

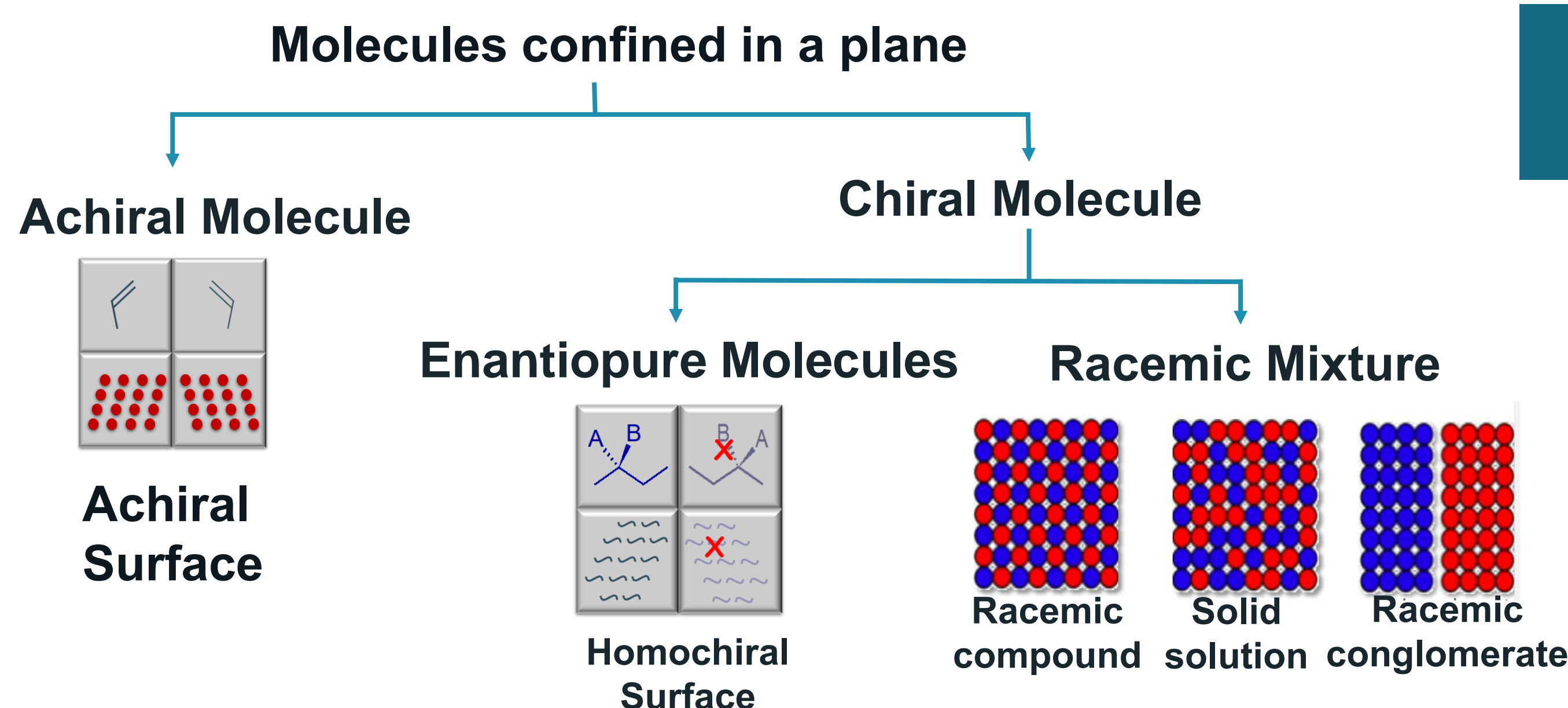
Preparation of Chiral Surfaces from Achiral Liquid Crystals?

Lekshmi Aravindan Geetha, Shammi Rana, Kunal S. Mali, and Steven De Feyter

Liquid crystals (LC) and their **self-assembly properties** have been the subject of extensive research due to their unique characteristics and potential applications in various fields, including displays, sensors, and optical devices. The **cyanobiphenyl family**, which includes compounds like **4'-n-octyl-4-cyano-biphenyl (8CB)** and **4-cyano-4'-n-dodecylbiphenyl (12CB)**, that are **prochiral molecules**, has been widely investigated for their **self-assembly behaviour on different substrates** such as graphite and gold. These achiral molecules upon adsorption onto a solid surface **form chiral surfaces** with **domains of opposite handedness** as the **2D space hinders its conformational mobility**, thereby also **breaking the molecular symmetry**.

