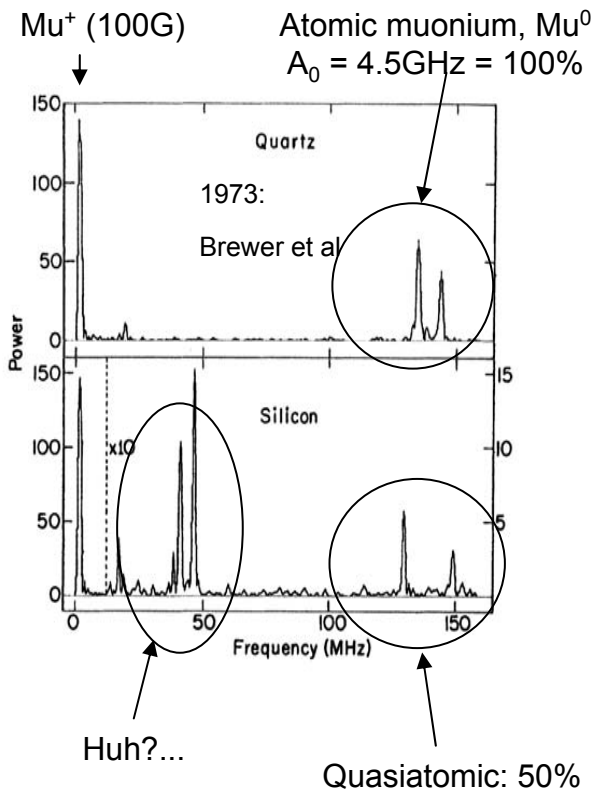
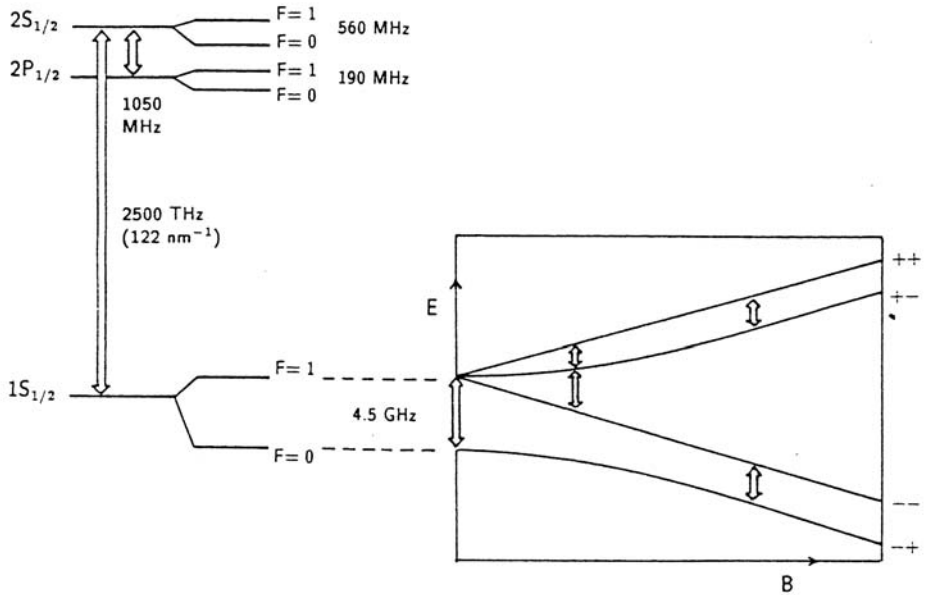
Non-metallic systems – Muonium spectroscopy

