

$$I[X, Y] = - \iint \pi(x, y) \log \left(\frac{\pi(x) \pi(y)}{\pi(x, y)} \right) dx dy$$

$$= - \iint \pi(x, y) \log \pi(x) dx dy - \iint \pi(x, y) \log \pi(y) dx dy$$

$$+ \iint \pi(x, y) \log \pi(x, y) dx dy$$

$$= H[X] + H[Y] - H[X, Y]$$