2016 / 12 / 28 (수)

Motome 논문에서 $N_{sk} = 2$ skyrmion lattice 의 multiple spin wave expression 이 topological number = 2 를 갖는 이유를 알아본다.

논문에 나온 expression 은

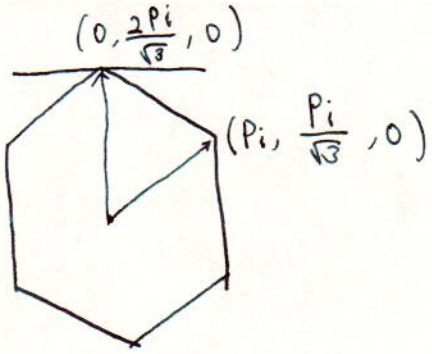
$$\vec{S}_i^{(n_{sk}=2)} \propto \left(\cos Q_{1i},\ \cos Q_{2i},\ \cos Q_{3i} \right)$$

$$= \left(\cos \frac{\pi}{3} k_x,\ \cos\left(-\frac{\pi}{6} k_x + \frac{\sqrt{3}\pi}{6} k_y \right),\ \cos\left(-\frac{\pi}{6} k_x - \frac{\sqrt{3}\pi}{6} k_y \right) \right)$$

$$\hat{S}_i = \left(\cos \frac{\pi}{3} k_x,\ \cos\left(-\frac{\pi}{6} k_x + \frac{\sqrt{3}\pi}{6} k_y \right),\ \cos\left(-\frac{\pi}{6} k_x - \frac{\sqrt{3}\pi}{6} k_y \right) \right) / \text{norm}.$$

$$\hat{S}_i \cdot \left(\frac{\partial \hat{S}_i}{\partial k_x} \times \frac{\partial \hat{S}_i}{\partial k_y} \right) = \frac{\pi^2 \left(-3 + \cos\left(\frac{2}{3}\pi k_x \right) + 2\cos\left(\frac{\pi}{3} k_x \right) \cos\left(\frac{\pi}{\sqrt{3}} k_y \right) \right)}{6\sqrt{6} \left(3 + \cos\left(\frac{2}{3} k_x \pi \right) + 2\cos\left(\frac{\pi k_x}{3} \right) \cos\left(\frac{\pi k_y}{\sqrt{3}} \right) \right)^{3/2}}$$

BZ 는



$$\frac{1}{(4\pi)} \int_{\hexagon} \frac{\pi^2 \left(-3 + \cos\left(\frac{2}{3}\pi k_x \right) + 2\cos\left(\frac{\pi}{3} k_x \right) \cos\left(\frac{\pi}{\sqrt{3}} k_y \right) \right)}{6\sqrt{6} \left(3 + \cos\left(\frac{2}{3}\pi k_x \right) + 2\cos\left(\frac{\pi}{3} k_x \right) \cos\left(\frac{\pi}{\sqrt{3}} k_y \right) \right)^{3/2}} dk_x dk_y = -2.$$