**FUNDING PROGRAM FOR NEXT GENERATION WORLD-LEADING RESEARCHERS**

| **Project Title**: Innovative NanoBio Detection with Plasmon Nanoantenna | |
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**1. Background of research**

Recently localized surface plasmon resonance (LSPR) with metallic nanoparticles has been studied extensively to develop highly sensitive biosensing devices. However it was difficult to fabricate large sized regular arrays on surface composed of metallic nanoparticles before our study.

**2. Research objectives**

To fabricate multidimensional, complex structured metallic nanoparticle sheet for fluorescence enhancement. This sheet can be used as disposable substrates for the fluorescence imaging with a regular optical microscope and give more than 10 times stronger emission. We will apply this technique to various life innovations.

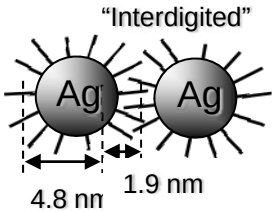
**3. Research characteristics (incl. originality and creativity)**

In our previous study, we have succeeded in a fabrication of homogeneous 2D crystalline sheet composed of Ag nanoparticles by self-assembly at air-water interface. This sheet can excite strong, collective LSPR field on surface. This technique is purely our original. We will extend this self-assembling technique to the fabrication of multidimensional, complex films in order to obtain further stronger electromagnetic field.

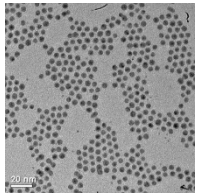
**4. Anticipated effects and future applications of research**

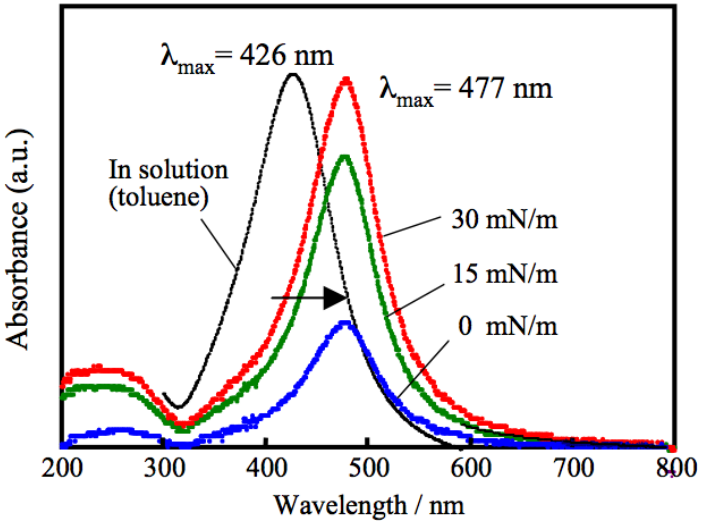
We would like to contribute to advanced bio-medical field by applying our fluorescence enhancement technique to tumor marker detections, which have low detection limits. Because our LSPR sheet keeps nano-spatial resolution, the sheet can be applied to a single molecular imaging, too, unlike the conventional propagating SPR.

