

• MACROSCOPIC ORIENTATION

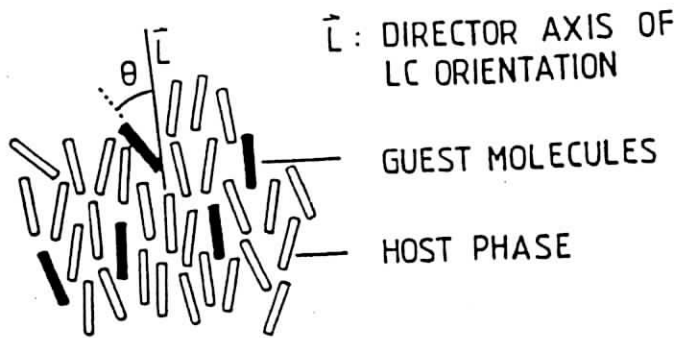
Microscopic LC-Order

Macroscopic Order

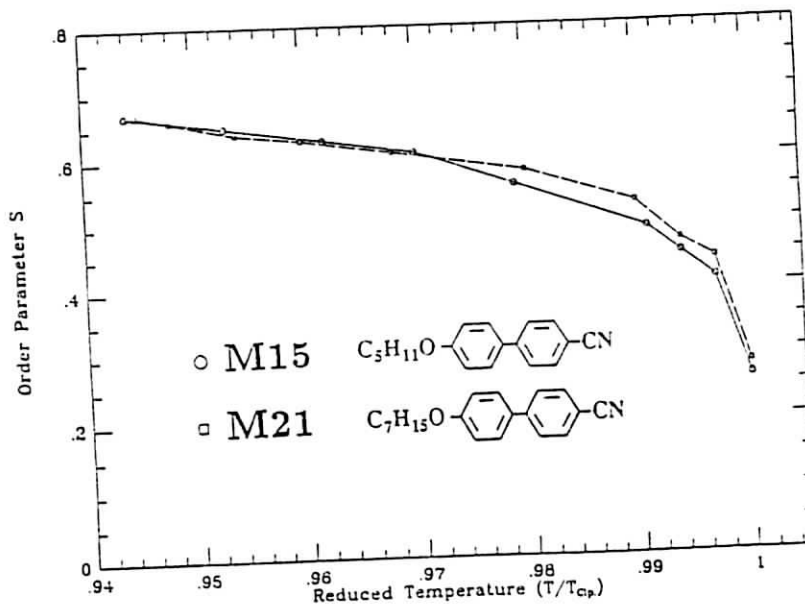


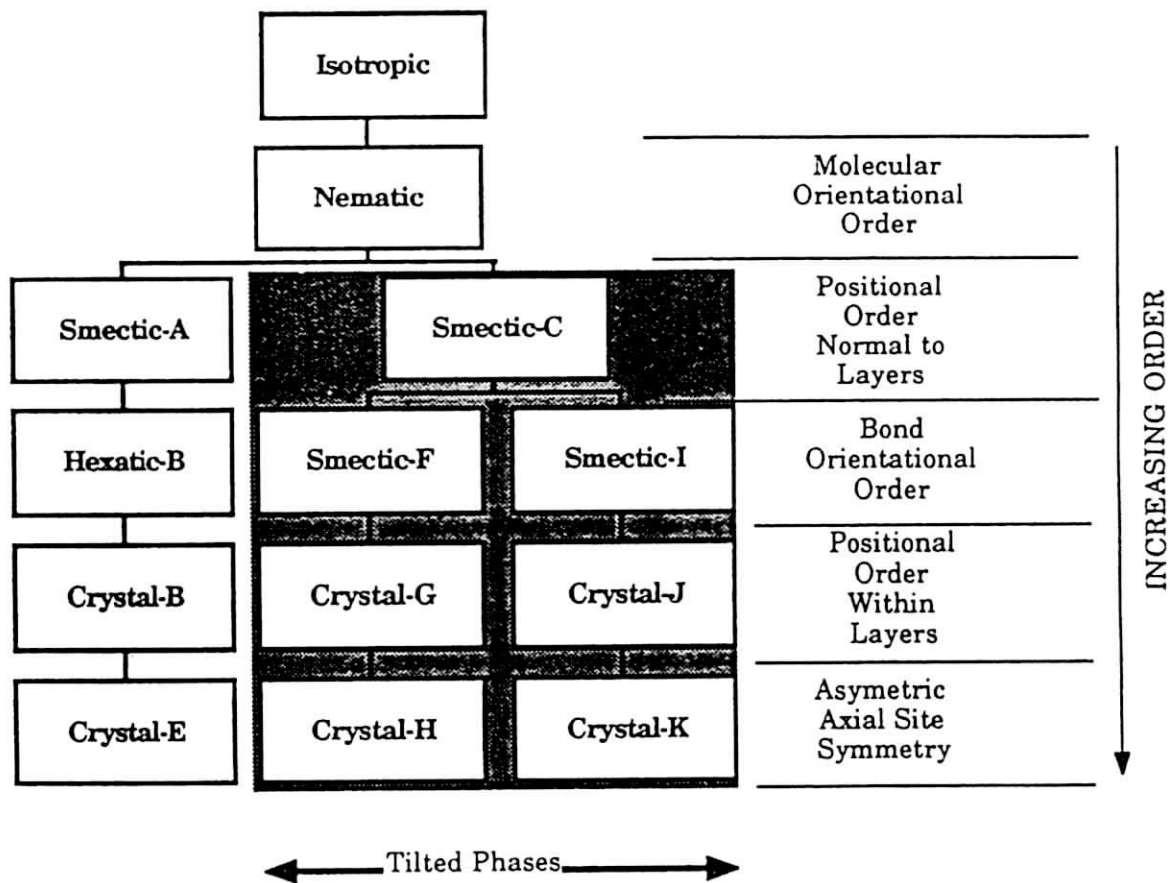
surface effects, mechanical forces, electrical field and magnetic field

