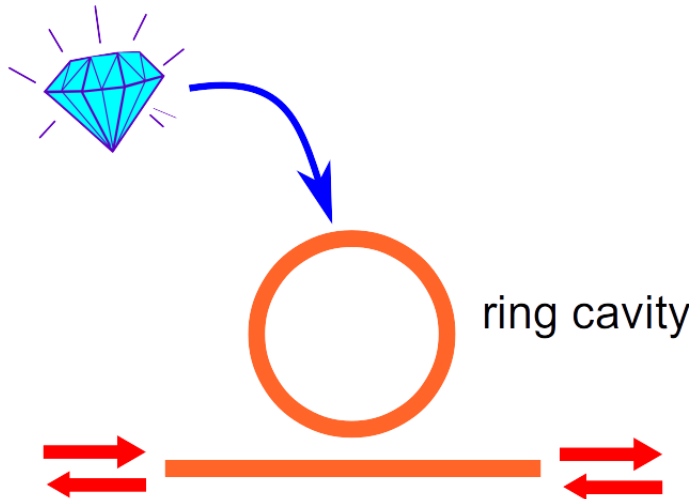


# Coupling Quantum Emitters in Nanodiamonds to Microring Resonators for Integrated Quantum Photonics



**Leonid Krivitsky**

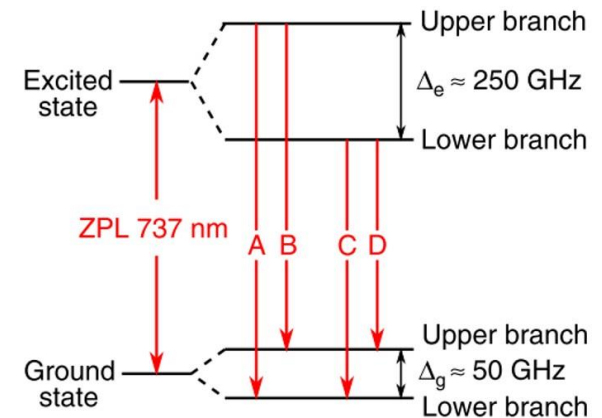
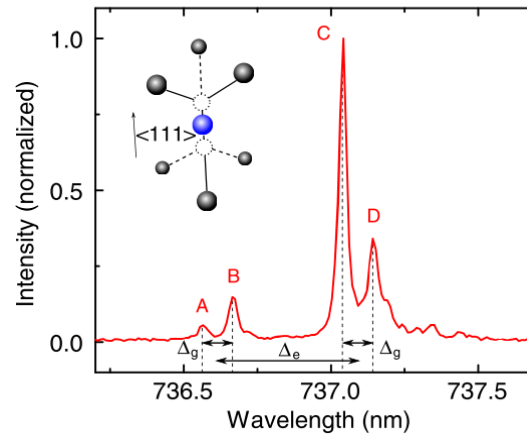
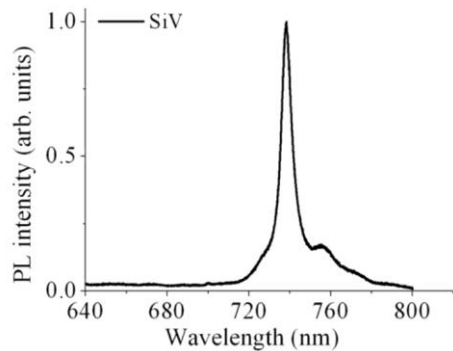
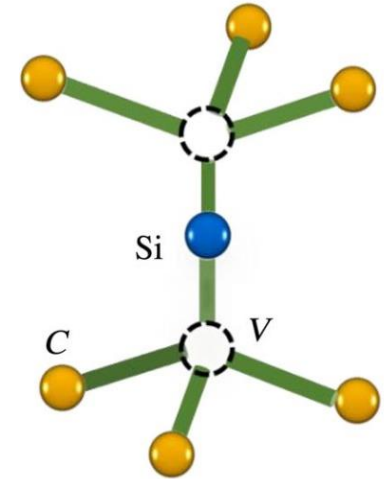
Institute of Materials Research and Engineering (IMRE)  
Agency for Science, Technology, and Research (A\*STAR)  
Singapore

