right)$	↘	4.762	4.767	4.779	4.787
$-VC2_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	8.618	8.640	8.683	8.713
$-VC2_{(T=80K)}$ $\left(\frac{10^{-3}\times V}{K}\right)$	↘	3.810	3.814	3.823	3.829
$-Ts_{(T=3K)}$ $\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.309	4.320	4.341	4.356
$-Ts_{(T=80K)}$ $\left(\frac{10^{-5}\times V}{K}\right)$	↘	7.143	7.151	7.168	7.180
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	1.293	1.296	1.302	1.308

$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	7.807	7.822	7.850	7.870
$ZT_{(T=3K)}\,(10^{-4})$	↗	7.608	7.647	7.724	7.777
$ZT_{(T=80K)}\,(10^{-1})$	↗	3.898	3.913	3.942	3.962
For **x=1** and **N=4 × 10^{19} cm^{-3}**, one has:					
$\xi_{n(T=3K)}$	↘	126.411	125.499	123.723	122.535
$\xi_{n(T=80K)}$	↘	4.985	4.951	4.885	4.840
$\kappa_{(T=3K)}\left(\frac{10^{-5}\times W}{cm\times K}\right)$	↘	5.933	5.599	5.072	4.785
$\kappa_{(T=80K)}\left(\frac{10^{-4}\times W}{cm\times K}\right)$	↘	19.813	18.740	17.056	16.141
$-S_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.484	4.516	4.581	4.626
$-S_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	10.043	10.096	10.200	10.272
$-VC1_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	2.987	3.009	3.052	3.082
$-VC1_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	4.856	4.876	4.916	4.946
$-VC2_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	8.963	9.028	9.158	9.247
$-VC2_{(T=80K)}\left(\frac{10^{-3}\times V}{K}\right)$	↘	3.885	3.901	3.933	3.957
$-Ts_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.481	4.514	4.579	4.623
$-Ts_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	7.285	7.314	7.375	7.419
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	1.345	1.355	1.374	1.388
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	8.034	8.077	8.160	8.218
$ZT_{(T=3K)}\,(10^{-4})$	↗	8.231	8.351	8.593	8.760
$ZT_{(T=80K)}\,(10^{-1})$	↗	4.129	4.172	4.259	4.319

In the $\mathbf{Y(x)} \equiv \mathbf{Si_{1-x}Ge_x}$ **-crystalline alloy** and for T=3K and 80K, the numerical results of various thermoelectric coefficients are reported. Further, their variations with increasing $r_{d(a)}$ are represented by the arrows: ↗ (increase), and ↘ (decrease).

Donor		P	As	Sb	Sn
For **x=0** and **N=4 × 10^{19} cm^{-3}**, one has:					
$\xi_{n(T=3K)}$	↘	125.773	125.370	121.867	119.981
$\xi_{n(T=80K)}$	↘	4.962	4.946	4.814	4.743
$\kappa_{(T=3K)}\left(\frac{10^{-5}\times W}{cm\times K}\right)$	↘	5.694	5.555	4.641	4.285
$\kappa_{(T=80K)}\left(\frac{10^{-4}\times W}{cm\times K}\right)$	↘	19.044	18.601	15.681	14.549
$-S_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.507	4.522	4.651	4.725
$-S_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	10.080	10.104	10.313	10.430
$-VC1_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	3.003	3.013	3.099	3.148
$-VC1_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	4.870	4.879	4.963	5.016
$-VC2_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	9.009	9.038	9.297	9.443
$-VC2_{(T=80K)}\left(\frac{10^{-3}\times V}{K}\right)$	↘	3.896	3.903	3.971	4.012
$-Ts_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	4.504	4.519	4.649	4.722
$-Ts_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	7.305	7.318	7.445	7.524
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	1.352	1.356	1.395	1.417
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	8.064	8.083	8.250	8.344
$ZT_{(T=3K)}\,(10^{-4})$	↗	8.315	8.369	8.857	9.137
$ZT_{(T=80K)}\,(10^{-1})$	↗	4.159	4.179	4.353	4.453

For **x=0.5** and **N=1.7×10^{19} cm^{-3}**, one has:

$\xi_{n(T=3K)}$	↘	126.178	126.025	124.705	123.999
$\xi_{n(T=80K)}$	↘	4.977	4.971	4.921	4.895
$\kappa_{(T=3K)}\ (\frac{10^{-5}\times W}{cm\times K})$	↘	7.708	7.529	6.380	5.949
$\kappa_{(T=80K)}\ (\frac{10^{-4}\times W}{cm\times K})$	↘	25.754	25.167	21.399	19.990
$-S_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	4.493	4.498	4.546	4.571
$-S_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	10.057	10.066	10.142	10.184
$-VC1_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	2.993	2.997	3.028	3.046
$-VC1_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	4.862	4.864	4.893	4.910
$-VC2_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	8.980	8.991	9.086	9.138
$-VC2_{(T=80K)}\ (\frac{10^{-3}\times V}{K})$	↘	3.889	3.891	3.915	3.928
$-Ts_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	4.490	4.495	4.543	4.569
$-Ts_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	7.292	7.297	7.340	7.365
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	1.348	1.349	1.363	1.371
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	8.045	8.052	8.114	8.147
$ZT_{(T=3K)}\ (10^{-4})$	↗	8.262	8.282	8.458	8.555
$ZT_{(T=80K)}\ (10^{-1})$	↗	4.140	4.147	4.211	4.246

For **x=1** and **N=4.5×10^{18} cm^{-3}**, one has:

$\xi_{n(T=3K)}$	↘	126.299	126.257	125.901	125.712
$\xi_{n(T=80K)}$	↘	4.981	4.979	4.966	4.959
$\kappa_{(T=3K)}\ (\frac{10^{-5}\times W}{cm\times K})$	↘	11.195	10.920	9.178	8.540
$\kappa_{(T=80K)}\ (\frac{10^{-4}\times W}{cm\times K})$	↘	37.396	36.480	30.690	28.571
$-S_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	4.488	4.489	4.502	4.509
$-S_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	10.050	10.052	10.072	10.084
$-VC1_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	2.990	2.991	2.999	3.004
$-VC1_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	4.859	4.860	4.864	4.871
$-VC2_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	8.972	8.974	8.999	9.013
$-VC2_{(T=80K)}\ (\frac{10^{-3}\times V}{K})$	↘	3.887	3.888	3.893	3.897
$-Ts_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	4.486	4.487	4.499	4.507
$-Ts_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	7.288	7.289	7.301	7.307
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	1.346	1.347	1.350	1.353
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	8.039	8.041	8.058	8.067
$ZT_{(T=3K)}\ (10^{-4})$	↗	8.246	8.251	8.298	8.323
$ZT_{(T=80K)}\ (10^{-1})$	↗	4.134	4.136	4.153	4.162

Table 4p:

In the $\mathbf{X(x)\equiv Ge_{1-x}Si_x}$ **-crystalline alloy** and for T=3K and 80K, the numerical results of various thermoelectric coefficients are reported. Further, their variations with increasing $r_{d(a)}$ are represented by the arrows: ↗ (increase), and ↘ (decrease).