Expression of Chirality in Two-Dimensions

- Chirality** is a geometric property which dictates that **an object and its mirror image are non-superimposable** by any form of translation or rotation.
- Scanning Tunneling Microscopy (STM)** can be used for imaging the surface at the atomic level.

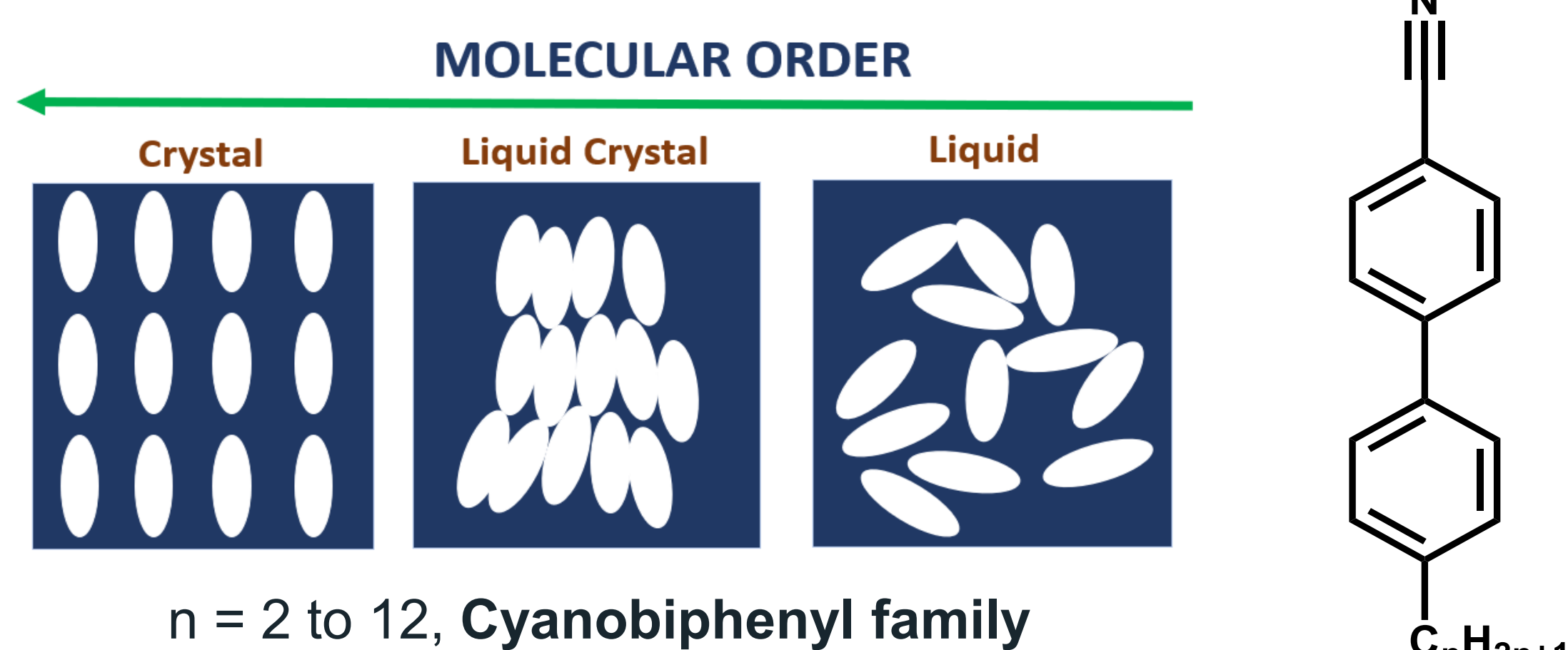


Induction of Chirality in Two-Dimensions

Physical means - e.g., application of magnetic field, geometric confinement.

