# Parallel and selective trapping in a patterned plasmonic landscape

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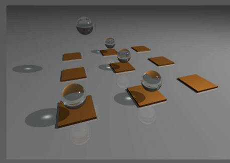


# Motivations

## Plasmon tweezers: in-plane optical manipulation with surface plasmons fields

The implementation of optical tweezers at a surface opens a huge potential towards the elaboration of future lab-on-a-chip devices entirely operated with light. The transition from conventional **3D** tweezers to **2D** is rendered possible by exploiting evanescent fields bound at interfaces [1,2] and particularly, **Surface Plasmons (SP) at metal/dielectric interfaces, are expected to relax the incident power requirement and to enable the manipulation of sub-wavelength size objects [3].**

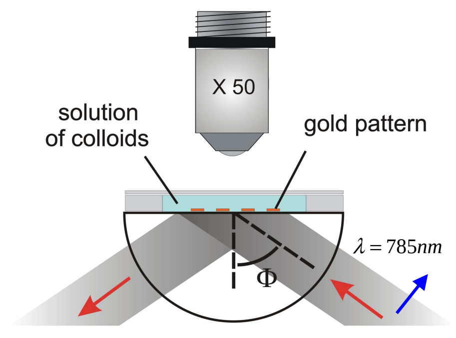
## Advantages:

**Low power.** The intensity of the incident beam is expected to be more than one order of magnitude weaker than conventional 3D optical traps [4].

**Integrable.** Acting as 2D tweezers, well suited for future lab-on-a-chip devices.

**Sub-wavelength trapping.** Evanescent fields at interfaces are not exposed to the diffraction limit and theoretically open a new frontier for the manipulation of nano-objects.

# Set-up and concept



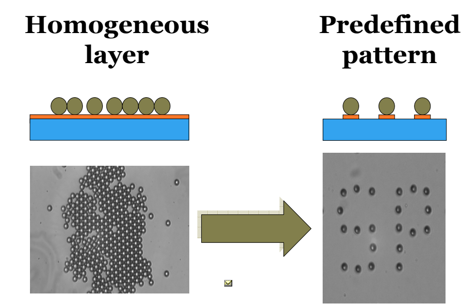
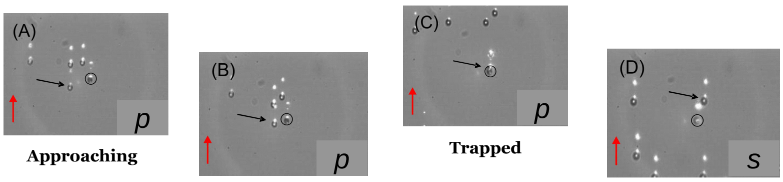




Fig. 1 Fig. 2

**Concept:** We use a non-focused *p*-polarized laser beam (λ=785 nm) to illuminate, under total internal reflection, a glass sample patterned with gold microstructures and exposed to an aqueous solution of mono-dispersed 4.88 µm polystyrene (PS) spheres. For an homogeneous gold coating, a combination of thermal and optical contribution [5] tend to gather the particles towards the center of the illuminated area (Fig. 1). By pattering the metal film, we can create local SP excitations that produce strong optical gradients. The resulting near-field landscape enables us to trap according to any predefined pattern (Fig. 2).

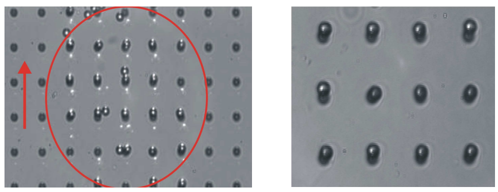
# Results

## Single SP trap

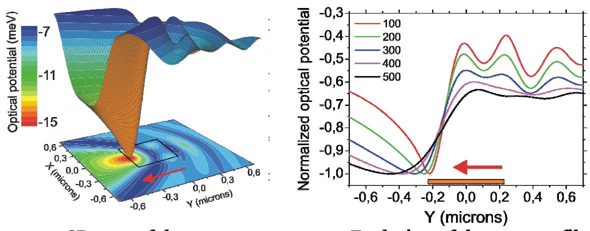



Approaching — Approaching — Trapped — Released

## Parallel trapping



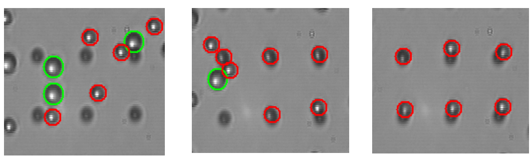
## Numerical simulations of the optical potential




3D map of the optical potential

Evolution of the trap profile with the particle diameter

## Trapping selectivity



○ = 3.55 µm ○ = 4.88 µm

**References.**

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