Acceptor		Ga	Mg	In	Cd
For **x=0** and **N=1.5×10^{19} cm^{-3}**, one has:					
$\xi_{n(T=3K)}$	↘	174.230	172.367	171.279	169.873

$\xi_{n(T=80K)}$	↘	6.729	6.661	6.622	6.571
$\kappa_{(T=3K)}\ (\frac{10^{-5}\times W}{cm\times K})$	↘	13.049	11.342	10.603	9.826
$\kappa_{(T=80K)}\ (\frac{10^{-3}\times W}{cm\times K})$	↘	3.959	3.450	3.230	3.000
$-S_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	3.254	3.289	3.310	3.337
$-S_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	7.855	7.924	7.965	8.018
$-VC1_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	2.169	2.192	2.206	2.224
$-VC1_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	4.265	4.285	4.297	4.312
$-VC2_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	6.506	6.576	6.618	6.673
$-VC2_{(T=80K)}\ (\frac{10^{-3}\times V}{K})$	↘	3.412	3.428	3.438	3.450
$-Ts_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	3.253	3.288	3.309	3.336
$-Ts_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	6.398	6.428	6.445	6.468
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	0.976	0.987	0.993	1.001
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	6.284	6.339	6.372	6.414
$ZT_{(T=3K)}\ (10^{-4})$	↗	4.334	4.428	4.485	4.559
$ZT_{(T=80K)}(10^{-1})$	↗	2.526	2.570	2.596	2.632

For x=0.5 and **N=3 $\times$ 10^{19} cm^{-3}** one has:

$\xi_{n(T=3K)}$	↘	189.621	184.961	182.226	178.674
$\xi_{n(T=80K)}$	↘	7.290	7.120	7.020	6.891
$\kappa_{(T=3K)}\ (\frac{10^{-5}\times W}{cm\times K})$	↘	11.018	9.486	8.809	8.084
$\kappa_{(T=80K)}\ (\frac{10^{-3}\times W}{cm\times K})$	↘	3.279	2.838	2.645	2.438
$-S_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	2.990	3.065	3.111	3.173
$-S_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	7.324	7.478	7.571	7.695
$-VC1_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	1.993	2.043	2.073	2.115
$-VC1_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	4.098	4.149	4.179	4.217
$-VC2_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	5.978	6.129	6.221	6.344
$-VC2_{(T=80K)}\ (\frac{10^{-3}\times V}{K})$	↘	3.278	3.319	3.343	3.374
$-Ts_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	2.989	3.064	3.110	3.172
$-Ts_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	6.147	6.223	6.268	6.326
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	0.897	0.919	0.933	0.952
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	5.859	5.982	6.057	6.156
$ZT_{(T=3K)}\ (10^{-4})$	↗	3.659	3.846	3.962	4.121
$ZT_{(T=80K)}(10^{-1})$	↗	2.196	2.289	2.346	2.424

For x=1 and **N=5 $\times$ 10^{19} cm^{-3}** one has:

$\xi_{n(T=3K)}$	↘	187.956	176.253	169.271	160.064
$\xi_{n(T=80K)}$	↘	7.229	6.803	6.549	6.214
$\kappa_{(T=3K)}\ (\frac{10^{-5}\times W}{cm\times K})$	↘	8.321	6.876	6.208	5.465
$\kappa_{(T=80K)}\ (\frac{10^{-3}\times W}{cm\times K})$	↘	2.481	2.080	1.897	1.695
$-S_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	3.016	3.216	3.349	3.542
$-S_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	7.378	7.781	8.041	8.407

$-VC1_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	2.010	2.144	2.232	2.360
$-VC1_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	4.116	4.244	4.318	4.416
$-VC2_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	6.031	6.431	6.696	7.081
$-VC2_{(T=80K)}\left(\frac{10^{-3}\times V}{K}\right)$	↘	3.293	3.395	3.455	3.533
$-Ts_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	3.015	3.215	3.348	3.540
$-Ts_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	6.174	6.365	6.478	6.624
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	0.905	0.965	1.005	1.062
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	5.903	6.225	6.433	6.726
$ZT_{(T=3K)}(10^{-4})$	↗	3.724	4.235	4.592	5.135
$ZT_{(T=80K)}(10^{-1})$	↗	2.228	2.479	2.647	2.893

In the $\mathbf{Y(x)} \equiv \mathbf{Si_{1-x}Ge_x}$ and for T=3K and 80K, the numerical results of various thermoelectric coefficients are reported. Further, their variations with increasing $r_{d(a)}$ are represented by the arrows: ↗ (increase), and ↘ (decrease).

Acceptor		Ga	Mg	In	Cd
For x=0 and **N=4** $\times$ **10^{19} cm^{-3}**, one has:					
$\xi_{n(T=3K)}$	↘	151.166	128.297	115.707	98.835
$\xi_{n(T=80K)}$	↘	5.892	5.056	4.577	3.864
$\kappa_{(T=3K)}\left(\frac{10^{-5}\times W}{cm\times K}\right)$	↘	6.303	4.373	3.612	2.774
$\kappa_{(T=80K)}\left(\frac{10^{-3}\times W}{cm\times K}\right)$	↘	1.987	1.453	1.240	0.981
$-S_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	3.750	4.418	4.899	5.735
$-S_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	8.790	9.936	10.706	12.024
$-VC1_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	2.499	2.944	3.264	3.820
$-VC1_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	4.511	4.819	5.155	6.039
$-VC2_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	7.497	8.832	9.791	11.459
$-VC2_{(T=80K)}\left(\frac{10^{-3}\times V}{K}\right)$	↘	3.609	3.855	4.124	4.831
$-Ts_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	3.749	4.416	4.896	5.729
$-Ts_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	6.767	7.228	7.734	9.059
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	1.125	1.325	1.470	1.720
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	7.032	7.949	8.565	9.619
$ZT_{(T=3K)}(10^{-4})$	↗	5.757	7.991	9.824	13.462
$ZT_{(T=80K)}(10^{-1})$	↗	3.163	4.041	4.692	5.918

For x=0.5 and **N=3** $\times$ **10^{19} cm^{-3}** one has:					
$\xi_{n(T=3K)}$	↘	188.609	180.576	176.372	171.019
$\xi_{n(T=80K)}$	↘	7.253	6.960	6.807	6.612
$\kappa_{(T=3K)}\left(\frac{10^{-5}\times W}{cm\times K}\right)$	↘	10.631	8.454	7.681	6.893
$\kappa_{(T=80K)}\left(\frac{10^{-3}\times W}{cm\times K}\right)$	↘	3.168	2.543	2.324	2.101
$-S_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	3.006	3.139	3.214	3.315
$-S_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	7.357	7.628	7.777	7.975
$-VC1_{(T=3K)}\left(\frac{10^{-6}\times V}{K}\right)$	↘	2.003	2.092	2.142	2.209
$-VC1_{(T=80K)}\left(\frac{10^{-5}\times V}{K}\right)$	↘	4.109	4.196	4.242	4.299

$-VC2_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	6.010	6.277	6.426	6.627
$-VC2_{(T=80K)}\ \left(\frac{10^{-3}\times V}{K}\right)$	↘	3.287	3.357	3.393	3.440
$-Ts_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	3.005	3.138	3.213	3.314
$-Ts_{(T=80K)}\ \left(\frac{10^{-5}\times V}{K}\right)$	↘	6.164	6.295	6.363	6.450
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	0.902	0.941	0.964	0.994
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	5.885	6.102	6.221	6.380
$ZT_{(T=3K)}\ (10^{-4})$	↗	3.698	4.034	4.229	4.498
$ZT_{(T=80K)}(10^{-1})$	↗	2.215	2.382	2.475	2.603

For x=1 and **N=2** $\times$ **10**^{19} **cm**$^{-3}$ one has:

$\xi_{n(T=3K)}$	↘	212.488	209.598	208.103	206.217
$\xi_{n(T=80K)}$	↘	8.128	8.022	7.967	7.898
$\kappa_{(T=3K)}\ (\frac{10^{-5}\times W}{cm\times K})$	↘	16.089	13.058	12.030	11.015
$\kappa_{(T=80K)}\ (\frac{10^{-3}\times W}{cm\times K})$	↘	4.686	3.812	3.517	3.225
$-S_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	2.668	2.705	2.724	2.749
$-S_{(T=80K)}\ (\frac{10^{-5}\times V}{K})$	↘	6.645	6.724	6.766	6.819
$-VC1_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	1.778	1.803	1.815	1.832
$-VC1_{(T=80K)}\ \left(\frac{10^{-5}\times V}{K}\right)$	↘	3.849	3.880	3.896	3.917
$-VC2_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	5.335	5.408	5.447	5.497
$-VC2_{(T=80K)}\ \left(\frac{10^{-3}\times V}{K}\right)$	↘	3.079	3.104	3.116	3.133
$-Ts_{(T=3K)}\ (\frac{10^{-6}\times V}{K})$	↘	2.668	2.704	2.723	2.749
$-Ts_{(T=80K)}\ \left(\frac{10^{-5}\times V}{K}\right)$	↘	5.773	5.820	5.844	5.875
$-Pt_{(T=3K)}(10^{-5}\times V)$	↘	0.800	0.811	0.817	0.825
$-Pt_{(T=80K)}(10^{-3}\times V)$	↘	5.316	5.379	5.412	5.455
$ZT_{(T=3K)}\ (10^{-4})$	↗	2.914	2.995	3.038	3.094
$ZT_{(T=80K)}(10^{-1})$	↗	1.807	1.850	1.873	1.904

Table 5n:
In the $X(x)\equiv Ge_{1-x}Si_x$**-crystalline alloy**, for a given N and with increasing T, the reduced Fermi-energy ξ_n decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_n \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.}\left(\simeq -1.563\times 10^{-4}\frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.}=1$, (ii) for $\xi_n=1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322\times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $1.105\times 10^{-4}\frac{V}{K}$, and $1.657\times 10^{-4}\frac{V}{K}$, respectively, and (iii) for $\xi_n \simeq 1.8138$, $(ZT)_{Mott}=1$.

For x=0,
In the degenerate P- X(x) – alloy, for $N = 2\times N_{CDn}(r_p) = 8.0759802\times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	7.26458		**7.422903**		7.5826		**10.1008063**		10.1111
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.446	↗	0	↗	0.477	↗	11.161	↗	11.213

$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.1347	↘	−1.1602	↘	−1.1844	↘	−1.3350	↗	−1.3347

In the degenerate As- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{As}) = 9.0649986 \times 10^{16}\ cm^{-3}$, one gets:

T(K)	↗	7.8462		**8.017189**		8.1896		**10.9094883**		10.92068
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**– 1.322**	↗	– 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.481	↗	0	↗	0.515	↗	12.054	↗	12.112
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.2256	↘	−1.2531	↘	−1.2792	↘	−1.4419	↗	−1.4415

In the degenerate Sb- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sb}) = 1.098127 \times 10^{17}\ cm^{-3}$, one gets:

T(K)	↗	8.9163		**9.1105653**		9.3065		**12.3973134**		12.41002
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**– 1.322**	↗	– 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.547	↗	0	↗	0.585	↗	13.698	↗	13.763
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.3927	↘	−1.4240	↘	−1.4537	↘	−1.6385	↗	−1.6381

In the degenerate Sn- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sn}) = 1.2255495 \times 10^{17}\ cm^{-3}$, one gets:

T(K)	↗	9.5933		**9.802365**		10.01327		**13.3386885**		13.3523
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**– 1.322**	↗	– 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.588	↗	0	↗	0.630	↗	14.738	↗	14.808
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.4985	↘	−1.5321	↘	−1.5641	↘	−1.7630	↗	−1.7625

For x=0.5,

In the degenerate P- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{P}) = 1.101176 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	17.3758		**17.754391**		18.13639		**24.159506**		24.1842
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**– 1.322**	↗	– 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.065	↗	0	↗	1.141	↗	26.695	↗	26.821

$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−2.7141	↘	−2.7750	↘	−2.8329	↘	−3.1932	↗	−3.1923

In the degenerate As- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{As}) = 1.2360306 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	18.7669		**19.1758274**		19.5884		**26.093743**		26.1205
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.151	↗	0	↗	1.232	↗	28.832	↗	28.969
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−2.9314	↘	−2.9972	↘	−3.0597	↘	−3.4488	↗	−3.4479

In the degenerate Sb- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sb}) = 1.497318 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	21.3263		**21.7910087**		22.2598		**29.652382**		29.6828
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.308	↗	0	↗	1.400	↗	32.764	↗	32.919
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−3.3312	↘	−3.4059	↘	−3.4770	↘	−3.9192	↗	−3.9181

In the degenerate Sn- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sn}) = 1.6710612 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	22.9457		**23.445682**		23.9501		**31.904**		31.9367
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.407	↗	0	↗	1.507	↗	35.252	↗	35.419
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−3.5841	↘	−3.6645	↘	−3.7410	↘	−4.2168	↗	−4.2156

For x=1,

In the degenerate P- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_P) = 6.4846222 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	33.1486		**33.871024**		34.5998		**46.090412**		46.1377
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109

$VC2\left(10^{-4}\frac{V}{K}\right)$	−2.033	↗	0	↗	2.177	↗	50.927	↗	51.169
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$	−5.1778	↘	−5.2940	↘	−5.4045	↘	−6.0918	↗	−6.0902

In the degenerate As- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{As}) = 7.2787562 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	35.8025		**36.582776**		37.3699		**49.780461**		49.831
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−2.196	↗	0	↗	2.351	↗	55.005	↗	55.263
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$	−5.5923	↘	−5.7179	↘	−5.8372	↘	−6.5795	↗	−6.5778

In the degenerate Sb- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sb}) = 8.8174294 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	40.6853		**41.5719**		42.4659		**56.569473**		56.6275
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−2.495	↗	0	↗	2.670	↗	62.506	↗	62.803
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$	−6.3550	↘	−6.4977	↘	−6.6332	↘	−7.4768	↗	−7.4748

In the degenerate Sn- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sn}) = 9.8405712 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	43.7749		**44.728612**		45.691		**60.865006**		60.9274
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−2.684	↗	0	↗	2.875	↗	67.252	↗	67.571
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$	−6.8376	↘	−6.9911	↘	−7.1369	↘	−8.0445	↗	−8.0424

In the $\mathbf{Y(x) \equiv Si_{1-x}Ge_x}$, for a given N and with increasing T, the reduced Fermi-energy ξ_n decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_n \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_n = 1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322 \times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $1.105 \times 10^{-4}\frac{V}{K}$, and $1.657 \times 10^{-4}\frac{V}{K}$, respectively, and (iii) for $\xi_n \simeq 1.8138$, $(ZT)_{Mott} = 1$.