• ORDER PARAMETER



$$S = \frac{1}{2} \langle 3 \cos^2 \theta - 1 \rangle$$

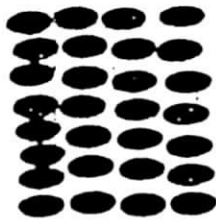




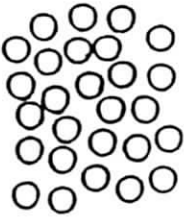
Pershan, P.S., *Structure of Liquid Crystal Phases*, World Scientific Notes In Physics, Vol. 23, World Scientific, Singapore, New Jersey, Hong Kong, 1988

# STRUCTURE OF SMECTIC MESOPHASES

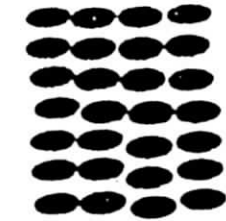
Side



Top



smectic A



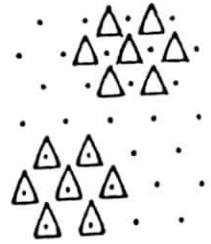
hexatic B



smectic C



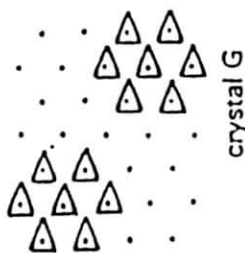
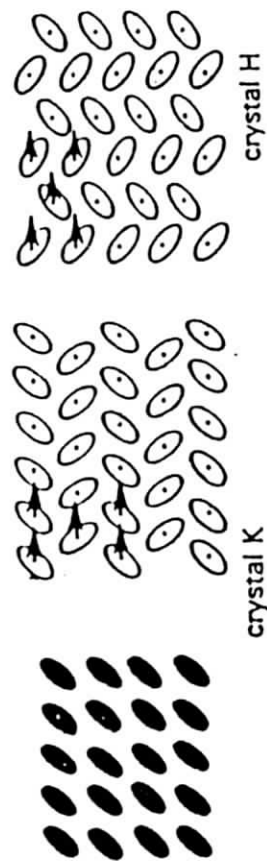
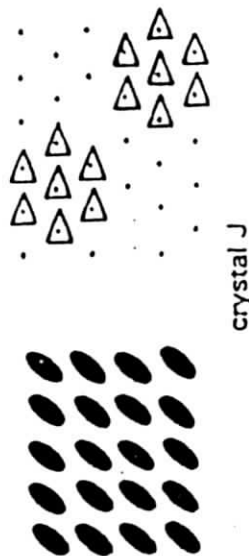
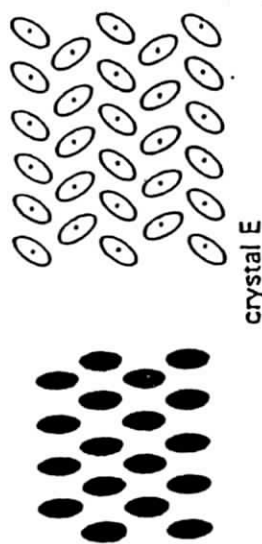
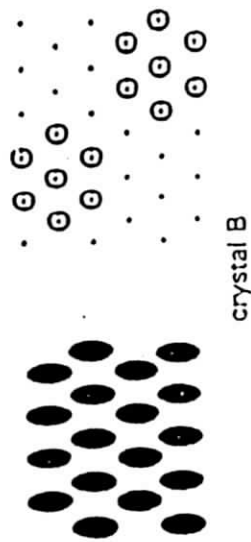
smectic I



