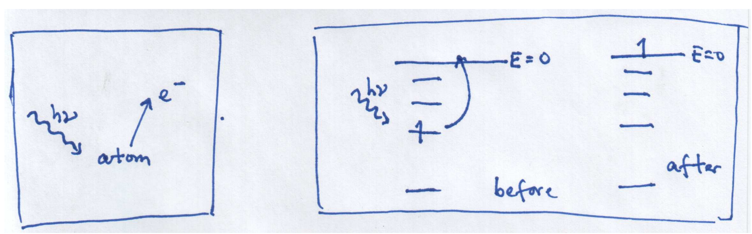
1 Morning class week 6 day 1: sp^3 hybridization

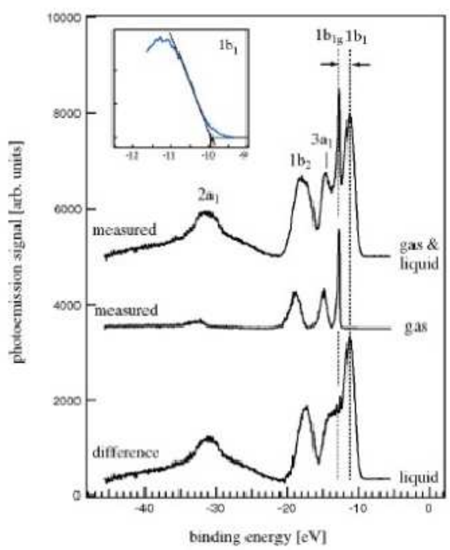
1. **Review:** In the last class, we derived the MO diagram for H_2O.

   (a) Please draw, again, the MO diagram for H_2O. Include in your MO diagram: shelves (energy levels), electrons, as well as drawings of all MOs. Place next to your MO diagram the full Lewis structure for H_2O.

   (b) On what points do your H_2O Lewis structure and MO diagrams agree? On what points do they disagree?

2. In general, the MO diagram gives more accurate answers, but the Lewis structure is easier to draw. Examine the two figures below. (Examine the central curves in the bottom graph, the one for molecular water, the gas.) Is the MO diagram or the Lewis structure in better agreement with experiment?





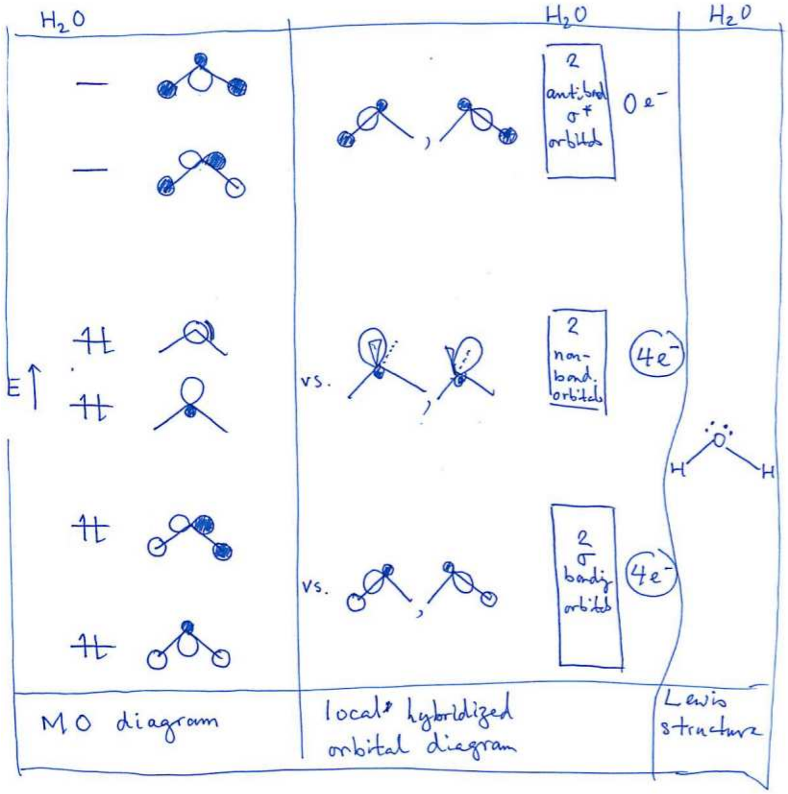
3. It is important to bridge MO theory to Lewis structures. **Hybridization**, the subject of today's class, is the best way to do so.

   (a) Add and subtract the two non-bonding H_2O MOs. What basic rule for making MO diagrams did we violate when we mixed these two orbitals?

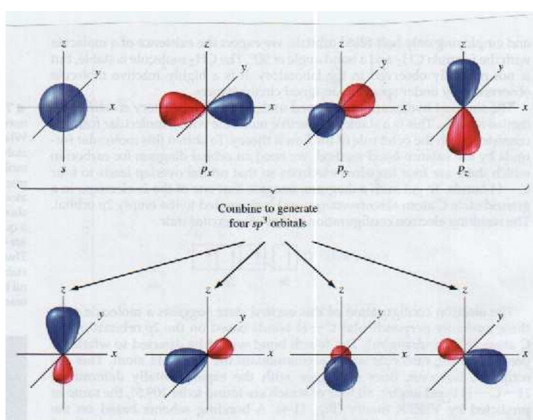
   (b) Add and subtract the two bonding H_2O MOs. What basic rule for making MO diagrams did we violate when we mixed these two orbitals?

   (c) Add and subtract the two antibonding H_2O MOs. What basic rule for making MO diagrams did we violate when we mixed these two orbitals?

   (d) Examine below the Rosetta Stone for water. What is the difference between the three "languages": MOs, hybridized orbitals, and Lewis structures?



4. The hybridized orbital diagram is intermediate between the MO diagram and the Lewis structure. For steric number 4 systems, it is generated by sp^3 hybridization, see below.



5. I will show in class how to generate a hybridized orbital diagram for ammonia. Please draw hybridized orbital diagrams for the following other SN 4 based molecules"

   (a) CH_4

   (b) C_2H_6

   (c) epoxide, $(CH_2)_2O$