For x=0,

In the degenerate P- $X(x)$ – alloy, for $N = 2\times N_{CDn}(r_P) = 7.0402848\times10^{18}\ cm^{-3}$, one gets:

T(K)	↗	35.0162		**35.779316**		36.54913		**48.68714**		48.737
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−2.148	↗	0	↗	2.300	↗	53.796	↗	54.051
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−5.4695	↘	−5.5923	↘	−5.7090	↘	−6.4350	↗	−6.4333

In the degenerate As- $X(x)$ – alloy, for $N = 2\times N_{CDn}(r_{As}) = 7.3912394\times10^{18}\ cm^{-3}$, one gets:

T(K)	↗	36.1705		**36.958703**		37.753		**50.292008**		50.343
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−2.218	↗	0	↗	2.373	↗	55.570	↗	55.831
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−5.6498	↘	−5.7766	↘	−5.8970	↘	−6.6471	↗	−6.6454

In the degenerate Sb- $X(x)$ – alloy, for $N = 2\times N_{CDn}(r_{Sb}) = 1.041339\times10^{19}\ cm^{-3}$, one gets:

T(K)	↗	45.4573		**46.44796**		47.447		**63.20463**		63.269
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−2.788	↗	0	↗	2.984	↗	69.838	↗	70.167
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−7.1004	↘	−7.2598	↘	−7.4112	↘	−8.3538	↗	−8.3516

In the degenerate Sn- $X(x)$ – alloy, for $N = 2\times N_{CDn}(r_{Sn}) = 1.2022797\times10^{19}\ cm^{-3}$, one gets:

T(K)	↗	50.0279		**51.1182**		52.218		**69.559718**		69.631
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−3.069	↗	0	↗	3.285	↗	76.860	↗	77.224
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−7.8143	↘	−7.9898	↘	−8.1564	↘	−9.1937	↗	−9.1913

For x=0.5,

In the degenerate P- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_P) = 1.1955349 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	18.3547	**18.7546722**	19.1582	**25.520651**	25.5468
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−1.126 ↗	0 ↗	1.205 ↗	28.199 ↗	28.332
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\ (10^{-3}V)$	−2.8670 ↘	−2.9313 ↘	−2.9925 ↘	−3.3731 ↗	−3.3722

In the degenerate As- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{As}) = 1.2551318 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	18.9597	**19.37288**	19.7897	**26.361884**	26.3889
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−1.163 ↗	0 ↗	1.245 ↗	29.128 ↗	29.266
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\ (10^{-3}V)$	−2.9615 ↘	−3.0280 ↘	−3.0911 ↘	−3.4842 ↗	−3.4833

In the degenerate Sb- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sb}) = 1.7683336 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	23.8277	**24.346924**	24.8707	**33.130375**	33.1642
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−1.461 ↗	0 ↗	1.565 ↗	36.607 ↗	36.780
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\ (10^{-3}V)$	−3.7219 ↘	−3.8054 ↘	−3.8848 ↘	−4.3788 ↗	−4.3777

In the degenerate Sn- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sn}) = 2.0416326 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	26.2235	**26.794955**	27.3714	**36.461563**	36.4989
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−1.608 ↗	0 ↗	1.722 ↗	40.288 ↗	40.479
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\ (10^{-3}V)$	−4.0961 ↘	−4.1880 ↘	−4.2754 ↘	−4.8191 ↗	−4.8179

For x=1,

In the degenerate P- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_P) = 8.768005 \times 10^{16}\ cm^{-3}$, one gets:

T(K)	↗	7.6739		**7.841109**		8.0098		**10.669885**		10.6808
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.471	↗	0	↗	0.504	↗	11.790	↗	11.845
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−1.1987	↘	−1.2256	↘	−1.2511	↘	−1.4102	↗	−1.4099

In the degenerate As- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{As}) = 9.2050858 \times 10^{16}\ cm^{-3}$, one gets:

T(K)	↗	7.9269		**8.0995742**		8.2738		**11.021595**		11.0329
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.486	↗	0	↗	0.520	↗	12.178	↗	12.236
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−1.2382	↘	−1.2660	↘	−1.2924	↘	−1.4567	↗	−1.4563

In the degenerate Sb- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sb}) = 1.2968887 \times 10^{17}\ cm^{-3}$, one gets:

T(K)	↗	9.9621		**10.1791635**		10.3981		**13.851422**		13.8656
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.611	↗	0	↗	0.654	↗	15.305	↗	15.377
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−1.5561	↘	−1.5910	↘	−1.6242	↘	−1.8307	↗	−1.8303

In the degenerate Sn- $X(x)$ – alloy, for $N = 2 \times N_{CDn}(r_{Sn}) = 1.4973251 \times 10^{17}\ cm^{-3}$, one gets:

T(K)	↗	10.9639		**11.2026564**		11.4436		**15.244152**		15.2597
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.672	↗	0	↗	0.720	↗	16.844	↗	16.923
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−1.7126	↘	−1.7510	↘	−1.7875	↘	−2.0148	↗	−2.0143

Table 5p:

In the $\mathbf{X(x) \equiv Ge_{1-x}Si_x}$**-crystalline alloy**, for a given N and with increasing T, the reduced Fermi-energy ξ_p decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_p \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_p = 1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322 \times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $1.105 \times 10^{-4}\frac{V}{K}$, and $1.657 \times 10^{-4}\frac{V}{K}$, respectively, and (iii) for $\xi_p \simeq 1.8138$, $(ZT)_{Mott} = 1$.

For x=0,

In the degenerate Ga- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Ga}) = 1.4581211 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	31.746		**32.437895**		33.1358		**44.140265**		44.1855
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.019	↗	0	↗	0.021	↗	0.488	↗	0.490
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−0.49591	↘	−0.5070	↘	−0.5176	↘	−0.5834	↗	−0.5832

In the degenerate Mg- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Mg}) = 1.9149212 \times 10^{18}\ cm^{-3}$, one gets

T(K)	↗	38.071		**38.900712**		39.7377		**52.93462**		52.9889
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.023	↗	0	↗	0.025	↗	0.585	↗	0.588
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−0.5947	↘	−0.6080	↘	−0.6207	↘	−0.6996	↗	−0.6994

In the degenerate In- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{In}) = 2.1803724 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	41.513		**42.417402**		43.33		**57.72**		57.7792
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.025	↗	0	↗	0.027	↗	0.638	↗	0.641
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−0.6484	↘	−0.6630	↘	−0.6768	↘	−0.7629	↗	−0.7627

In the degenerate Cd- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Cd}) = 2.5221376 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	45.745	**46.741516**	47.7472	**63.604092**	63.669
ξ_p	↘	1.880	**1.8138**	1.750	**1**	0.998

$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$	−0.028	↗	0	↗	0.030	↗	0.703	↗	0.706
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−0.7145	↘	−0.7306	↘	−0.7458	↘	−0.8406	↗	−0.8404

For x=0.5,

In the degenerate Ga- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Ga}) = 6.2823408 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	60.014		**61.3216**		62.641		**83.44412**		83.5297
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$	−0.037	↗	0	↗	0.039	↗	0.922	↗	0.926
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−0.9374	↘	−0.9584	↘	−0.9784	↘	−1.1029	↗	−1.1026

In the degenerate Mg- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Mg}) = 8.2504722 \times 10^{18}\ cm^{-3}$, one gets

T(K) ↗	71.971		**73.539108**		75.1213		**100.06924**		100.1719
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$	−0.044	↗	0	↗	0.047	↗	1.106	↗	1.110
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−1.1242	↘	−1.1494	↘	−1.1734	↘	−1.3226	↗	−1.3223

In the degenerate In- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{In}) = 9.394174 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	78.477		**80.18717**		81.912		**109.115677**		109.227
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$	−0.048	↗	0	↗	0.051	↗	1.206	↗	1.211
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−1.2258	↘	−1.2533	↘	−1.2795	↘	−1.4422	↗	−1.4418

In the degenerate Cd- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Cd}) = 1.0866675 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	86.477		**88.361608**		90.262		**120.23914**		120.362
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.053	↗	0	↗	0.057	↗	1.328	↗	1.334
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−1.3508	↘	−1.3811	↘	−1.4098	↘	−1.5892	↗	−1.5888

For x=1,

In the degenerate Ga- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Ga}) = 2.268738 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	109.844		**112.23677**		114.651		**152.72756**		152.884
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.067	↗	0	↗	0.072	↗	1.687	↗	1.695
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−1.7158	↘	−1.7542	↘	−1.7908	↘	−2.0186	↗	−2.0181

In the degenerate Mg- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Mg}) = 2.979488 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	131.73		**134.5984**		137.49		**183.156**		183.344
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.081	↗	0	↗	0.086	↗	2.024	↗	2.033
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−2.0576	↘	−2.1038	↘	−2.1476	↘	−2.4208	↗	−2.4201

In the degenerate In- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{In}) = 3.3925124 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	143.645		**146.7663**		149.919		**199.714**		199.919
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.088	↗	0	↗	0.094	↗	2.207	↗	2.217
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−2.2437	↘	−2.2939	↘	−2.3417	↘	−2.6396	↗	−2.6389

In the degenerate Cd- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{In}) = 3.9242758 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	158.290		**161.728**		165.199		**220.072**		220.299
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.097	↗	0	↗	0.104	↗	2.432	↗	2.443
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−2.4725	↘	−2.5278	↘	−2.5804	↘	−2.9087	↗	−2.9079

In the $Y(x) \equiv Si_{1-x}Ge_x$, for a given N and with increasing T, the reduced Fermi-energy ξ_p decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_p \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_p = 1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322 \times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $1.105 \times 10^{-4}\frac{V}{K}$, and $1.657 \times 10^{-4}\frac{V}{K}$, respectively, and (iii) for $\xi_p \simeq 1.8138$, $(ZT)_{Mott} = 1$.

