A. External result for XRD

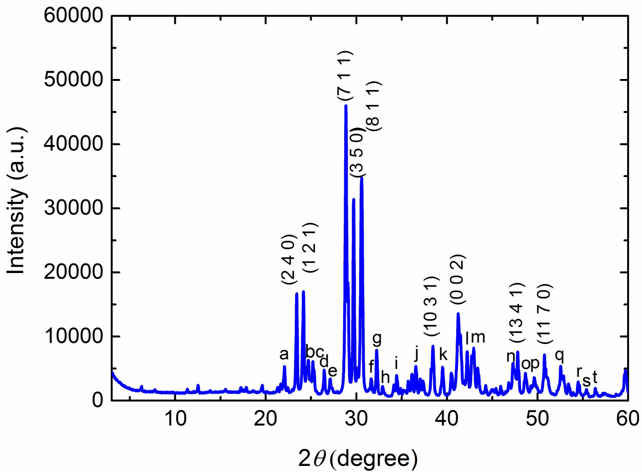

Figure S1. Powder x-ray diffraction pattern (Cu *Kα* radiation) of $EuBiSe_3$ fiber

The dates of diffraction angle of peaks measured and simulated from the reported single crystal structure of $EuBiSe_3$ [1] are listed as follows：

peak code	(h k l)	2*θ*(measured)	2*θ*(simulated)
a	(8 1 0)	22.06	22.06
b	(2 21)	24.68	24.54
c	(7 3 0)	25.20	25.34
d	(5 4 0)	26.44	26.46
e	(6 1 1)	27.12	27.11
f	(6 3 1)	31.62	31.66
g	(8 2 1)	32.24	32.26
h	(6 5 0)	32.90	32.90
i	(9 2 1)	34.44	34.15
j	(9 3 1)	36.56	36.57
k	(14 2 0)	39.52	39.54
l	(5 6 1)	42.24	43.02
m	(11 4 1)	42.94	43.43
n	(4 7 1)	47.30	47.35
o	(16 0 1)	48.68	48.69
p	(3 4 2)	49.64	49.74
q	(3 5 2)	52.56	52.96
r	(4 5 2)	54.48	53.50

s	**(13 7 0)**	**55.40**	**54.52**
t	**(6 9 0)**	**56.40**	**56.44**

B. The temperature-dependent experimental data of two samples

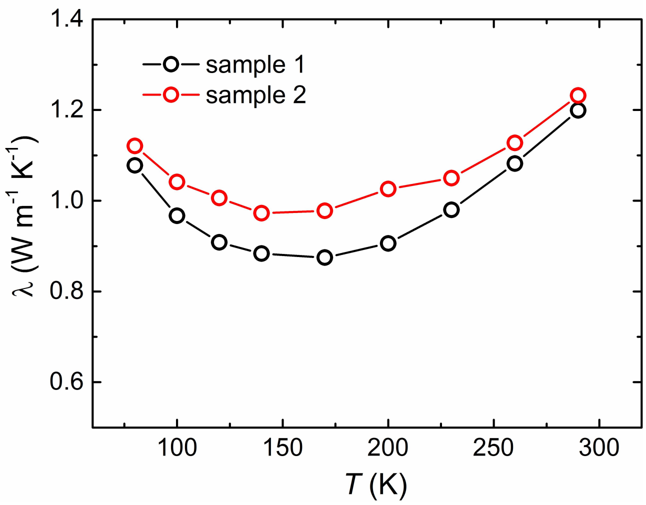

Figure S2. Temperature dependence of thermal conductivity of two $EuBiSe_3$ fiber samples

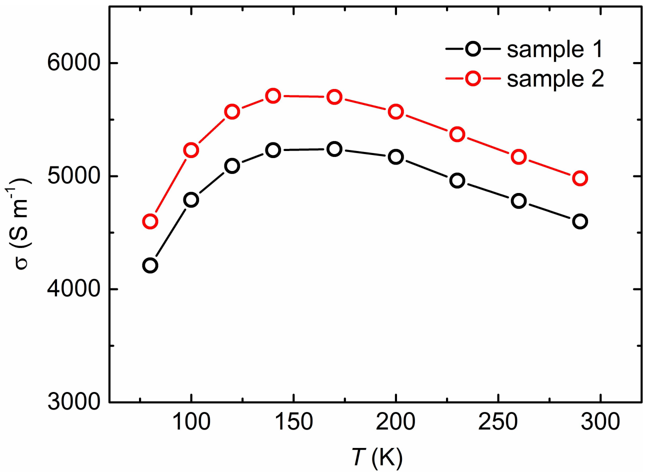

Figure S3. Temperature dependence of electrical conductivity of two $EuBiSe_3$ fiber samples

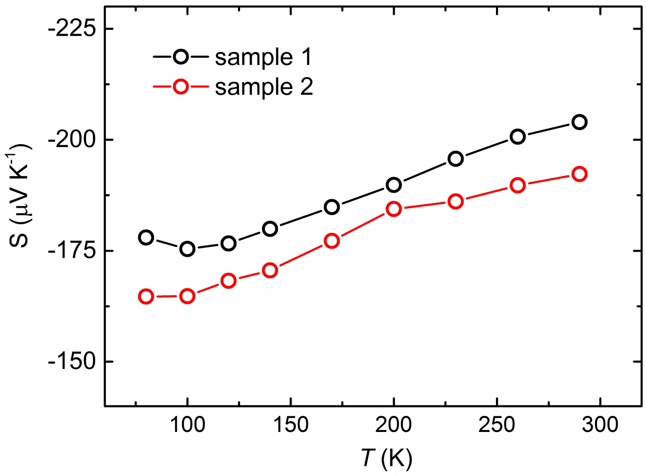

Figure S4. Temperature dependence of Seebeck coefficient of two $EuBiSe_3$ fiber samples