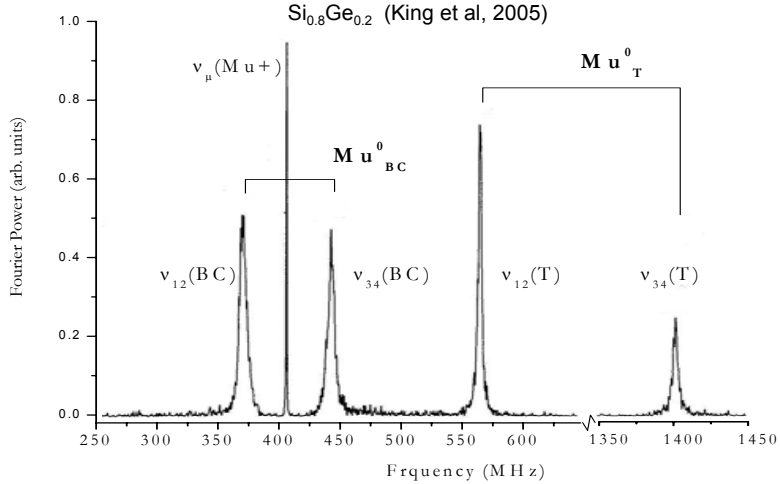
Steve Cox

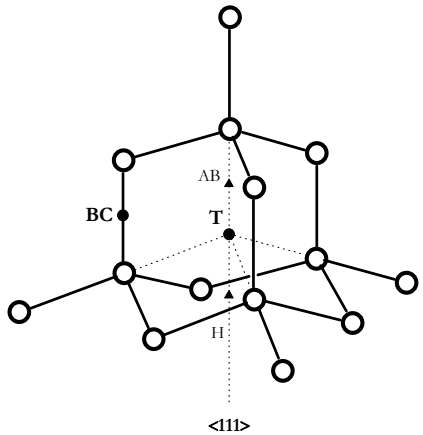


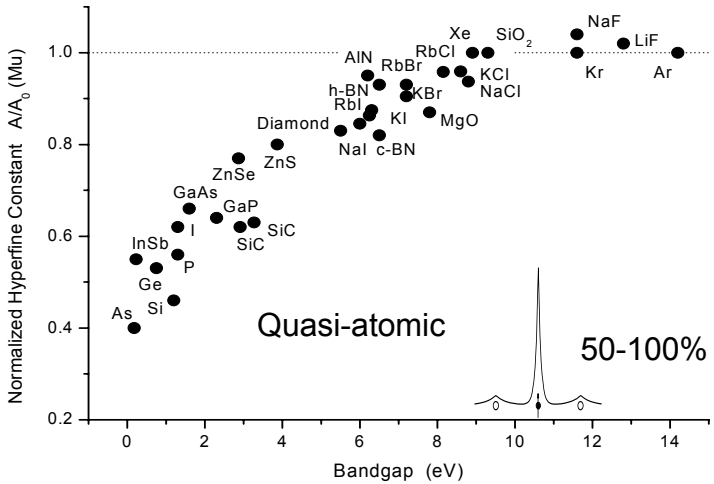


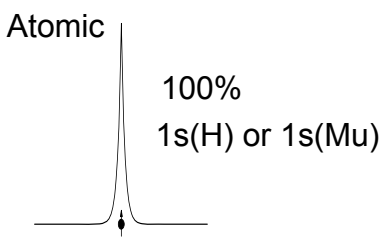
Energy levels for vacuum-state muonium.

