Opto-Electronics at the Nanoscale

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The field of opto-electronics is an integral part of our modern world with applications ranging from lasers and light-emitting diodes to photodetectors and solar cells. Scaling it down to the nanoscale enables more compact and probably more capable devices on the one hand and on the other also opens up new applications and research areas. For example electrically-connected antennas scaled down to work with light[1] can be used as diffraction limited point sources and are tunable over a wide spectral range[2] but at the same time are also promising for single molecule characterization and manipulation.

In order to reach these goals a control from the macroscopic level down to the 1-nm regime is required. In this talk I will give an overview how we achieve this by utilizing single-crystalline gold platelets[3], transfer processes, focused ion-beam milling[4], AFM manipulation, dielectrophoresis as well as regrowth steps and discuss what new effects and possibilities appear at these scales.

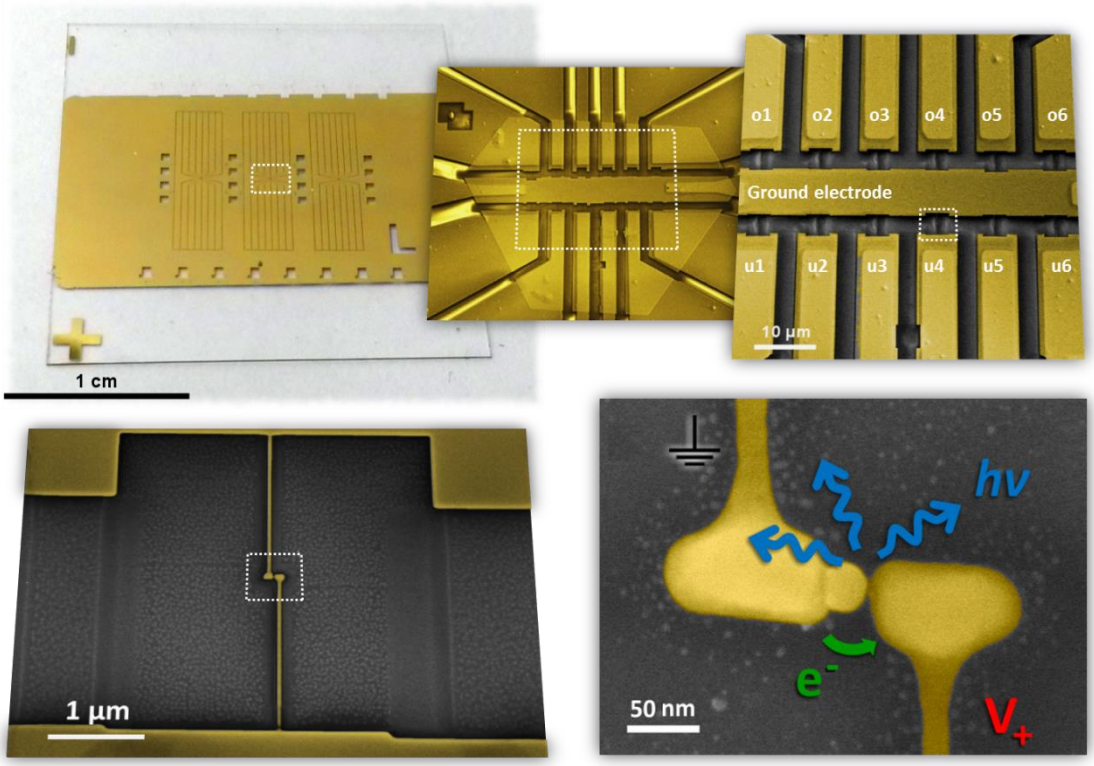

Figure 1. Zoom into an electrically-connected optical antenna from the macroscopic electrode level down to the nanometer gap. When the gap is sufficient small electrons can tunnel inelastically and emit light.

References

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