Final Non-dimensionalization notes

1 Cheatsheet of quantities to use

$$f_{\text{bulk}} = AE_{ij}E^*_{ij} + \frac{C}{2}(E_{ij}E^*_{ij})^2 \tag{1}$$

$$f_{\text{comp}} = b_1^{\parallel}\Pi_{kl}E_{ij,k}E^*_{ij,l} + b_1^{\perp}T_{kl}E_{ij,k}E^*_{ij,l} \tag{2}$$

$$f_{\text{cdiv}} = b_d|\underline{\nabla} \cdot \underline{\underline{E}}|^2 = b_d E_{ji,j}E^*_{ji,j} \quad \text{No } \underline{\underline{\Pi}} \text{ for now} \tag{3}$$

$$f_{\text{curv}} = b_2^{\parallel}\Pi_{kl}E_{ij,lk}\Pi_{mn}E^*_{ij,nm} + b_2^{\perp}T_{kl}E_{ij,lk}T_{mn}E^*_{ij,nm} + b_2^{\parallel\perp}(\Pi_{kl}E_{ij,lk}T_{mn}E^*_{ij,nm} + T_{kl}E_{ij,lk}\Pi_{mn}E^*_{ij,nm}) \tag{4}$$

C, and all the bs are positive And a time evolution of form

$$\frac{\partial \underline{\underline{E}}}{\partial t} = -\mu\frac{\delta F}{\delta \underline{\underline{E}}^*} \tag{5}$$

Notable differences from Jack's are that I omit the 2 extra factors of $\frac{1}{2}$ in the bulk contribution and change μ to its inverse.

quantity	$\underline{\underline{E}}$	A, C	$b_1^?$, b_d	$b_2^?$	μ
unit	1	$\frac{E}{L^3}$	$\frac{E}{L}$	EL	$\frac{1}{ET}$

1.1 Dealing with the amount of bs and physical quantities

Introduce b_1 and b_2 to set the overall scale for the bs, these also correspond to the 1ca bs. Then have $b_i^? = q_i^? b_i$, in the code one can set the b_i and the qs (this naturally has a degree of degeneracy). I then use the overall b_i for the physical quantities Jack introduced, this is likely not perfect but if proceeding with care makes some sense. I also don't worry about the $\frac{1}{2}$ factors fro bulk terms as it is to order of magnitude anyway.

$$|\psi|_{eq} = \sqrt{\frac{3}{2} * \frac{-A}{C}} \quad \text{The ideal smectic phase value, dimensionless} \tag{6}$$

$$\varepsilon = \sqrt{\frac{b_1}{|A|}} \quad \text{Lamellar in-plane coherence length, } L \tag{7}$$

$$\lambda = \sqrt{\frac{b_2}{b_1}} \quad \text{Penetration depth, } L \tag{8}$$

$$\kappa = \frac{\lambda}{\varepsilon} = \sqrt{\frac{b_2|A|}{b_1^2}} \quad \text{Ginzburg parameter, dimensionless} \tag{9}$$