Hyperfine constants: assignments and systematics

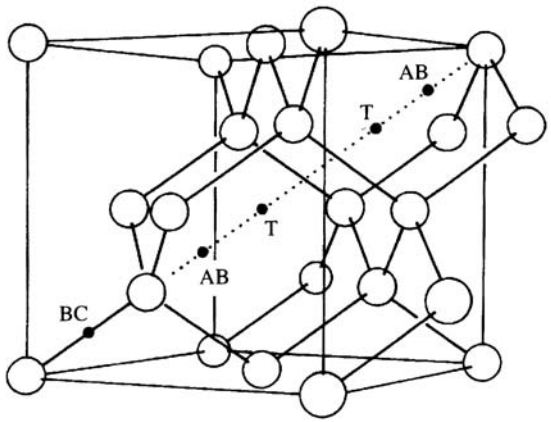


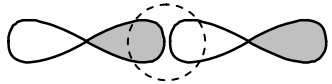




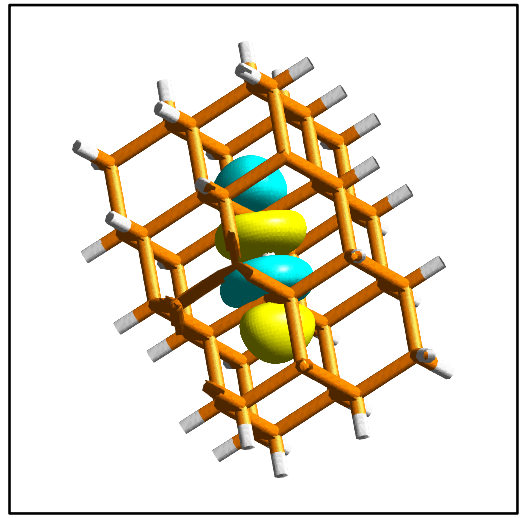


Metastability in Si, GaAs etc: cage-centre versus bond-centre



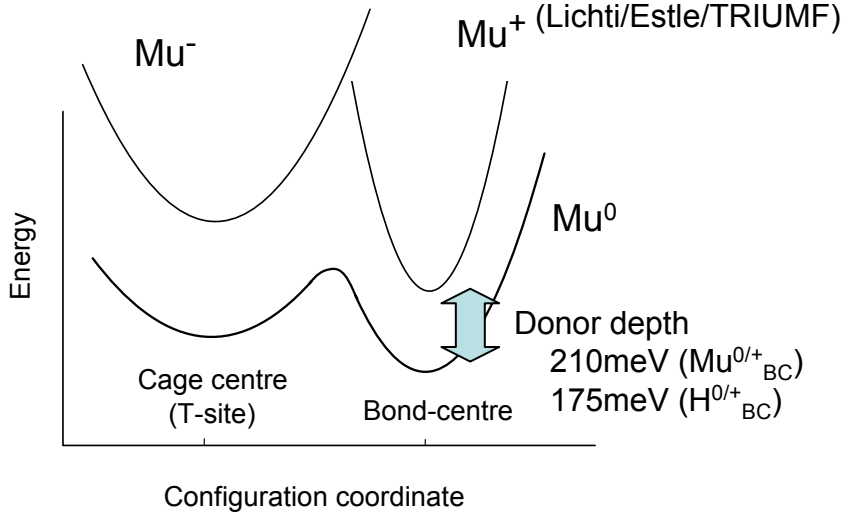


Molecular orbital model
for Mu_{BC} (Cox and Symons '86)

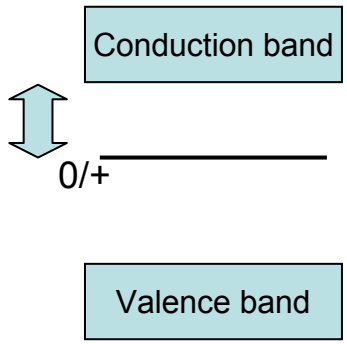


Simulation (Ewels)

