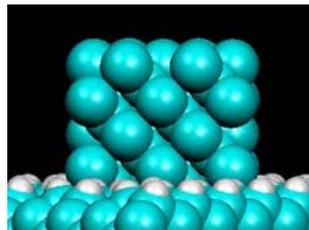




Goal:

Sub-10nm Si quantum dots with **discrete atomic** precision in XYZ.



The only limits to precision of the Si structures are the physics of the Si lattice. Top down control will allow independent control of X, Y, and Z dimensions of the structure.

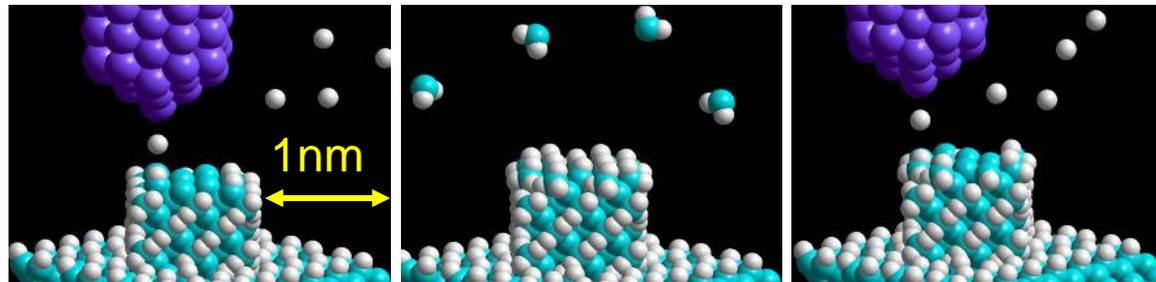
Team:

Zyvex Labs: Randall
 Univ Illinois UC: Lyding
 UT Dallas: Wallace, Chabal, Cho
 NIST: Silver, J. Gorman
 Univ North Texas: B. Gorman
 Univ Central Florida: Deppe
 UT Austin: Sreenivasan
 ICSPi: Sarkar
 General Dynamics: Toth-Fejel
 Vought Aircraft: Wimmer
 NTXRCIC: Lockerd

Funding:

40% - DARPA,
 30% - State of Texas (ETF)
 30% - Self funding

Tip based atomic precision fabrication



STM tip (purple atoms) is used for electron stimulated desorption of H (white) atoms from Si (cyan) surface atoms. SiH₂ radicals deposit Si atoms. Process repeats to create 3D structures.

Atomic Precision (AP) Lithography

- Precise, stable UHV STM
- Invariant, atomically sharp STM tip
- Atomic precision H removal from Si surface with STM
- Atomic Layer Epitaxy of Si in dehydrogenated areas
- Multiple pattern / deposit cycles to build Q-dots

Scale-up by parallel MEMS and nanoimprint litho

- Closed-loop MEMS scanner arrays with sub-nm resolution
- CMOS / MEMS process supports integrated electronics
- Nanoimprint templates via atomically precise litho
- Nanoimprint litho, etching, and regrowth for III-V q-dots

Commercialization pathways integrated with program