*QTech - 2020*  
*02 Nov 2020*

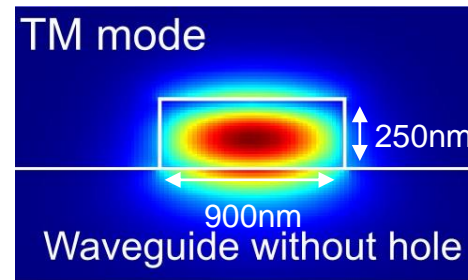
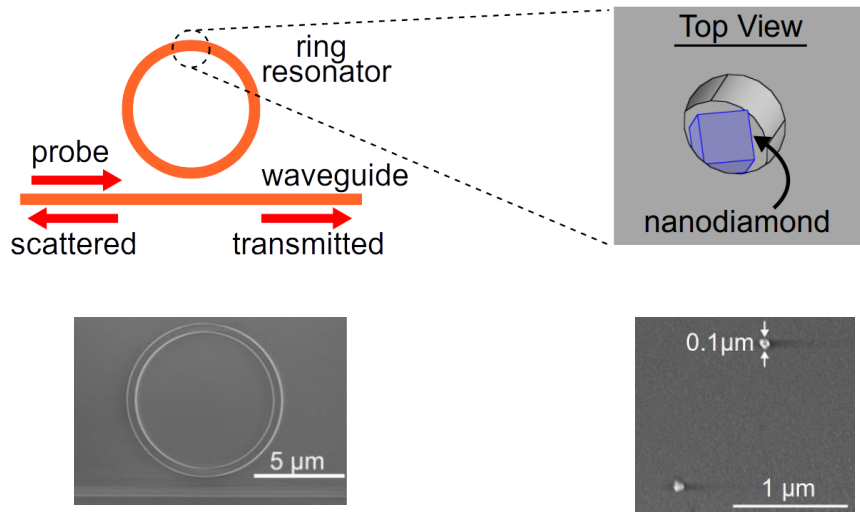
# Silicon-vacancy centers in diamond

## Desirable optical properties

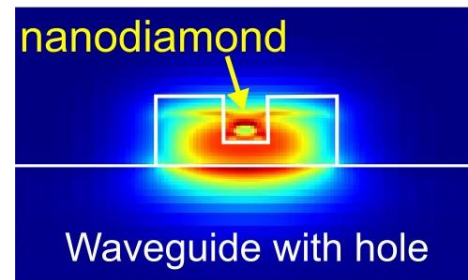
- Bright
- Photostable
- 70% of emission into narrow ZPL at 737nm



# Our approach: Nanodiamond in a silicon nitride ring resonator



Straight waveguide



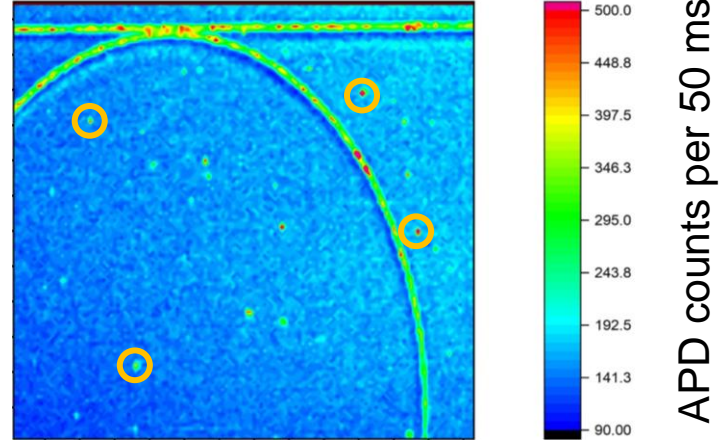
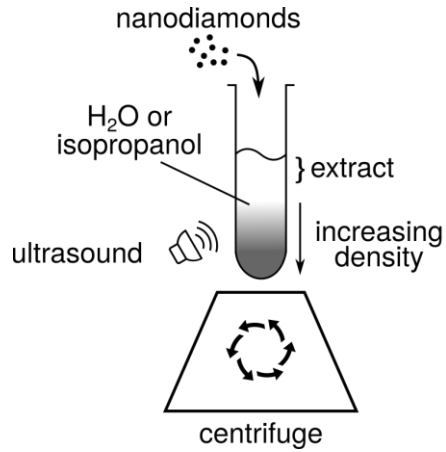
With nanodiamond

**Nanodiamonds** : alternative to complex machining of bulk diamond

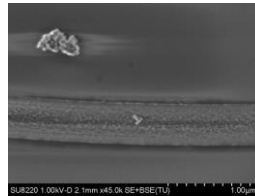
**Silicon Nitride** : CMOS compatible, transparent at visible wavelengths