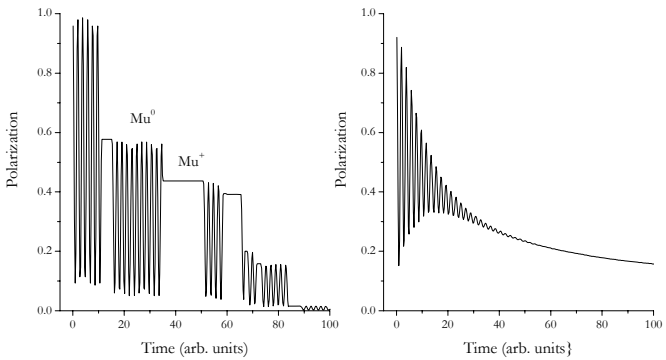
Interplay of site and charge state

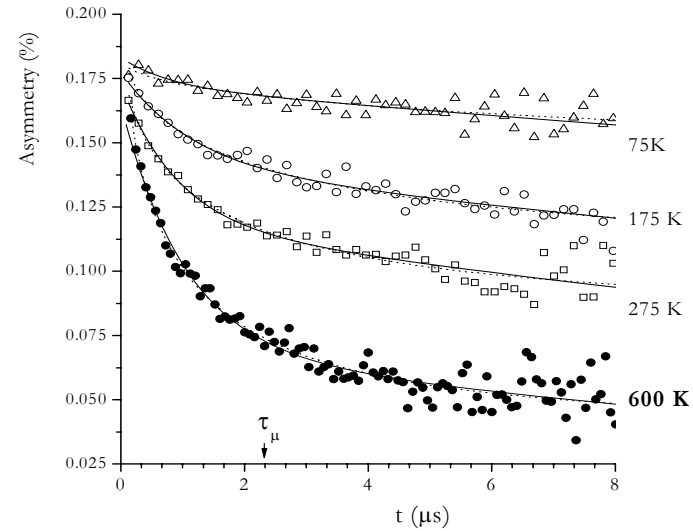


→ **Electrical activity**

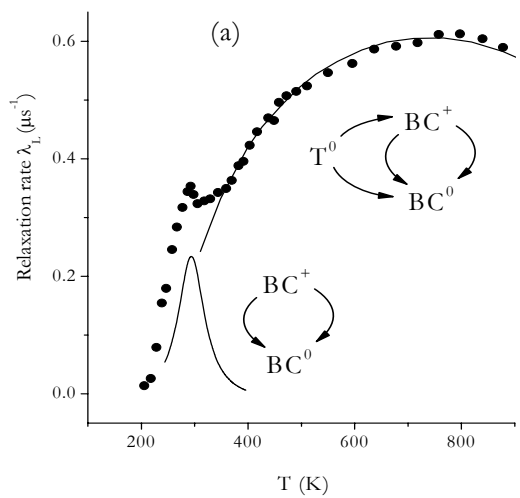


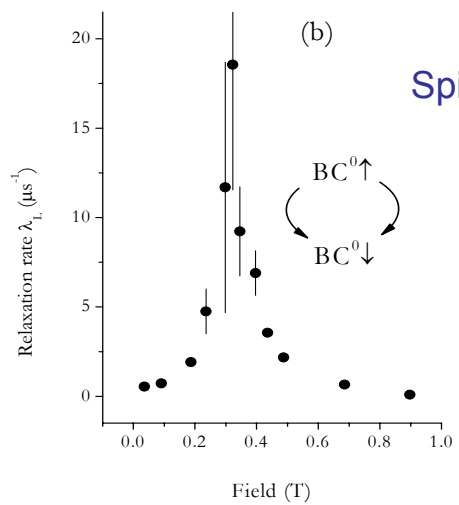
Electrical activity: capture, loss and scattering of carriers



