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**Hybrid twins:  
somebody chooses one out of  $N$  - we take them all!**

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# Limits of the reticular theory of twinning

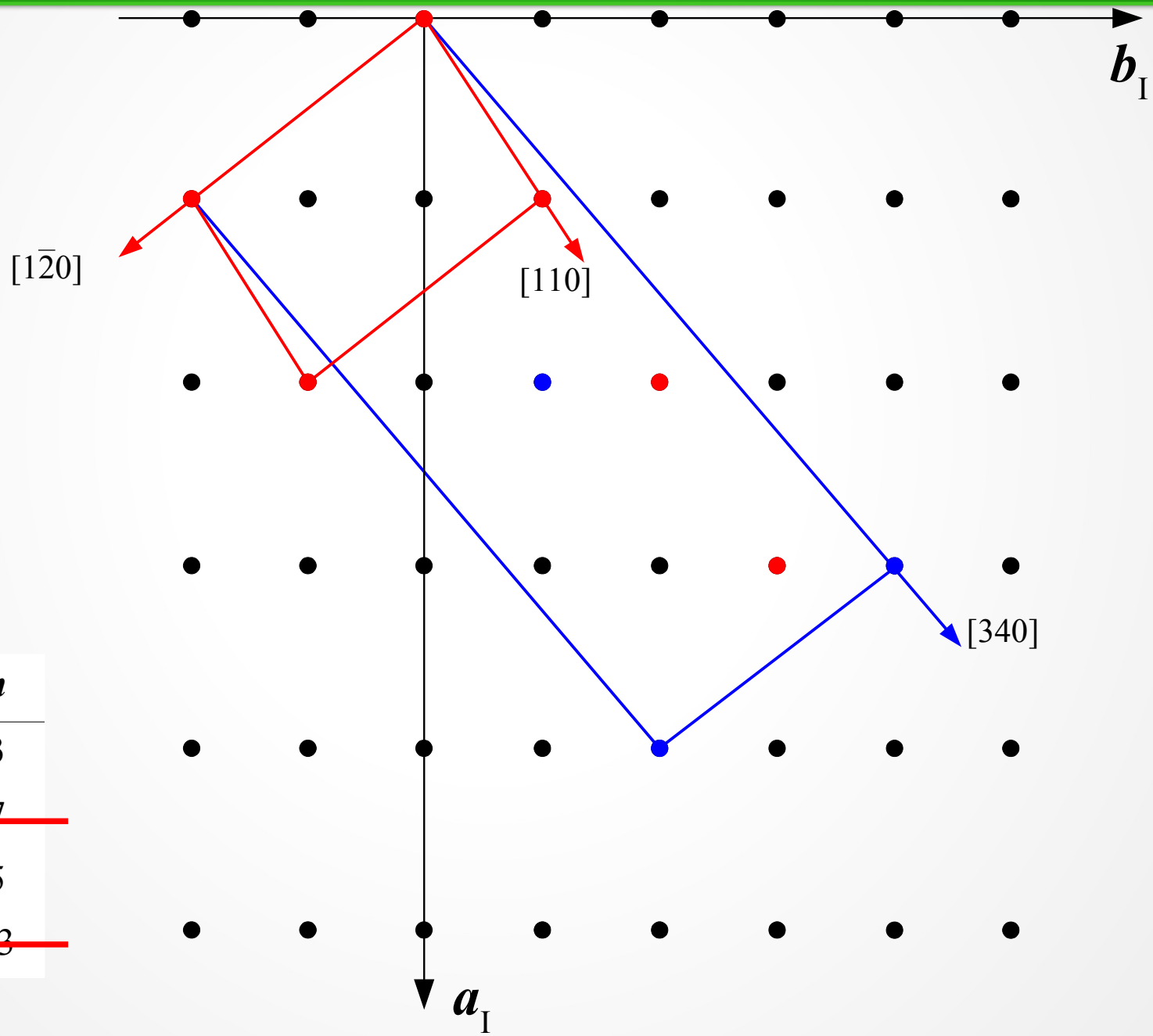
Twins with the **same twin index and obliquity** do *not necessarily* occur with the **same frequency** – ex. albite (010) and pericline [010] twins in triclinic pseudo-monoclinic plagioclases.

Twins with **higher index / obliquity** occur *sometimes more frequently* than twins with lower twin index / obliquity – contradicting the “necessary” condition – ex. Saint Andrews cross twin ( $n = 12$ ) more frequent than Greek cross twin ( $n = 6$ ) in staurolite.