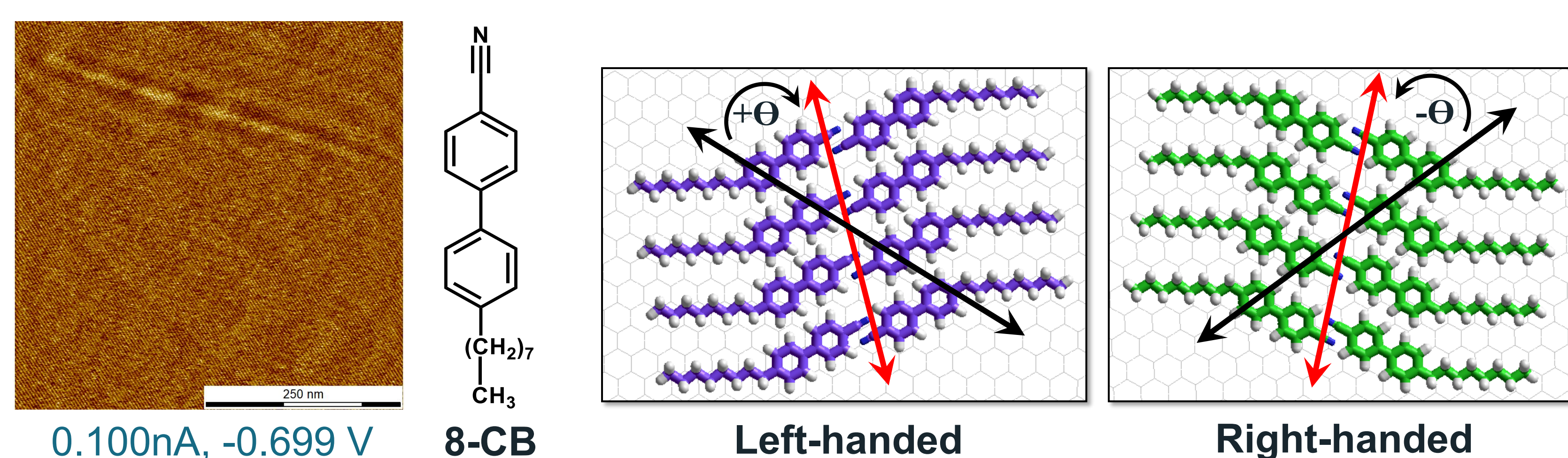
Chemical means - e.g., Majority rules, "sergeant-soldiers" principle