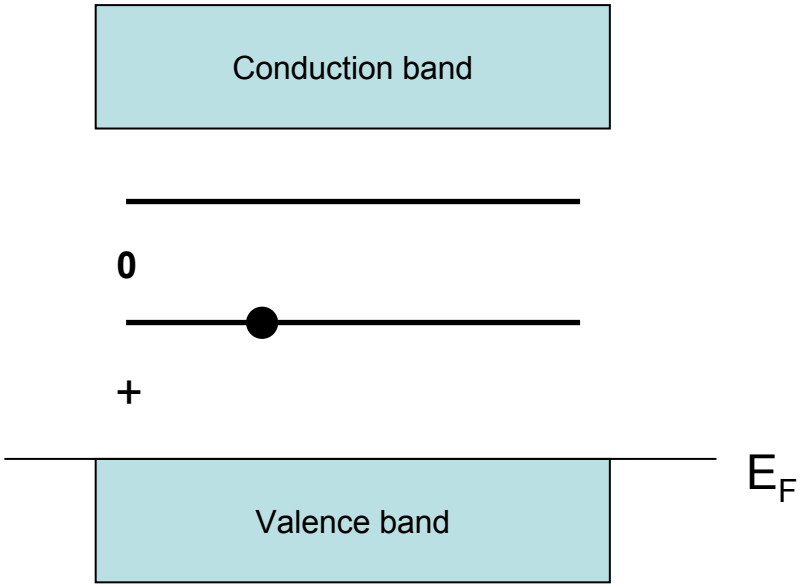


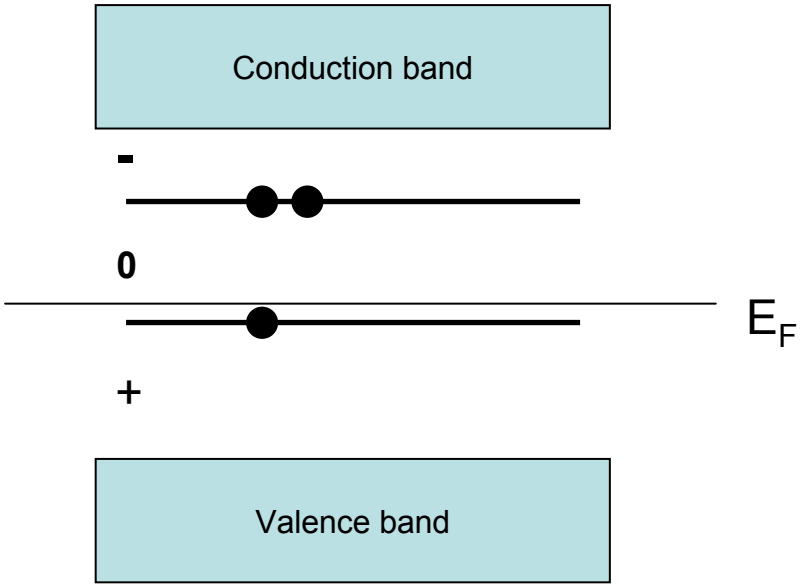
Charge exchange



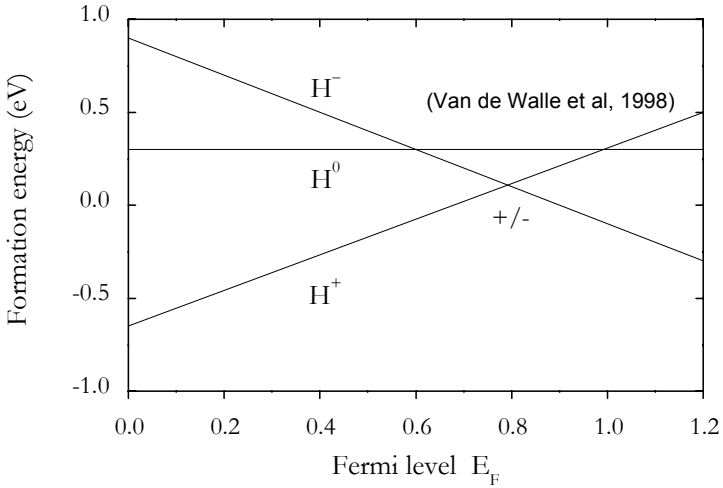


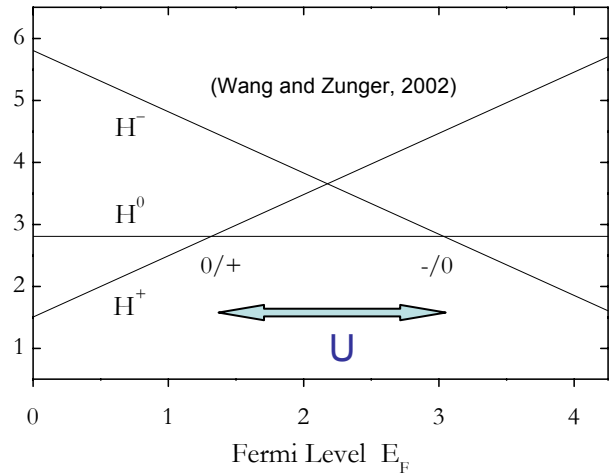
Spin exchange

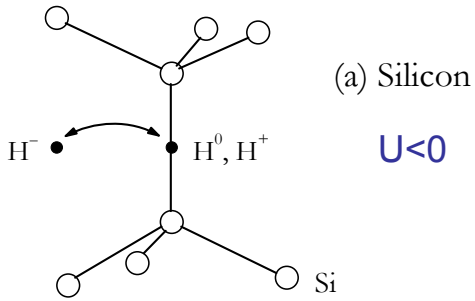

Conduction band
0
+
Valence band