For x=0,

In the degenerate Ga- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Ga}) = 2.4238482 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	114.795		**117.295822**		119.8099		**159.61173**		159.775
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.070	↗	0	↗	0.075	↗	1.764	↗	1.772
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−1.7931	↘	−1.8333	↘	−1.8714	↘	−2.1096	↗	−2.1090

In the degenerate Mg- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Mg}) = 3.6402136 \times 10^{19}\ cm^{-3}$, one gets

T(K)	↗	150.5453		**153.826153**		157.135		**209.32083**		209.535
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.098	↗	2.313	↗	2.324
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−2.3515	↘	−2.4043	↘	−2.4544	↘	−2.7666	↗	−2.7659

In the degenerate In- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{In}) = 4.2660254 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	167.34		**170.986263**		174.665		**232.67166**		232.91
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320

ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.103	↗	0	↗	0.109	↗	2.571	↗	2.583
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−2.6138	↘	−2.6725	↘	−2.7283	↘	−3.0752	↗	−3.0744

In the degenerate Cd- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Cd}) = 5.0523546 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	187.318		**191.3998**		195.518		**260.44963**		260.716
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.115	↗	0	↗	0.123	↗	2.878	↗	2.891
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−2.9259	↘	−2.9916	↘	−3.0540	↘	−3.4424	↗	−3.4415

For x=0.5,

In the degenerate Ga- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Ga}) = 6.7118554 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	62.719		**64.085663**		65.464		**87.205352**		87.294
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.038	↗	0	↗	0.041	↗	0.963	↗	0.968
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−0.9797	↘	−1.0016	↘	−1.0225	↘	−1.1526	↗	−1.1523

In the degenerate Mg- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{Mg}) = 1.0080081 \times 10^{19}\ cm^{-3}$, one gets

T(K)	↗	82.252		**84.044347**		85.852		**114.364375**		114.481
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.050	↗	0	↗	0.054	↗	1.264	↗	1.269
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−1.2848	↘	−1.3136	↘	−1.3410	↘	−1.5115	↗	−1.5112

In the degenerate In- $X(x)$ – alloy, for $N = 2 \times N_{CD_p}(r_{In}) = 1.1813011 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	91.429		**93.419934**		95.429		**127.122322**		127.252
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998

$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.056	↗	0	↗	0.060	↗	1.405	↗	1.411
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−1.4281	↘	−1.4601	↘	−1.4906	↘	−1.6802	↗	−1.6797

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In the degenerate Cd- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Cd}) = 1.3990428 \times 10^{19}\ cm^{-3}$, one gets:

T(K)	↗	102.343		**104.57306**		106.823		**142.299077**		142.445
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.063	↗	0	↗	0.067	↗	1.572	↗	1.579
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−1.5986	↘	−1.6345	↘	−1.6686	↘	−1.8808	↗	−1.8803

For x=1,

In the degenerate Ga- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Ga}) = 1.5578107 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	33.177		**33.900029**		34.629		**46.12988**		46.1772
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.020	↗	0	↗	0.022	↗	0.510	↗	0.512
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−0.5182	↘	−0.5298	↘	−0.5409	↘	−0.6097	↗	−0.6095

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In the degenerate Mg- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{Mg}) = 2.3395704 \times 10^{18}\ cm^{-3}$, one gets:

T(K)	↗	43.5096		**44.457772**		45.414		**60.496458**		60.558
ξ_p	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT		0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$		−0.027	↗	0	↗	0.028	↗	0.668	↗	0.672
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$		−0.6796	↘	−0.6949	↘	−0.7094	↘	−0.7996	↗	−0.7994

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In the degenerate In- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{In}) = 2.7417806 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	48.364		**49.417269**		50.4805		**67.245155**		67.314
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$	−0.030	↗	0	↗	0.031	↗	0.743	↗	0.746
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−0.7554	↘	−0.7724	↘	−0.7885	↘	−0.8888	↗	−0.8885

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In the degenerate Cd- $X(x)$ – alloy, for $N = 2 \times N_{CDp}(r_{In}) = 3.2471554 \times 10^{18}\ cm^{-3}$, one gets:

T(K) ↗	54.1372		**55.317048**		56.5072		**75.273351**		75.3505
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.998	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-2}\frac{V}{K}\right)$	−0.033	↗	0	↗	0.035	↗	0.832	↗	0.836
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−0.8456	↘	−0.8646	↘	−0.8826	↘	−0.9949	↗	−0.9946

Table 6n

In the $X(x) \equiv Ge_{1-x}Si_x$**-crystalline alloy**, for a given T and with decreasing N, the reduced Fermi-energy ξ_n decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_n \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_n = 1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322 \times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $-1.105 \times 10^{-4}\frac{V}{K}$, and $1.657 \times 10^{-4}\frac{V}{K}$, respectively, and (iii) for $\xi_n \simeq 1.8138$, $(ZT)_{Mott} = 1$.

For x=0,

In the degenerate P- $X(x)$ – alloy, for T= **7.422903 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	8.2087		**8.0759802**		7.9491		**6.5818422**		6.57794
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−0.455	↗	0	↗	0.467	↗	8.202	↗	8.232
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$	−1.1594	↘	−1.1602	↗	−1.1594	↗	−0.9811	↗	−0.9798

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In the degenerate As- $X(x)$ – alloy, for T= **8.017189 K**, one gets:

$N(10^{18}cm^{-3})$	↘	9.21397		**9.0649986**		8.9226		**7.3878823**		7.3835
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.492	↗	0	↗	0.504	↗	8.858	↗	8.891
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−1.2523	↘	−1.2531	↗	−1.2523	↗	−1.0596	↗	−1.0583

In the degenerate Sb- $X(x)$ – alloy, for T= **9.1105653 K**, one gets:

$N(10^{17}cm^{-3})$	↘	1.11617		**1.098127**		1.08088		**0.89496236**		7.3835
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.559	↗	0	↗	0.573	↗	10.067	↗	10.103
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−1.4231	↘	−1.4240	↗	−1.4231	↗	−1.2041	↗	−1.2026

In the degenerate Sn- $X(x)$ – alloy, for T=**9.802365 K**, one gets:

$N(10^{17}cm^{-3})$	↘	1.24568		**1.2255495**		1.2063		**0.99881048**		0.99822
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−0.601	↗	0	↗	0.616	↗	10.831	↗	10.871
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−1.5311	↘	−1.5321	↗	−1.5311	↗	−1.2956	↗	−1.2939

For x=0.5,

In the degenerate P- $X(x)$ – alloy, for T=**17.754391 K**, one gets:

$N(10^{18}cm^{-3})$	↘	1.11927		**1.101176**		1.0839		**0.89744727**		0.896915
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.089	↗	0	↗	1.115	↗	19.618	↗	19.690
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−2.7732	↘	−2.7750	↗	−2.7732	↗	−2.3466	↗	−2.3436

In the degenerate As- $X(x)$ – alloy, for T= **19.1758274 K**, one gets:

$N(10^{18}cm^{-3})$	↘	1.25634		**1.2360306**		1.21661		**1.00735243**		1.00676
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.176	↗	0	↗	1.206	↗	21.188	↗	21.266
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−2.9953	↘	−2.9972	↗	−2.9953	↗	−2.5345	↗	−2.5312

In the degenerate Sb- $X(x)$ – alloy, for T=**21.7910087 K**, one gets

$N(10^{18}cm^{-3})$	↘	1.52192		**1.497318**		1.47379		**1.22029902**		1.21958
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.336	↗	0	↗	1.371	↗	24.078	↗	24.167
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−3.4037	↘	−3.4059	↗	−3.4037	↗	−2.8801	↗	−2.8764

In the degenerate Sn- $X(x)$ – alloy, for T=**23.445682 K** one gets:

$N(10^{18}cm^{-3})$	↘	1.69852		**1.6710612**		1.64481		**1.36189797**		1.36109
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.438	↗	0	↗	1.475	↗	25.906	↗	26.002
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−3.6622	↘	−3.6645	↗	−3.6622	↗	−3.0988	↗	−3.0948

For x=1,
In the degenerate P- $X(x)$ – alloy, for T=**33.871024 K**, one gets:

$N(10^{18}cm^{-3})$	↘	6.59119		**6.4846222**		6.3828		**5.2849015**		5.28177
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−2.078	↗	0	↗	2.129	↗	37.426	↗	37.564
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−5.2906	↘	−5.2940	↗	−5.0926	↗	−4.4767	↗	−4.4710

In the degenerate As- $X(x)$ – alloy, for T=**36.582776 K**, one gets:

$N(10^{18}cm^{-3})$	↘	7.39837		**7.2787562**		7.16438		**5.9321127**		5.9286
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−2.244	↗	0	↗	2.302	↗	40.422	↗	40.572
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−5.7142	↘	−5.7179	↗	−5.7142	↗	−4.8351	↗	−4.8289

In the degenerate Sb- $X(x)$ – alloy, for T=**41.5719 K**, one gets:

$N(10^{18}cm^{-3})$	↘	8.9623		**8.8174294**		8.6789		**7.18611577**		7.18185
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−2.549	↗	0	↗	2.615	↗	45.935	↗	46.105
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−6.4935	↘	−6.4977	↗	−6.4935	↗	−5.4946	↗	−5.4875

In the degenerate Sn- $X(x)$ – alloy, for T=**44.728612 K**, one gets:

$N(10^{18}cm^{-3})$	↘	10.0023		**9.8405712**		9.686		**8.019966**		8.01521
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−2.744	↗	0	↗	2.813	↗	49.423	↗	49.606
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−6.9866	↘	−6.9911	↗	−6.9866	↗	−5.9118	↗	−5.9042

In the $\mathbf{Y(x) \equiv Si_{1-x}Ge_x}$, for a given T and with decreasing N, the reduced Fermi-energy ξ_n decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_n \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_n = 1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322 \times 10^{-4}\frac{V}{K}$, 0.715, 3.290, $-1.105 \times 10^{-4}\frac{V}{K}$, and $1.657 \times 10^{-4}\frac{V}{K}$, respectively, and (iii) for $\xi_n \simeq 1.8138$, $(ZT)_{Mott} = 1$.

For x=0,

In the degenerate P- $X(x)$ – alloy, for T= **35.779316 K**, one gets:

$N(10^{18}cm^{-3})$	↘	7.1559		**7.0402848**		6.9297		**5.737761**		5.7344
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713

$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−2.193 ↗	0 ↗	2.250 ↗	39.534 ↗	39.679
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\,(10^{-3}V)$	−5.5887 ↘	−5.5923 ↗	−5.5887 ↗	−4.7290 ↗	−4.7229

In the degenerate As- $X(x)$ – alloy, for T= **36.958703 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	7.5127	**7.3912394**	7.2751	**6.0237853**	6.02021
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−2.267 ↗	0 ↗	2.325 ↗	40.837 ↗	40.989
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\,(10^{-3}V)$	−5.7729 ↘	−5.7766 ↗	−5.7729 ↗	−4.8848 ↗	−4.8785

In the degenerate Sb- $X(x)$ – alloy, for T= **46.44796 K**, one gets:

$N(10^{19}cm^{-3})$ ↘	1.058452	**1.041339**	1.02498	**0.84868079**	0.848177
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−2.849 ↗	0 ↗	2.922 ↗	51.322 ↗	51.513
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\,(10^{-3}V)$	−7.2552 ↘	−7.2598 ↗	−7.2552 ↗	−6.1390 ↗	−6.1311

In the degenerate Sn- $X(x)$ – alloy, for T=**51.1182 K**, one gets:

$N(10^{19}cm^{-3})$ ↘	1.22203	**1.2022797**	1.1834	**0.9798458**	0.979264
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061 ↗	0 ↗	0.063 ↗	**1.105** ↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$	−3.134 ↗	0 ↗	3.214 ↗	56.483 ↗	56.693
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092 ↗	0 ↗	0.094 ↗	**1.657** ↗	1.663
$Pt\,(10^{-3}V)$	−7.9847 ↘	−7.9898 ↗	−7.9847 ↗	−6.7563 ↗	−6.7476

For x=0.5,

In the degenerate P- $X(x)$ – alloy, for T=**18.7546722 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	1.21518	**1.1955349**	1.1768	**0.97434888**	0.973771
ξ_n ↘	1.880	**1.8138**	1.750	**1**	0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562 ↘	**−1.563** ↗	−1.562 ↗	**− 1.322** ↗	− 1.320
ZT	0.999 ↗	**1** ↘	0.999 ↘	**0.715** ↘	0.713
$(ZT)_{Mott}$ ↗	0.931	**1**	1.074	**3.290**	3.306

$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.150	↗	0	↗	1.177	↗	20.723	↗	20.799
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−2.9295	↘	−2.9313	↗	−2.9295	↗	−2.4788	↗	−2.4756

In the degenerate As- X(x) – alloy, for T= **19.37288 K**, one gets:

$N(10^{18}cm^{-3})$	↘	1.27575		**1.2551318**		1.23541		**1.0229197**		1.02232
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.188	↗	0	↗	1.219	↗	21.406	↗	21.484
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−3.0260	↘	−3.0280	↗	−3.0260	↗	−2.5605	↗	−2.5573

In the degenerate Sb- X(x) – alloy, for T=**24.346924 K**, one gets:

$N(10^{18}cm^{-3})$	↘	1.79739		**1.7683336**		1.74055		**1.441174**		1.44032
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.493	↗	0	↗	1.532	↗	26.902	↗	27.002
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−3.8030	↘	−3.8054	↗	−3.8030	↗	−3.2179	↗	−3.2138

In the degenerate Sn- X(x) – alloy, for T=**26.794955 K** one gets:

$N(10^{18}cm^{-3})$	↘	2.07509		**2.0416326**		2.00956		**1.66390992**		1.66293
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\left(10^{-4}\frac{V}{K}\right)$		−1.639	↗	0	↗	1.685	↗	29.607	↗	29.716
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-3}V)$		−4.1854	↘	−4.1880	↗	−4.1854	↗	−3.5415	↗	−3.5370

For x=1,

In the degenerate P- X(x) – alloy, for T=**7.841109 K**, one gets:

$N(10^{18}cm^{-3})$	↘	8.9121		**8.768005**		8.6303		**7.1458355**		7.1416
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306

VC1 $\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $\left(10^{-4}\frac{V}{K}\right)$		−0.481	↗	0	↗	0.493	↗	8.664	↗	8.696
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.2248	↘	−1.2256	↗	−1.2248	↗	−1.0364	↗	−1.0350

In the degenerate As- $X(x)$ – alloy, for T=**8.0995742 K**, one gets:

$N(10^{18}cm^{-3})$	↘	9.3563		**9.2050858**		9.061		**7.502051**		7.4976
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
VC1 $\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $\left(10^{-4}\frac{V}{K}\right)$		−0.497	↗	0	↗	0.507	↗	8.949	↗	8.983
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.2651	↘	−1.2660	↗	−1.2651	↗	−1.0705	↗	−1.0691

In the degenerate Sb- $X(x)$ – alloy, for T=**10.1791635 K**, one gets:

$N(10^{17}cm^{-3})$	↘	1.3182		**1.2968887**		1.27651		**1.0569511**		1.05633
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
VC1 $\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $\left(10^{-4}\frac{V}{K}\right)$		−0.624	↗	0	↗	0.640	↗	11.247	↗	11.288
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.5900	↘	−1.5910	↗	−1.5900	↗	−1.3454	↗	−1.3437

In the degenerate Sn- $X(x)$ – alloy, for T=**11.2026564 K**, one gets:

$N(10^{17}cm^{-3})$	↘	1.5219		**1.4973251**		1.4738		**1.22030477**		1.21958
ξ_n	↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$		−1.562	↘	**−1.563**	↗	−1.562	↗	**− 1.322**	↗	− 1.320
ZT		0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$	↗	0.931		**1**		1.074		**3.290**		3.306
VC1 $\left(10^{-4}\frac{V}{K}\right)$		−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $\left(10^{-4}\frac{V}{K}\right)$		−0.686	↗	0	↗	0.705	↗	12.378	↗	12.424
$T_s\left(10^{-4}\frac{V}{K}\right)$		−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-3}V)$		−1.7498	↘	−1.7510	↗	−1.7498	↗	−1.4806	↗	−1.4787

Table 6p

In the $X(x) \equiv Ge_{1-x}Si_x$**-crystalline alloy**, for a given T and with decreasing N, the reduced Fermi-energy ξ_p decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_p \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.}\left(\simeq -1.563 \times 10^{-4}\frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_p = 1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322\times10^{-4}\frac{V}{K}$, 0.715, 3.290, $-1.105\times10^{-4}\frac{V}{K}$, and $1.657\times10^{-4}\frac{V}{K}$, respectively, and (iii) for $\xi_p \simeq 1.8138$, $(ZT)_{Mott}=1$.

For x=0,

In the degenerate Ga- $X(x)$ – alloy, for T=**32.437895 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	1.48208		**1.4581211**		1.43522		**1.18836**		1.18765
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.020	↗	0	↗	0.020	↗	0.358	↗	0.360
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−0.5067	↘	−0.5070	↗	−0.5067	↗	−0.4287	↗	−0.4219

In the degenerate Mg- $X(x)$ – alloy, for T= **38.900712** K, one gets:

$N(10^{18}cm^{-3})$ ↘	1.94629		**1.9149212**		1.88484		**1.56065**		1.55972
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.024	↗	0	↗	0.024	↗	0.430	↗	0.431
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−0.6076	↘	−0.6080	↗	−0.6076	↗	−0.5141	↗	−0.5135

In the degenerate In- $X(x)$ – alloy, for T=**42.417402 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	2.2162		**2.1803724**		1.14613		**1.776982**		1.77593
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.026	↗	0	↗	0.027	↗	0.469	↗	0.470
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2}V)$	−0.6625	↘	−0.6630	↗	−0.6625	↗	−0.5606	↗	−0.5599

In the degenerate Cd- $X(x)$ – alloy, for T=**46.741516 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	2.5635		**2.5221376**		2.4826		**2.05552**		2.0543
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.029	↗	0	↗	0.029	↗	0.516	↗	0.518
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663

Pt $(10^{-2}V)$	−0.7301	↘	−0.7306	↗	−0.7301	↗	−0.6178	↗	−0.6170

For x=0.5,

In the degenerate Ga- X(x) – alloy, for T=**61.3216** K, one gets:

$N(10^{18}cm^{-3})$ ↘	6.38558		**6.2823408**		6.6065		**5.12005**		5.11701
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.038	↗	0	↗	0.038	↗	0.677	↗	0.680
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−0.9578	↘	−0.9584	↗	−0.9578	↗	−0.8105	↗	−0.8094

In the degenerate Mg- X(x) – alloy, for **T=73.539108 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	8.386		**8.2504722**		8.12083		**6.72406**		6.7201
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.045	↗	0	↗	0.046	↗	0.812	↗	0.815
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−1.1487	↘	−1.1494	↗	−1.1487	↗	−0.9720	↗	−0.9707

In the degenerate In- X(x) – alloy, for T=**80.18717 K**, one gets:

$N(10^{18}cm^{-3})$ ↘	9.5485		**9.394174**		9.2467		**7.6562**		7.65161
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.049	↗	0	↗	0.050	↗	0.889	↗	0.815
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−1.2525	↘	−1.2533	↗	−1.2525	↗	−1.0598	↗	−1.0585

In the degenerate Cd- X(x) – alloy, for T=**88.361608 K**, one gets:

$N(10^{19}cm^{-3})$ ↘	1.10452		**1.0866675**		1.0696		**0.885624**		0.8851
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.054	↗	0	↗	0.055	↗	0.976	↗	0.980
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−1.3802	↘	−1.3811	↗	−1.3802	↗	−1.1679	↗	−1.1664

For x=1,

In the degenerate Ga- X(x) – alloy, for T=**112.23677** K, one gets:

$N(10^{19}cm^{-3})$ ↘	2.30599		**2.268738**		2.2331		**1.8490**		1.84791
ξ_D ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.069	↗	0	↗	0.070	↗	1.240	↗	1.245
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt(10^{-2}V)$	−1.7531	↘	−1.7542	↗	−1.7531	↗	−1.4834	↗	−1.4815

In the degenerate Mg- X(x) – alloy, for T=**134.5984** K, one gets:

$N(10^{19}cm^{-3})$ ↘	3.02845		**2.979488**		2.9327		**2.4283**		2.42682
ξ_D ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.082	↗	0	↗	0.085	↗	1.487	↗	1.493
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt(10^{-2}V)$	−2.1024	↘	−2.1038	↗	−2.1024	↗	−1.7791	↗	−1.7767

In the degenerate In- X(x) – alloy, for T=**146.7663** K, one gets:

$N(10^{19}cm^{-3})$ ↘	3.44826		**3.3925124**		3.3393		**2.76489**		2.76323
ξ_D ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.090	↗	0	↗	0.092	↗	1.621	↗	1.628
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt(10^{-2}V)$	−2.2925	↘	−2.2939	↗	−2.2925	↗	−1.9398	↗	−1.9373

In the degenerate Cd- X(x) – alloy, for T=**161.728** K, one gets:

$N(10^{19}cm^{-3})$ ↘	3.98876		**3.9242758**		3.8627		**3.19825**		3.19635
ξ_D ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2}V)$	−0.099	↗	0	↗	0.102	↗	1.787	↗	1.793
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt(10^{-2}V)$	−2.5262	↘	−2.5278	↗	−2.5262	↗	−2.1376	↗	−2.1348

In the $Y(x) \equiv Si_{1-x}Ge_x$, for a given T and with decreasing N, the reduced Fermi-energy ξ_p decreases, and other thermoelectric coefficients are in variations, as indicated by the arrows as: (increase: ↗, decrease: ↘). One notes here that with increasing T: (i) for $\xi_p \simeq 1.8138$, while the numerical results of S present a same minimum $(S)_{min.} \left(\simeq -1.563 \times 10^{-4} \frac{V}{K}\right)$, those of ZT show a same maximum $(ZT)_{max.} = 1$, (ii) for $\xi_p = 1$, those of S, ZT, $(ZT)_{Mott}$, VC1, and T_s present the same results: $-1.322 \times 10^{-4} \frac{V}{K}$, 0.715, 3.290, $-1.105 \times 10^{-4} \frac{V}{K}$, and $1.657 \times 10^{-4} \frac{V}{K}$, respectively, and (iii) for $\xi_p \simeq 1.8138$, $(ZT)_{Mott} = 1$.