**Ring resonators**: high Q, simple to fabricate

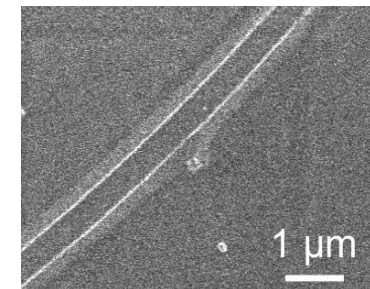
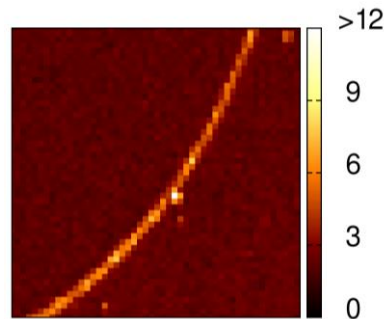
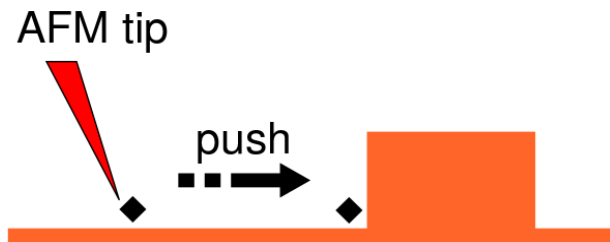
# Results: getting the nanodiamonds in place...



Spin-coating alone is not deterministic!