E_F


Conduction band
-
0
E_F
+
Valence band

Donor, acceptor and pinning levels

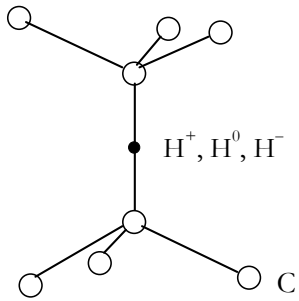






(a) Silicon

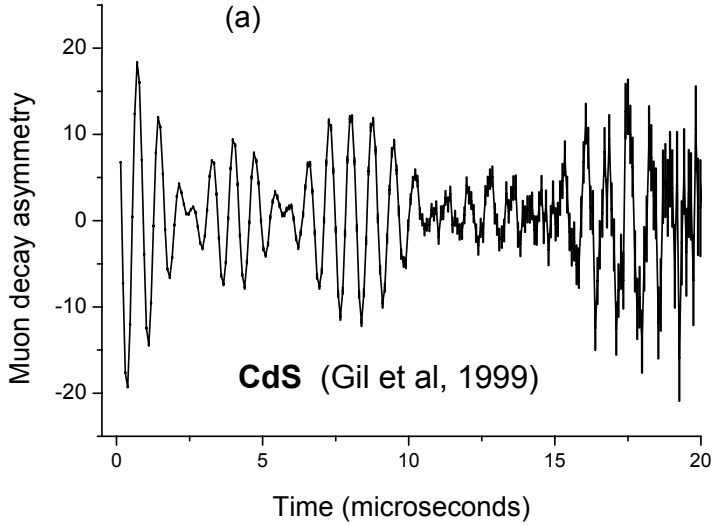
U<0

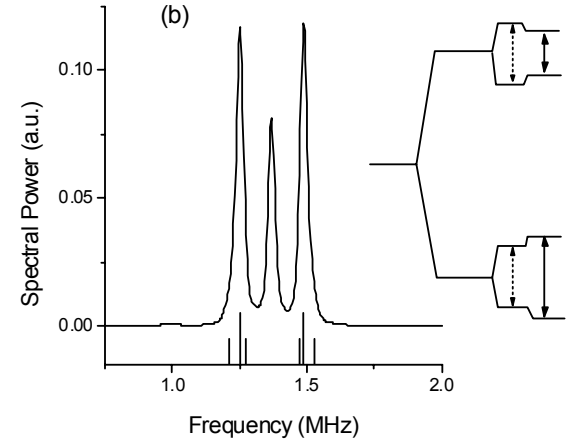


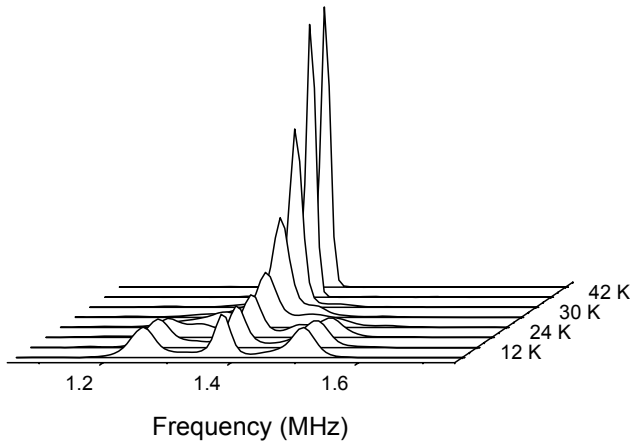
