Hybrid Solar Cells group (AMOLF)

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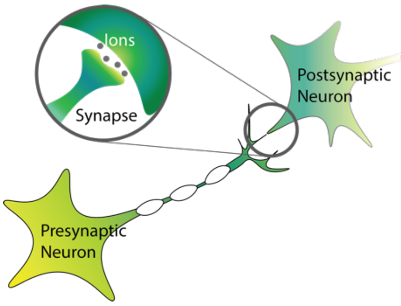
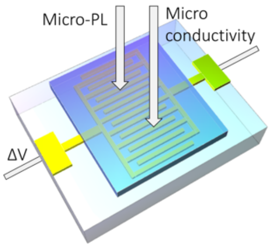
Research theme The *Hybrid Solar Cell group* focuses on novel concepts towards more efficient solar cells using both organic and inorganic materials. We combine the unique properties and the richness of organic materials with highly efficient, well-characterized inorganic materials.
For instance, we study the fundamental processes in perovskite semiconductors, materials that are built from organic and inorganic ions, which have the potential to transform the semiconductor industry (solar cells, LEDs, transistors).

Project 1. Ultralow energy consumption artificial synapse from halide perovskites
Supervisors: Jeroen de Boer and Bruno Ehrler



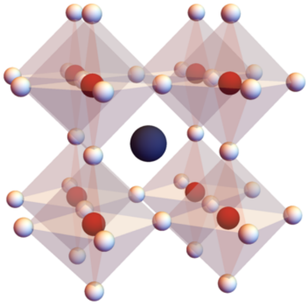
Lead halide perovskites are semiconducting compounds that are both efficient electronic and ionic conductors. This efficient mixed ionic-electronic conductivity enables novel applications that are not possible with conventional semiconductors. In this Master project you will work on artificial synapses based on lead halide perovskite that use the ionic conduction to change the resistance of the device. These devices enable efficient forms of computing inspired by information processing in the brain. The aim of the project is to make the artificial synapses as energy-efficient as biological synapses. To achieve this, you will develop a lithography procedure to prepare halide perovskite synapses on the microscale.

Project 2. Looking at the interface in a perovskite solar cell with a microscope
Supervisors: Imme Schuringa and Bruno Ehrler



Perovskite solar cells are now very efficient (25%), and the main remaining loss is recombination at the interface between the perovskite and the transport layers. In a typical solar cell stack that interface is buried within the cell and therefore difficult to study. We will fabricate lateral contacts as shown in the sketch and deposit the perovskite on top of them. We then study recombination with time-resolved and spatially resolved photoluminescence. If desired, the project could also contain a modelling component, where we further understand our measurements with drift-diffusion simulations.

Project 3. Effect of strain on ion migration in perovskite solar cells
Supervisors: Moritz Schmidt and Bruno Ehrler



Solar cells based on halide perovskites are efficient, but poor stability due to ion migration is still one of the main bottlenecks on their way to commercialization. Inducing strain in the perovskite has been suggested to suppress ion migration and enhance their stability. In this project you will induce different strain levels in the perovskite layer and quantify the effect on ion migration. Part of the project will be the fabrication of perovskite solar cells and the characterization of ion migration using powerful techniques like transient ion drift and impedance spectroscopy.