

Deep Tech Commercialization Strategies 2024

Nano-scale rings for optical applications

- **Tereza Rezabkova** (LLM, 2025)
- **Juan Mabile** (ChemE MS - PDP, 2025)
- **Pierre-Louis Soulie** (MechE MEng, 2025)
- **Chen Dai** (MechE 5th Year MS)
- **Remy Freire** (MBA / MEng, 2025)



Our patent outlines a novel method for fabricating ring-shaped nanostructures using **directed self-assembly (DSA)**

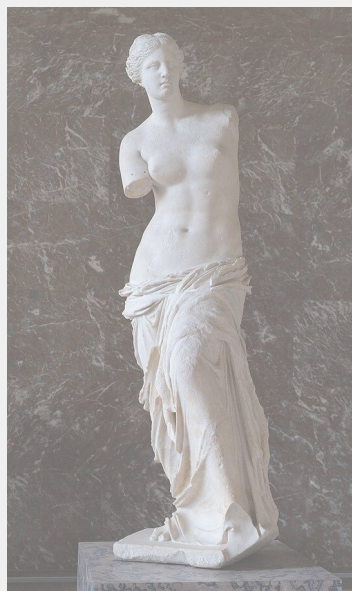


Nanofabrication techniques

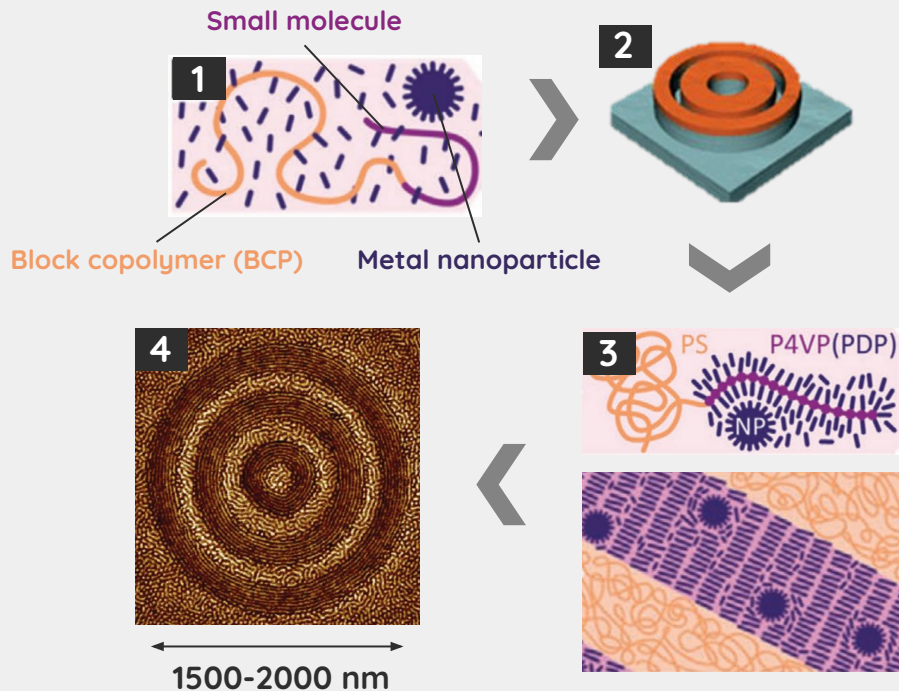
Our patent's fabrication process



Bottom Up



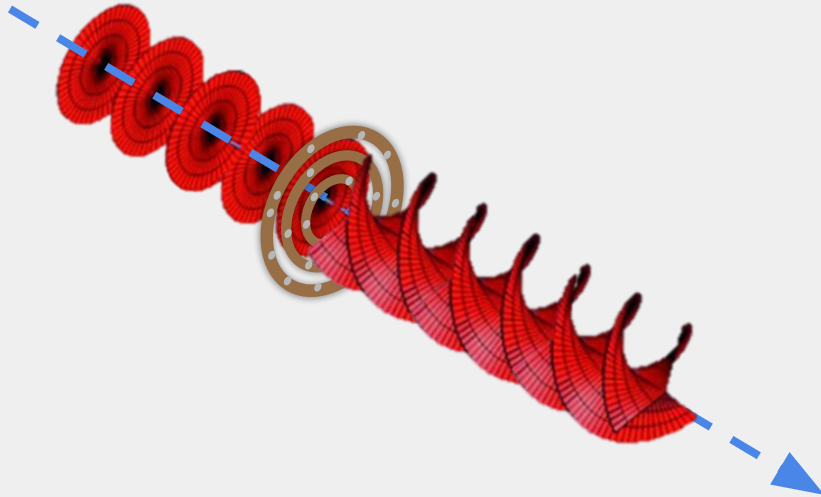
Top Down



These “nanorings” have been shown to generate **orbital angular momentum (OAM)** for light beams