(b) Diamond

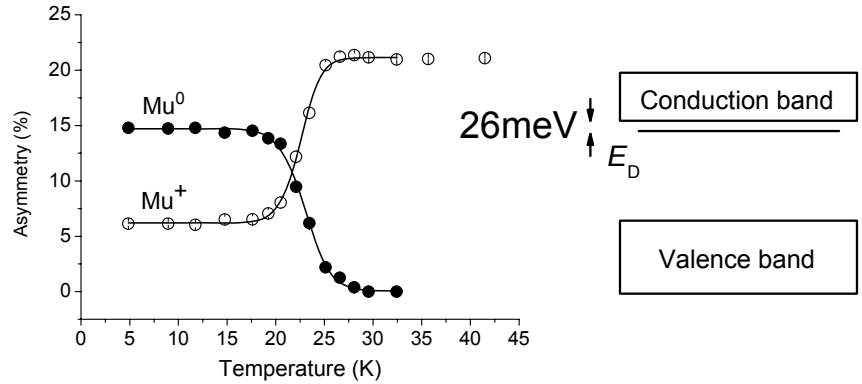
U>0

Shallow-donor states

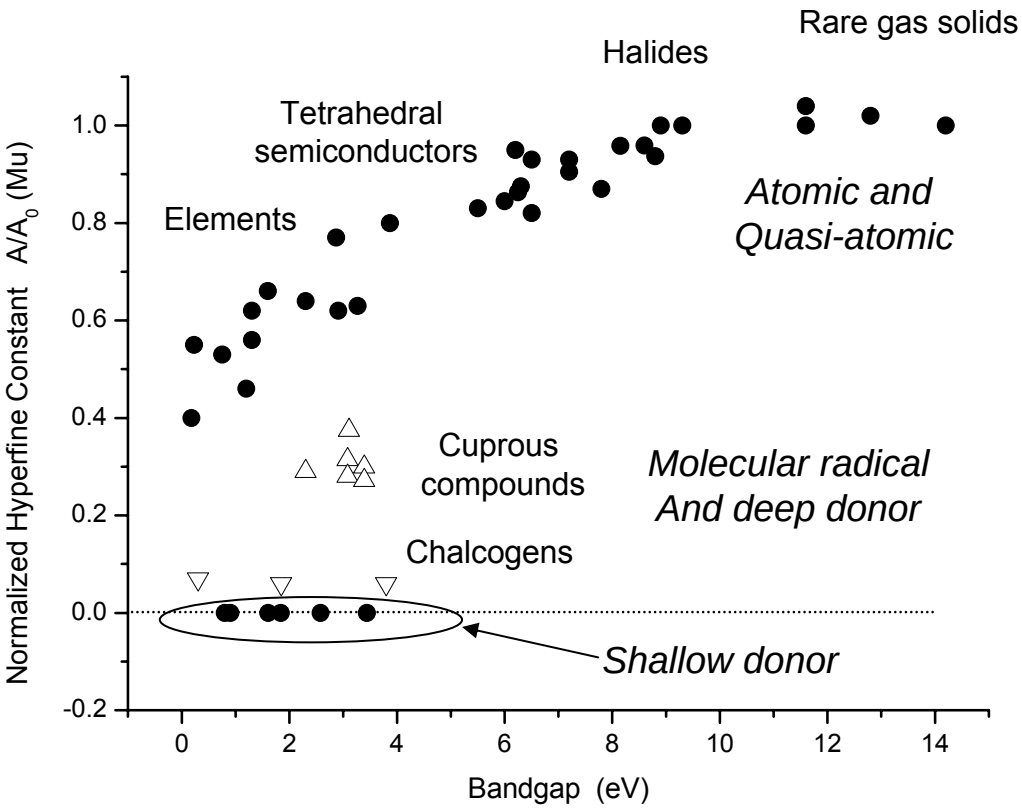


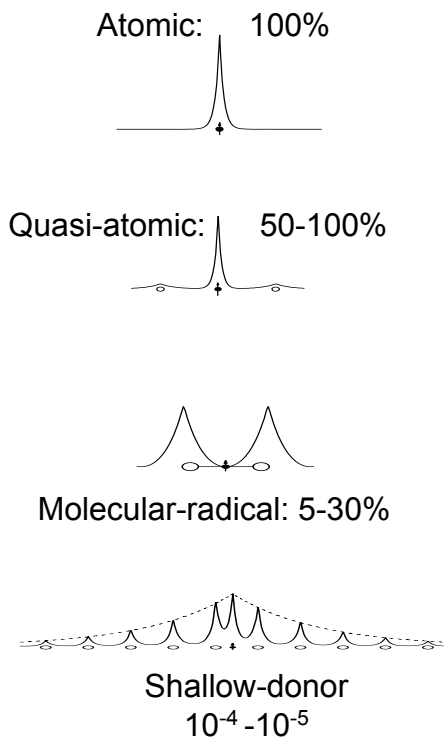




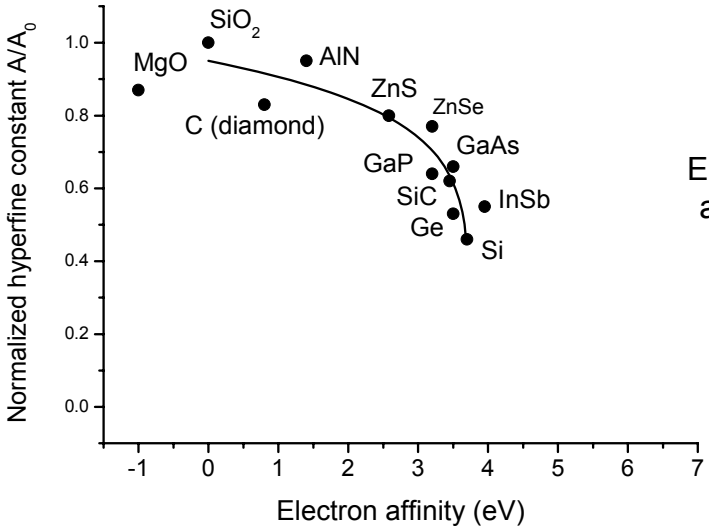


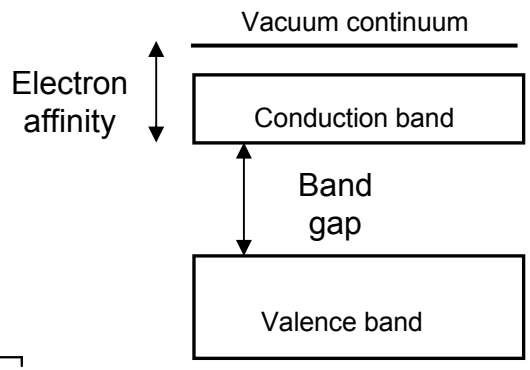