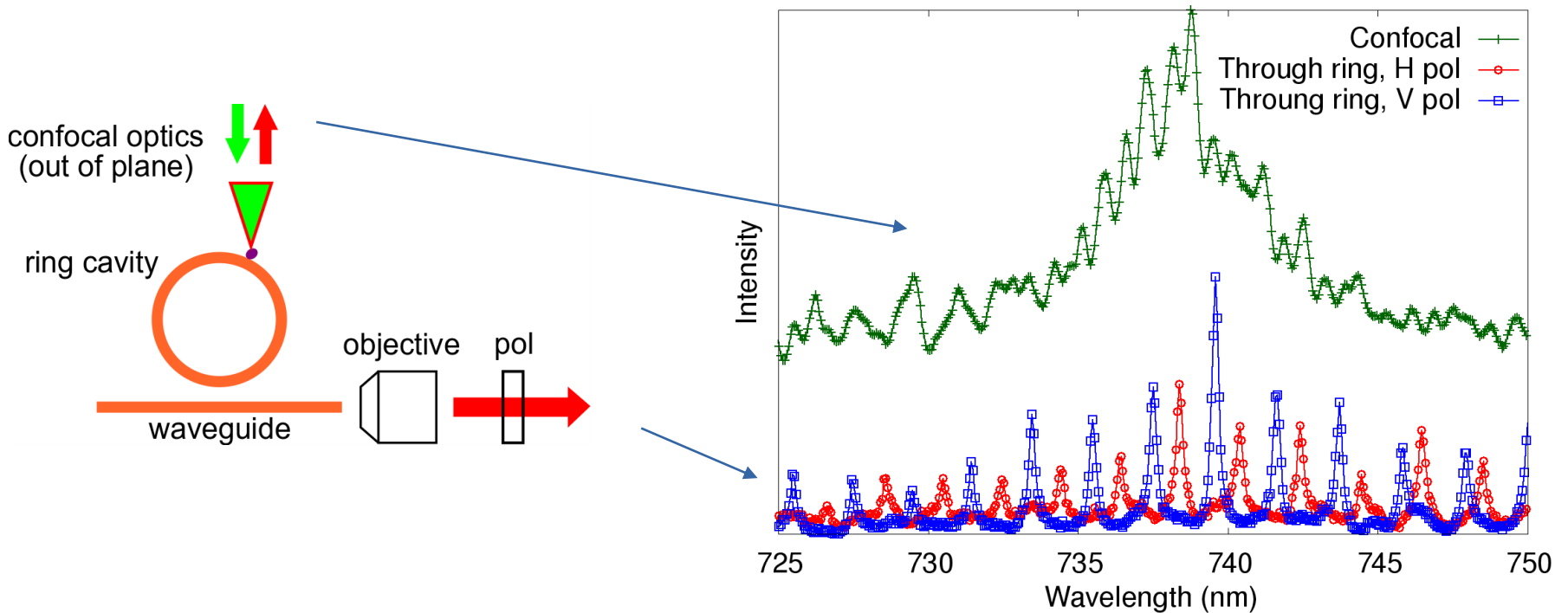


More deterministic solution: AFM



APD counts / s

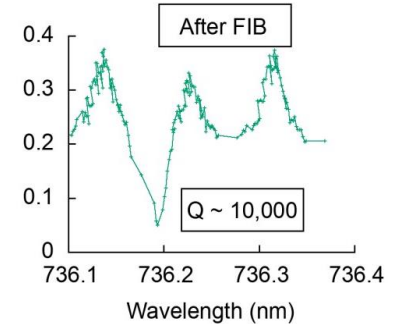
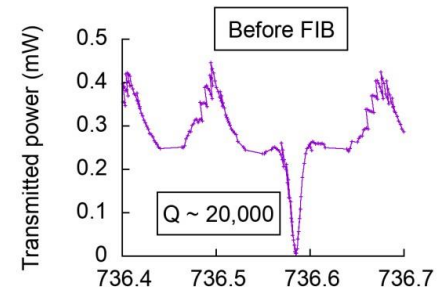
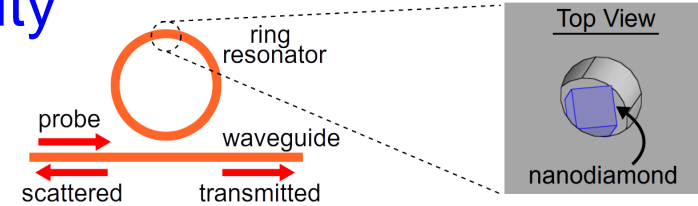
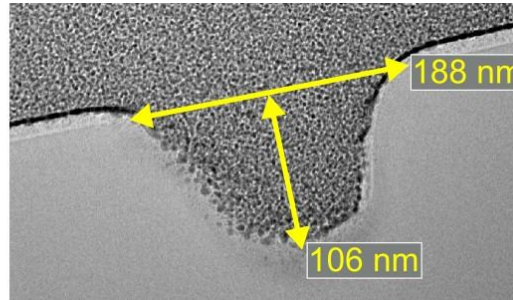
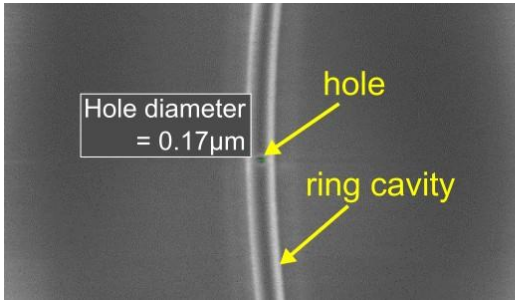
## Results: demonstration of coupling



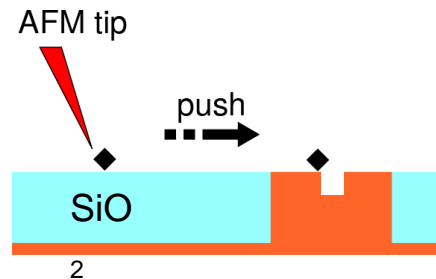
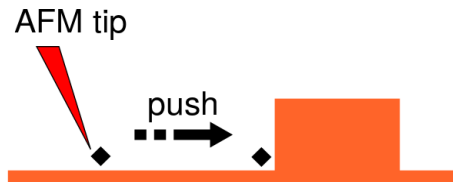
**What we see:** Many SiVs coupling to H and V modes of cavity

# Challenge #1: Nanodiamonds in ring cavity

## Drilling a hole via FIB



## Nanodiamond positioning

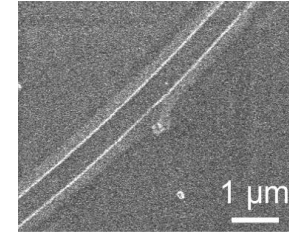


Improved devices to have a level surface

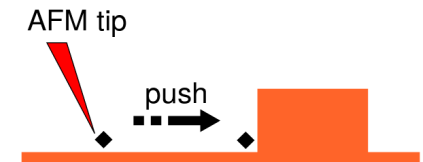
Possible idea: functionalized surfaces for NDs to attach, no need for AFM

# Summary

→ Photonics platform with SiV in nanodiamonds



→ Nanodiamonds positioned by AFM for coupling to ring cavities



→ Some SiV-cavity coupling observed

→ Outstanding challenges:

- Nanodiamond quality
- Nanodiamond in cavity
- Cavity tuning