smectic F

Phase type	Molecular orientation	Molecular packing	Orientalional ordering	Positional ordering
A	orthogonal	random	short range	short range
C	tilted	random	short range	short range
B (hexatic)	orthogonal	hexagonal	long range	short range
I	tilt to apex of hexagon	pseudo hexagonal	long range	short range
F	tilt to side of hexagon	pseudo hexagonal	long range	short range

# STRUCTURE OF HIGHLY ORDERED SMECTIC MESOPHASES



Phase type	Molecular orientation	Molecular packing	Orientational ordering	Positional ordering
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L (B crystal)	orthogonal	hexagonal	long range	long range
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J (G')	tilt to apex of hexagon	pseudo hexagonal	long range	long range
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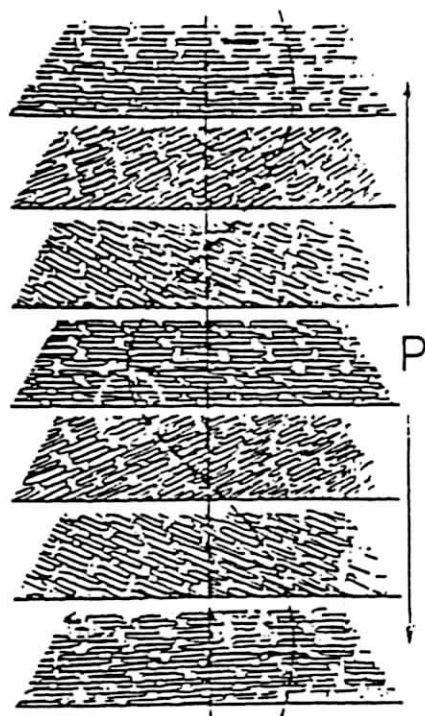
G	tilt to side of hexagon	pseudo hexagonal	long range	long range
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E	orthogonal	ortho-rhombic	long range	long range
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K (H')	tilted to side a	monoclinic	long range	long range
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H	tilted to side b	monoclinic	long range	long range
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# CHOLESTERIC

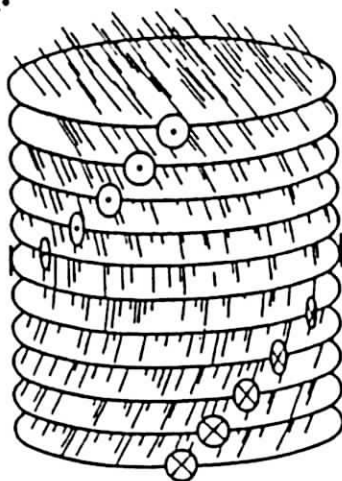


periodicity:  $d = P/2$

pitch:  $P = 2\pi d/\varphi = 2d$

twist angle:  $\varphi$

## Structure of $S^*_c$ phase:



## Phase types of chiral liquid crystals

### Non ferroelectric structures

- N\* Helical nematic structure, optical activity,  
selective reflection, Fig. 1.33
- Blue phases cubic structure, optical activity and  
selective reflection

### Ferroelectric phase types (chiral tilted smectics)

#### Random molecular packing

- C\* helix, optical activity, selective reflection, Fig. 1.34

#### Pseudo-hexagonal structure

- |    |                |   |
|----|----------------|---|
| I* | tilted to side | no layer correlation<br>short range in-plane correlation        |
| F* | tilted to apex | helix structure, optical activity<br>selective reflection       |
| J* | tilted to apex | long-range layer correlation<br>long-range in-plane correlation |
| G* | tilted to side | no helix structure  |

#### Herring-bone molecular packing

- |    |                |   |
|----|----------------|---|
| K* | tilted to side | long-range layer correlation<br>long-range in-plane correlation |
| H* | tilted to apex | no helix structure  |