Liquid Crystal



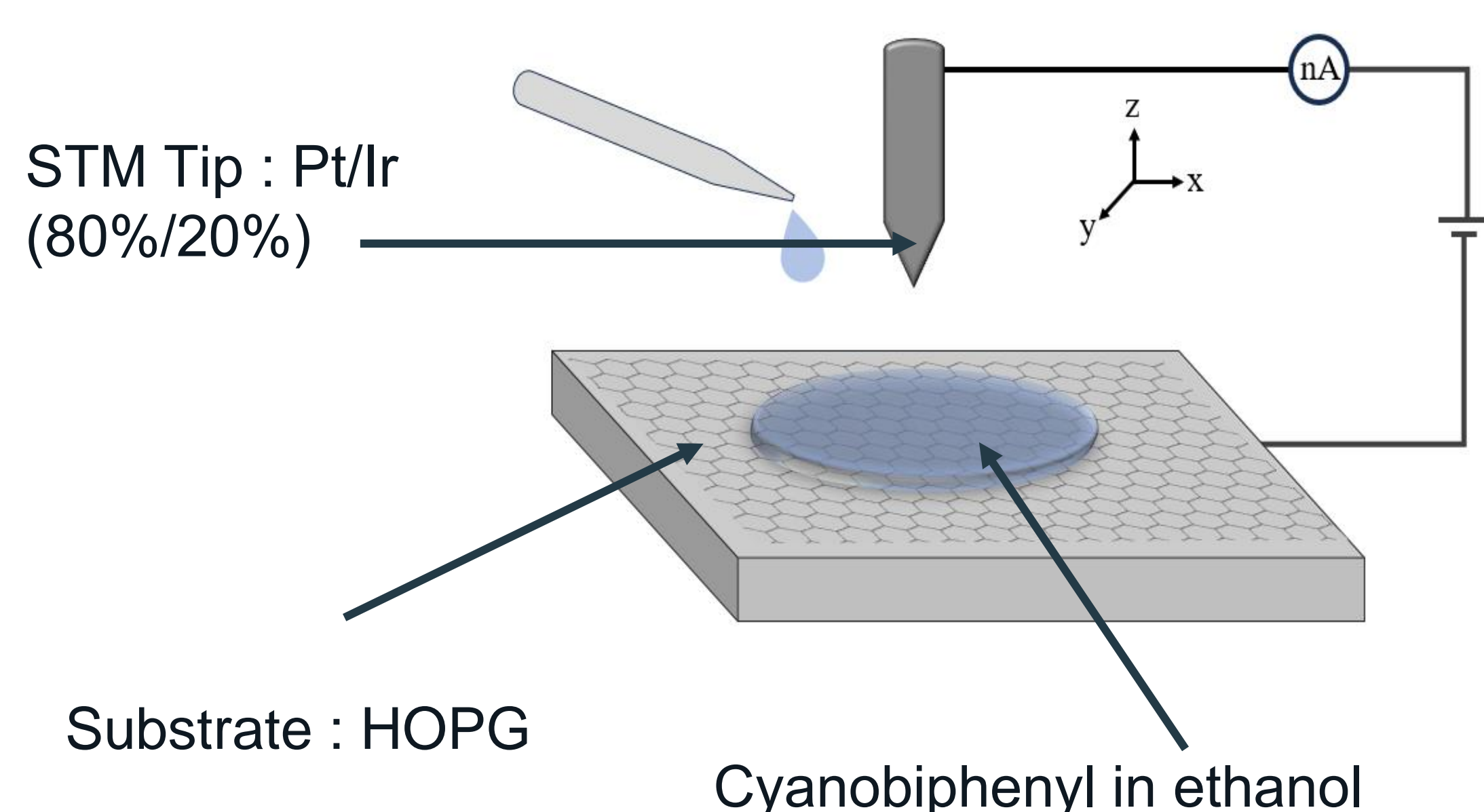
Self Assembly of 8CB

8CB self assembles into **domains of opposite handedness** in HOPG. It is reported that in the absence of any external influence, there is **equal probability of formation of left-handed domains and right-handed domains**, of size of more than 500nm.



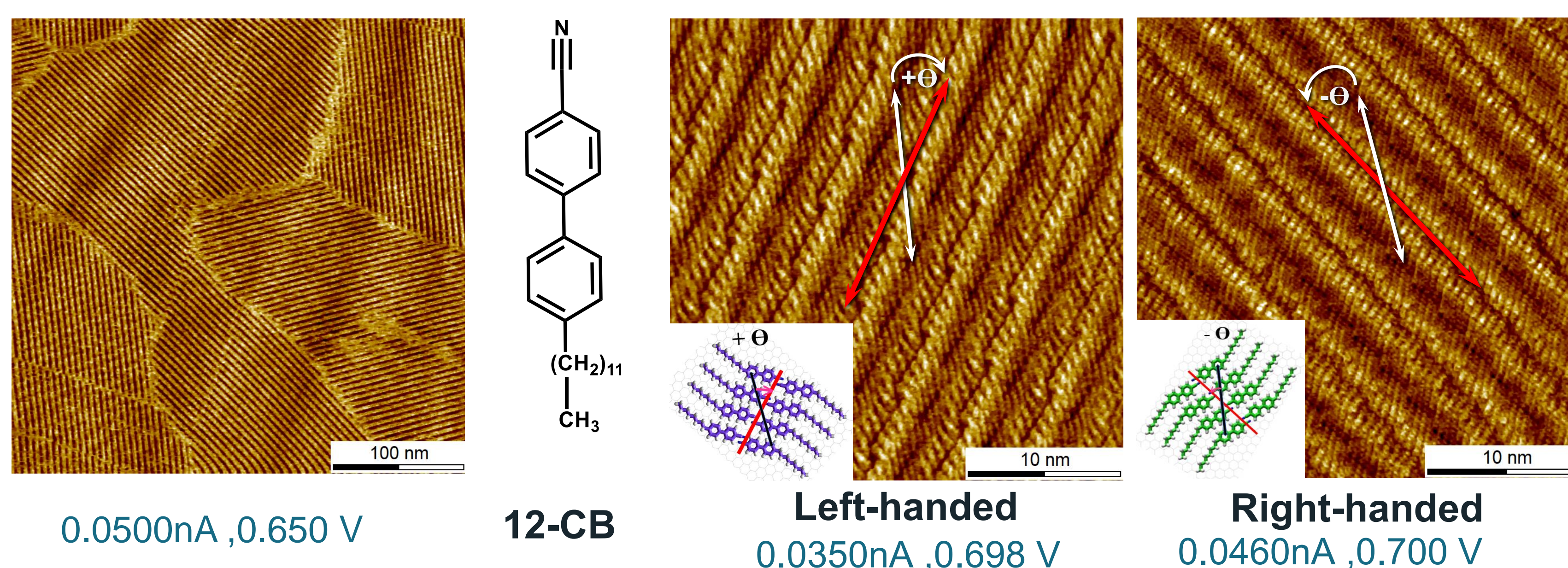
Scanning tunneling microscopy (STM)