For x=0,

In the degenerate Ga- $X(x)$ – alloy, for T=**117.295822 K**, one gets:

$N(10^{19} cm^{-3})$ ↘	2.46368		**2.4238482**		2.38577		**1.97541176**		1.97424
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4} \frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4} \frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2} V)$	−0.072	↗	0	↗	0.074	↗	1.296	↗	1.301
$T_s\left(10^{-4} \frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2} V)$	−1.8322	↘	−1.8333	↗	−1.8322	↗	−1.5503	↗	−1.5483

In the degenerate Mg- $X(x)$ – alloy, for T= **153.826153** K, one gets:

$N(10^{19} cm^{-3})$ ↘	3.70001		**3.6402136**		3.5831		**2.9667373**		2.96499
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4} \frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4} \frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2} V)$	−0.094	↗	0	↗	0.097	↗	1.700	↗	1.706
$T_s\left(10^{-4} \frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2} V)$	−2.4028	↘	−2.4043	↗	−2.4028	↗	−2.0331	↗	−2.0305

In the degenerate In- $X(x)$ – alloy, for T=**170.986263 K**, one gets:

$N(10^{19} cm^{-3})$ ↘	4.3361		**4.2660254**		4.199		**3.47676751**		3.474703
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4} \frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4} \frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2(10^{-2} V)$	−0.105	↗	0	↗	0.107	↗	1.889	↗	1.896
$T_s\left(10^{-4} \frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\ (10^{-2} V)$	−2.6708	↘	−2.6725	↗	−2.6708	↗	−2.2599	↗	−2.2570

In the degenerate Cd- $X(x)$ – alloy, for T=**191.3998 K**, one gets:

$N(10^{19} cm^{-3})$ ↘	5.13538		**5.0523546**		4.973		**4.11761786**		4.11518
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4} \frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		1		1.074		**3.290**		3.306

VC1 $\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $(10^{-2}V)$	−0.117	↗	0	↗	0.120	↗	2.115	↗	2.122
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−2.9897	↘	−2.9916	↗	−2.9897	↗	−2.5297	↗	−2.5265

For x=0.5,

In the degenerate Ga- X(x) – alloy, for T=**64.085663** K, one gets:

$N(10^{18}cm^{-3})$ ↘	6.8221		**6.7118554**		6.6065		**5.4700943**		5.46685
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
VC1 $\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $(10^{-2}V)$	−0.039	↗	0	↗	0.040	↗	0.708	↗	0.710
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−1.0010	↘	−1.0016	↗	−1.0010	↗	−0.8470	↗	−0.8459

In the degenerate Mg- X(x) – alloy, for **T=84.044347 K**, one gets:

$N(10^{19}cm^{-3})$ ↘	1.02457		**1.0080081**		0.99219		**0.82151643**		0.82103
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
VC1 $\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $(10^{-2}V)$	−0.051	↗	0	↗	0.052	↗	0.929	↗	0.932
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−1.3128	↘	−1.3136	↗	−1.3128	↗	−1.1108	↗	−1.1094

In the degenerate In- X(x) – alloy, for T=**93.419934 K**, one gets:

$N(10^{19}cm^{-3})$ ↘	1.20071		**1.1813011**		1.16274		**0.96274844**		0.96218
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
VC1 $\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
VC2 $(10^{-2}V)$	−0.057	↗	0	↗	0.059	↗	1.032	↗	1.036
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
Pt $(10^{-2}V)$	−1.4592	↘	−1.4601	↗	−1.4592	↗	−1.2347	↗	−1.2331

In the degenerate Cd- X(x) – alloy, for T=**104.57306 K**, one gets:

$N(10^{19}cm^{-3})$ ↘	1.42203		**1.3990428**		1.37707		**1.14020573**		1.13953
ξ_n ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
VC1 $\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109

$VC2\,(10^{-2}V)$	−0.064	↗	0	↗	0.066	↗	1.155	↗	1.160
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\,(10^{-2}V)$	−1.6334	↘	−1.6345	↗	−1.6334	↗	−1.3821	↗	−1.3804

For x=1,

In the degenerate Ga- $X(x)$ – alloy, for T=**33.900029** K, one gets:

$N(10^{18}cm^{-3})$ ↘	1.5834		**1.5578107**		1.53334		**1.2696**		1.26885
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\,(10^{-2}V)$	−0.021	↗	0	↗	0.021	↗	0.374	↗	0.376
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\,(10^{-2}V)$	−0.5295	↘	−0.5298	↗	−0.5295	↗	−0.4480	↗	−0.4475

In the degenerate Mg- $X(x)$ – alloy, for T=**44.457772** K, one gets:

$N(10^{18}cm^{-3})$ ↘	2.3780		**2.3395704**		2.30281		**1.90672621**		1.9056
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\,(10^{-2}V)$	−0.027	↗	0	↗	0.028	↗	0.491	↗	0.493
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\,(10^{-2}V)$	−0.6944	↘	−0.6949	↗	−0.6944	↗	−0.5876	↗	−0.5868

In the degenerate In- $X(x)$ – alloy, for T=**49.417269** K, one gets:

$N(10^{18}cm^{-3})$ ↘	2.78683		**2.7417806**		2.6987		**2.23452345**		2.2332
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109
$VC2\,(10^{-2}V)$	−0.030	↗	0	↗	0.031	↗	0.546	↗	0.548
$T_s\left(10^{-4}\frac{V}{K}\right)$	−0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\,(10^{-2}V)$	−0.7719	↘	−0.7724	↗	−0.7719	↗	−0.6531	↗	−0.6523

In the degenerate Cd- $X(x)$ – alloy, for T=**55.317048** K, one gets:

$N(10^{18}cm^{-3})$ ↘	3.3005		**3.2471554**		3.1962		**2.6463988**		2.64483
ξ_p ↘	1.880		**1.8138**		1.750		**1**		0.998
$S\left(10^{-4}\frac{V}{K}\right)$	−1.562	↘	**−1.563**	↗	−1.562	↗	**−1.322**	↗	−1.320
ZT	0.999	↗	**1**	↘	0.999	↘	**0.715**	↘	0.713
$(ZT)_{Mott}$ ↗	0.931		**1**		1.074		**3.290**		3.306
$VC1\left(10^{-4}\frac{V}{K}\right)$	−0.061	↗	0	↗	0.063	↗	**1.105**	↗	1.109

$VC2\,(10^{-2}V)$	–0.034	↗	0	↗	0.035	↗	0.611	↗	0.613
$T_s\left(10^{-4}\frac{V}{K}\right)$	–0.092	↗	0	↗	0.094	↗	**1.657**	↗	1.663
$Pt\,(10^{-2}V)$	–0.8640	↘	–0.8646	↗	–0.8640	↗	–0.7311	↗	–0.7302