11.10 (b) It is easy to show that $(\hat{\beta}\cdot\vec{K})^{2k} = (\hat{\beta}\cdot\vec{K})^2$, $(\hat{\beta}\cdot\vec{K})^{2k+1} = (\hat{\beta}\cdot\vec{K})$, $k \geq 1$.

then. $$\exp\{-\zeta\hat{\beta}\cdot\vec{K}\} = \sum_{n=0}^{\infty}\frac{(-\zeta)^n}{n!}(\hat{\beta}\cdot\vec{K})^n$$

$$= 1 + \sum_{k=0}^{\infty}\frac{(-\zeta)^{2k+1}}{(2k+1)!}(\hat{\beta}\cdot\vec{K})^{2k+1} + \sum_{k=1}^{\infty}\frac{(-\zeta)^{2k}}{(2k)!}(\hat{\beta}\cdot\vec{K})^{2k}$$

$$= 1 + (\hat{\beta}\cdot\vec{K})\sum_{k=0}^{\infty}\frac{(-\zeta)^{2k+1}}{(2k+1)!} + (\hat{\beta}\cdot\vec{K})^2\sum_{k=1}^{\infty}\frac{(-\zeta)^{2k}}{(2k)!}$$

$$= 1 + (\hat{\beta}\cdot\vec{K})\sinh(-\zeta) + (\hat{\beta}\cdot\vec{K})^2\left[\cosh(-\zeta) - 1\right]$$

$$= 1 - (\hat{\beta}\cdot\vec{K})\sinh\zeta + (\hat{\beta}\cdot\vec{K})^2\left[\cosh\zeta - 1\right]$$

Where we have use the expansion

$$\sinh\zeta = \sum_{k=0}^{\infty}\frac{\zeta^{2k+1}}{(2k+1)!}, \quad \cosh\zeta = \sum_{k=0}^{\infty}\frac{\zeta^{2k}}{(2k)!}$$