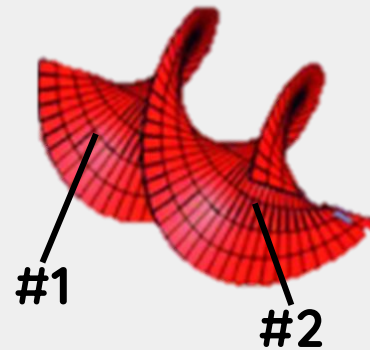


- When a wave has OAM, the **wavefront's radial angle changes as it moves through space**; thus, the wave is “spinning” like a coil or corkscrew

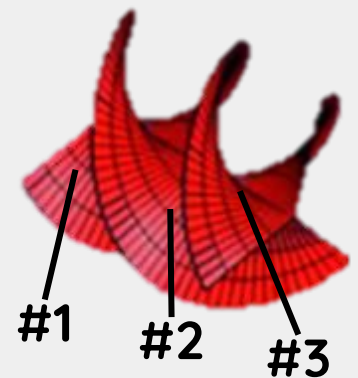


- Waves whose spin are phase-shifted **do not interfere**; thus, multiple beams can be **combined into one wavefront** and transmitted together, allowing **many different stream of information** to be sent simultaneously

2 beams



3 beams



Our team identified **optical communications devices** and **AR/VR** as the most promising end markets



Optical communications

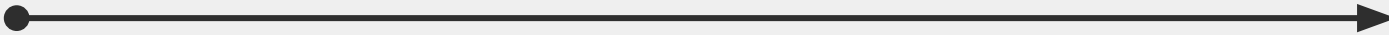


Solar panels



Quantum sensing

Near-term ●



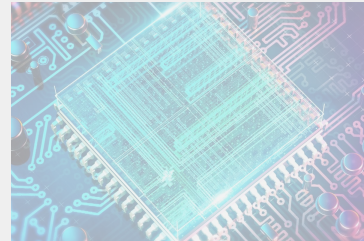
▶ Long-term



Optical instruments



Medical imaging



Photonic computing



Augmented Reality /
Virtual Reality devices

Nanorings may have **numerous advantages over current technologies** for multi-mode optical transmission



Phase element coupling, fiber grating, optical coupling conversion, and photonic crystal fiber are currently used to generate OAM

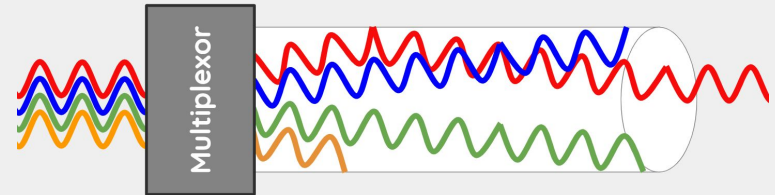
These methods introduce losses during mode conversion, **reducing signal power**

External devices or specialized fiber designs **complicate integration with fiber networks**

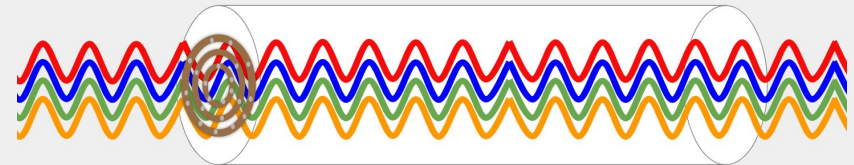
→ **Impact of nanorings:**

Can be easily integrated into optical fibers, **generating precise OAM modes directly, without the use of external converters**

Current technology



Potential impact of nanorings



Nanorings could **enable miniaturization** and **boost bandwidth** in AR/VR devices

AR hardware must balance **performance** with **wearability**

→ **Impact of nanorings:**

- **Compact optical components** replace bulky systems
- Enables **sleeker and lighter designs**

Current AR lenses face issues like **limited field-of-view** and **chromatic aberrations**.

→ **Impact of nanorings:**

- Nanorings can **enhance light bandwidth** for clearer display visuals
- Improved light manipulation efficiency **minimizes distortions and energy loss**



Microsoft HoloLens



Meta Orion



???



Miniaturization
progression

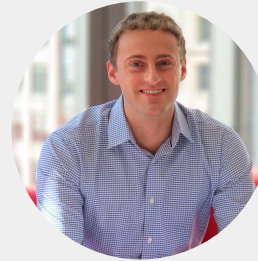


Thanks for listening! Questions?



Pierre-Louis Soulié

MechE MEng, 2025



Remy Freire

MBA / MEng, 2025



Juan Mabile

ChemE MS - PDP, 2025



Chen Dai

MechE 5th Year MS



Tereza Rezabkova

LLM, 2025