**Introduction**

"Moore's law" has enforced progressively ambitious scaling targets for lithography in terms of feature sizes and densities, raising questions about the economical sustainability at future nodes. It is therefore paramount that Veldhoven-based ASML, the undisputed world leader in lithography, considers alternative approaches for creating ever smaller features.

**Project Overview**

Liquid crystals have long been known for their capability to self-assemble into regular structures with nanometer size domains. In my project we explore the option of using the self-assembling properties of these molecules to construct the next generation of semiconducting features, such as dense line spaces, multiple times smaller than the current state of the art (figure 2).

To do this, we design and synthesize novel liquid crystals which self-assemble on the length scale of 3 to 5 nm! The liquid crystals are also light-responsive which allows top-down control over the self-assembly; allowing alignment by exposure to linearly polarized light and hierarchical patterning on the micron scale (Scheme 1).

**I Need Your Help!**

Join this project at any level for an exciting blend of organic and physical chemistry! You may choose to synthesize new molecules, characterize their phase behavior, or focus on the patterning aspects for lithography; there are possibilities along the entire chain of knowledge.

Scheme 1. Liquid crystals are developed for nanolithography. The family of molecules can be aligned by exposure to polarised light, and the self-assembly "switched off" by exposure to UV light, resulting in aligned, micro-patterned films (right).

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