# Friedelian twins

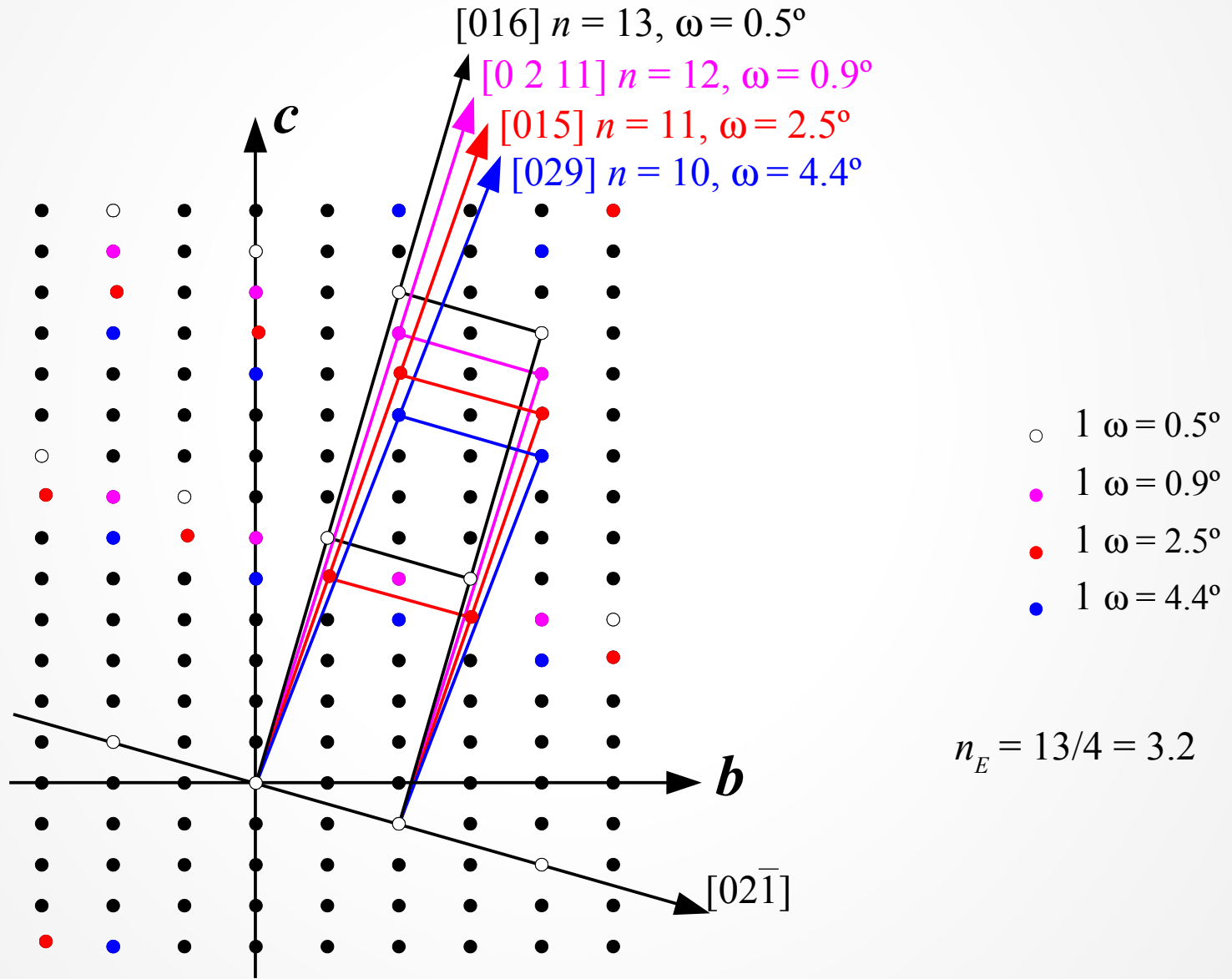
- The probability of occurrence of a twin is inversely proportional to the twin index and to the obliquity
- Friedel's empirical criterion:  $n \leq 6$ ,  $\omega \leq 6^\circ$
- Twins for which the above criterion is obeyed are termed “Friedelian twins”

Effective twin index:  $10/(3+2) = 2.0$



$uvw$	$\omega$	$n$
110	$5.36^\circ$	3
<del>230</del>	<del><math>5.86^\circ</math></del>	<del>7</del>
340	$2.50^\circ$	5
<del>450</del>	<del><math>0.69^\circ</math></del>	<del>13</del>

# {012} twin in forsterite $Pbnm$



# {052} twin in pyrite $Pa\bar{3}$

In a cubic lattice,  
for each  $(hkl)$   
plane there is a  
direction  $[hkl]$   
exactly  
perpendicular