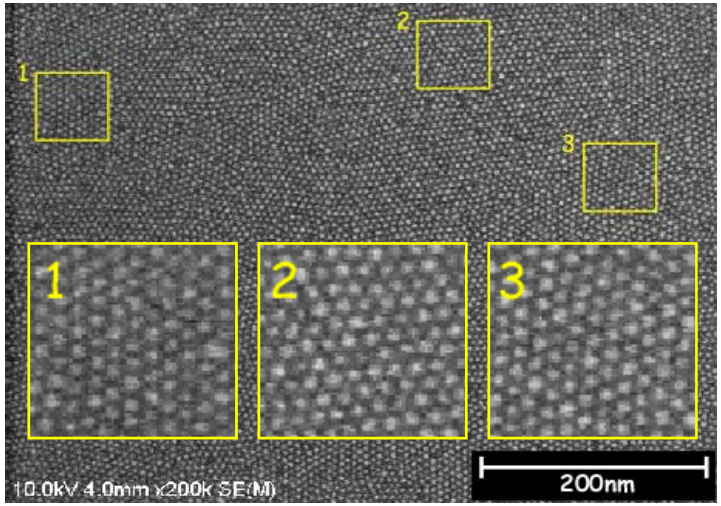
# Plasmonic Nano Antenna

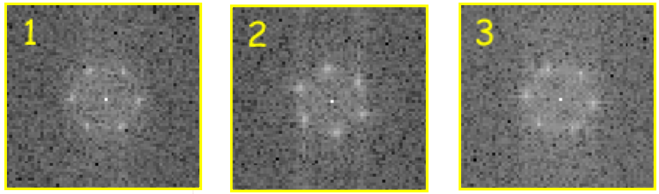



- Gram-scale synthesis of uniformly sized Ag nanoparticles
- Giant crystalline growth by self-assembly at air-water interface





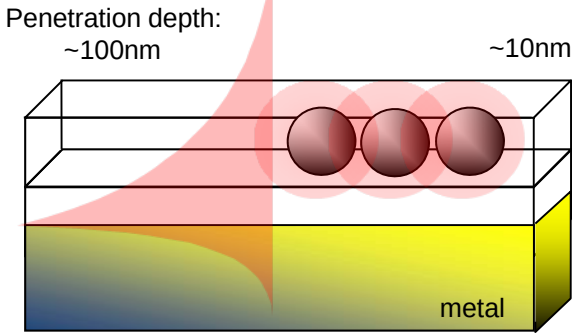




Gap distance is kept constant by organic capping molecules
＝＞Homogeneous coupling of LSPR

"Plasmonic Nano Antenna"

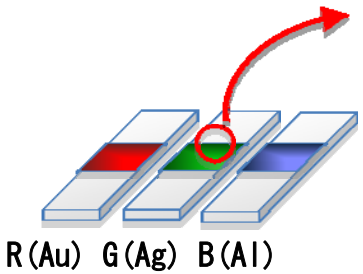
Tuning of resonance wavelength by gap distance
"Bulk light" can be trapped at nano-interface

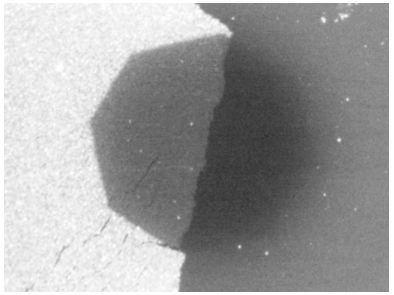



- No prism coupling is necessary
- Stronger electro magnetic field

# Development of Fluorescence Enhancement Sheet

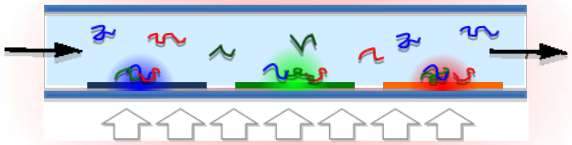
***Disposable (Low cost, user friendly), high reliability***



- Usable by regular optical microscope with white light source
- Selective enhancement of full-color dyes (RGB)
- Bio-compatible surface

MicroTAS with Ag nanosheet



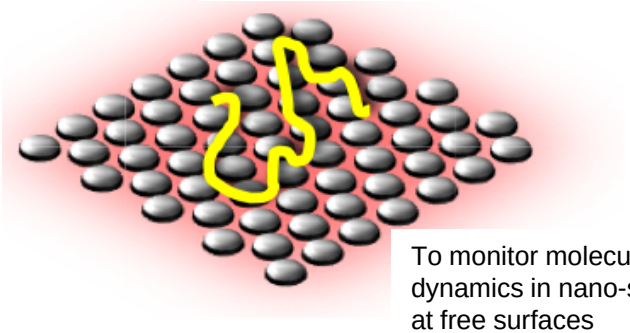
White light

## LIFE INNOVATION 1 ＝＞Tumor Marker Chip

- High spatial resolution : ~10nm

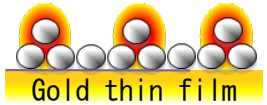
## LIFE INNOVATION 2 ＝＞Single Molecule Detection

Single Molecule Imaging



- Challenge to present spatial resolution limit
- To obtain nano-spatial information from on-off signals arising when a molecule crosses hot spots on surface

  - Nano-stimulation to biomolecules by complex structured LSPR
  - From DNA to cells




To monitor molecular dynamics in nano-scale at free surfaces