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The dipole moment of a ring w/ radius R and current I is $\vec{m} = \pi R^2 I \hat{z}$.

Here, $\vec{K} = \sigma \vec{v} = r\omega \hat{z}$ so $\vec{I} = \omega \sigma r \hat{z}$

$$\text{Then } \vec{m} = \int_0^R \pi r^2 dI \hat{z} = \pi \int_0^R \omega \sigma r^3 dr \hat{z} = \frac{\omega \pi \sigma R^4}{4} \hat{z}$$

