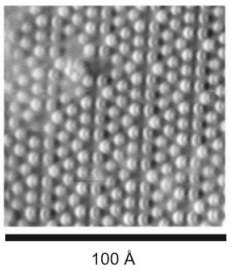
Homework #5
(Quantum Mechanical Model of the Atom)
CHEM 11 (S 2016, LAC)

(Due Tuesday, March 8

Note: You must show your work where appropriate; correct answers by themselves do not get credit. Also remember to apply significant digits to round your answers appropriately.

1. If Arbis can run the 300.-meter sprint in 82 seconds, what is his average velocity? (Remember the units on speed and velocity are m/s.) Assume his mass is 92 kg (he told us the other day it was a bit more than that) and find his de Broglie wavelength when he would run the 300-meter dash.

2. In the photo below we can see individual atoms of silicon. It is reasonable to assume that we can locate any given atom (and thus its electron cloud) to within about ±2Å. Use this uncertainty in position and Heisenberg's Uncertainty Principle to calculate the minimum uncertainty a scientist could measure the velocity of a silicon atom to have. Note: 1 Å = 0.1 nm.



[Source: ; Franz J. Giessibl, et al. Subatomic Features on the Silicon (111)-(7×7)Surface Observed by Atomic Force Microscopy. *Science* **289**, 422 (2000).\

3. Using the data and results from #1 and assuming the uncertainty in Arbis' velocity to be 0.1% of his average speed, calculate the minimum uncertainty at which we could possibly measure his position at any time during his sprint.

4. For iron (Fe) and cesium (Ce), fill in the orbital chart with arrows representing electrons and write the full electron configuration for each.