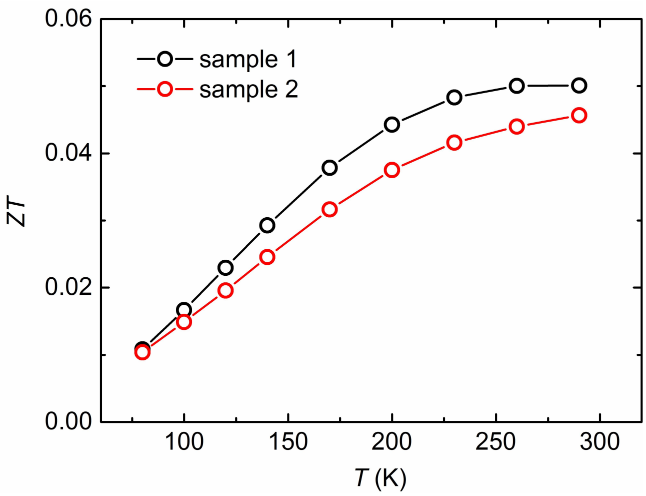

Figure S5. Temperature dependence of figure of merit of two $EuBiSe_3$ fiber samples

C. The calculation for the carrier concentration, mobility and effective mass

We calculated the carrier concentration, mobility and effective mass using a single parabolic band (SPB) approximation and the formula of Fermi energy[2]. In this model, the equations are expressed as follows:

$$S = \frac{k_B}{q}\left[\left(\frac{5}{2}+\gamma\right) + In\frac{2(2\pi m^* k_B T)^{\frac{3}{2}}}{nh^3} \right] \quad (1)$$

$$m^* = \frac{h^2}{2k_B T}\left(\frac{n}{4\pi F_{\frac{1}{2}}(\zeta_F)}\right)^{\frac{2}{3}} \tag{2}$$

With Fermi integral

$$F_i(\xi_F) = \int_0^\infty \frac{x^i}{1+e^{(x-\xi_F)}}dx \tag{3}$$

Reduced Fermi level

$$\xi_F = \frac{E_F}{k_B T} \tag{4}$$

Fermi energy

$$E_F = \frac{h^2}{2m_e}\left(\frac{3n}{8\pi}\right)^{\frac{2}{3}} \tag{5}$$

Electrical conductivity

$$\sigma = nq\mu \tag{6}$$

Where h is the Plank constant (6.626×10^{-34} J/s), k_B is the Boltaman constant (1.38×10^{-23} J/K), m^* is the carrier effective mass, m_e is the electron rest mass (9.109×10^{-31} kg), q is the quantity of electric charge(1.6×10^{-19} C), n is the carrier concentration, γ is scattering factor and E_F is the Fermi energy. In our calculations, the carrier scattering factor γ=3/2. The temperature dependences of carrier mobility, concentration and effective mass of $EuBiSe_3$ fiber are shown as follows:

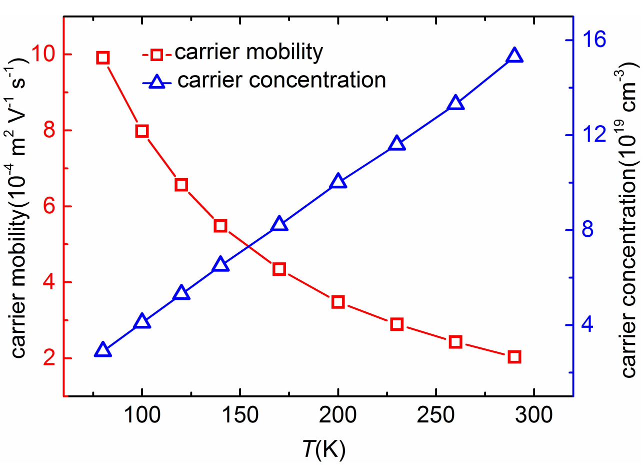

Figure S6. Temperature dependences of the carrier concentration and mobility of $EuBiSe_3$ fiber

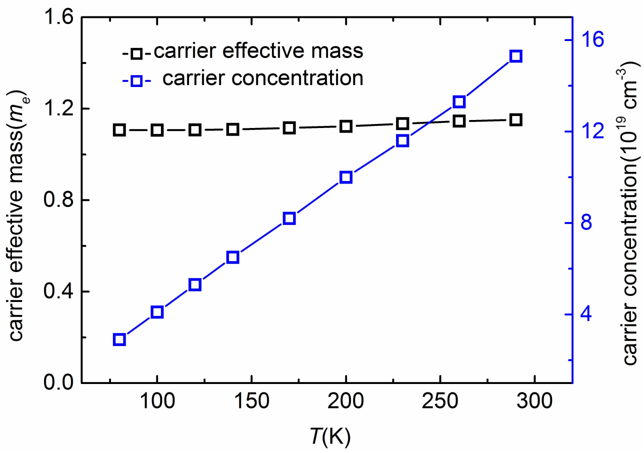

Figure S7. Temperature dependences of carrier concentration and effective mass of $EuBiSe_3$ fiber

References

[1] S. Forbes, Y. C. Tseng, and Y. Mozharivskyj, "Crystal cluster growth and physical properties of the $EuSbSe_3$ and $EuBiSe_3$ phases," *Inorg. Chem.*, vol. 54, pp 815-820, 2015.

[2] S. Johnsen, et al., "Nanostructures boost the thermoelectric performance of PbS," *J. Am. Chem. Soc.*, vol. 133, pp 3460-3470, 2011.