STM under ambient conditions



Self Assembly of 12CB

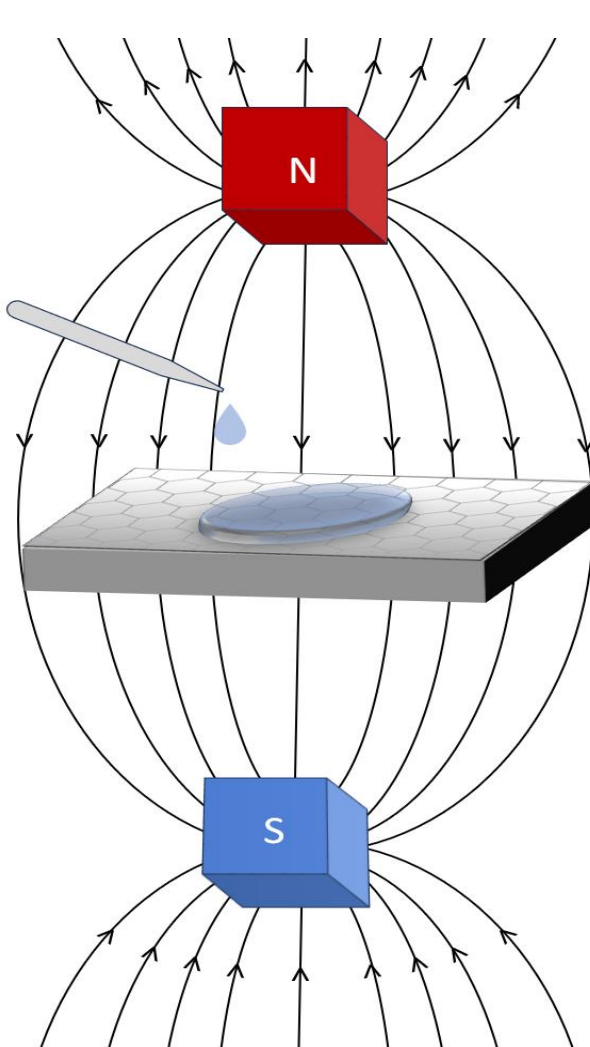
12CB undergo self assembly to **form smaller domains** compared to 8CB. There is **equal surface coverage of left-handed domains and right-handed domains**. The LC director makes an angle of $\sim \pm 30^\circ$ with the surface molecular rows



Conclusion and Outlook

- 12CB** forms **smaller domains** compared to 8CB.
- Self assembles into **left and right handed domains of equal probability**

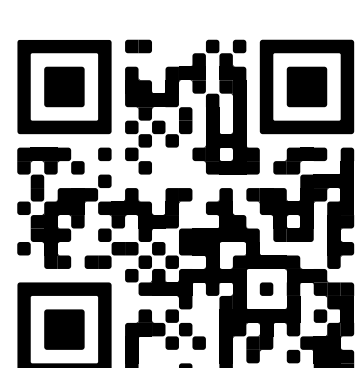
What Next : Produce **net excess of one enantiomorph** over other using **magnetic field**



Acknowledgments:

Contact:

lekshmi.aravindangeetha@kuleuven.be



Funded by the European Union

We acknowledge the financial support from the EU through 101071886 — CISSE — HORIZON-MSCA-2021-DN-01 project titled "Chiral-Induced Spin Selectivity Effect"