Almost all muonia! (Well, except all the organic radicals....)





The deep-to-shallow instability





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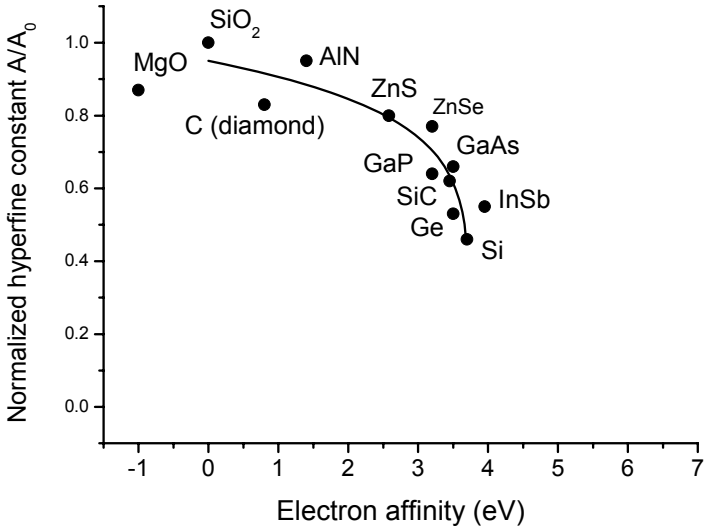

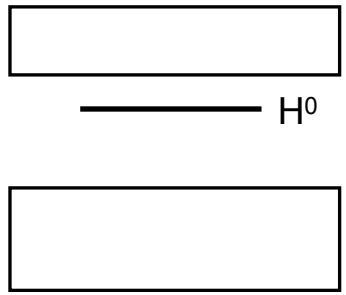

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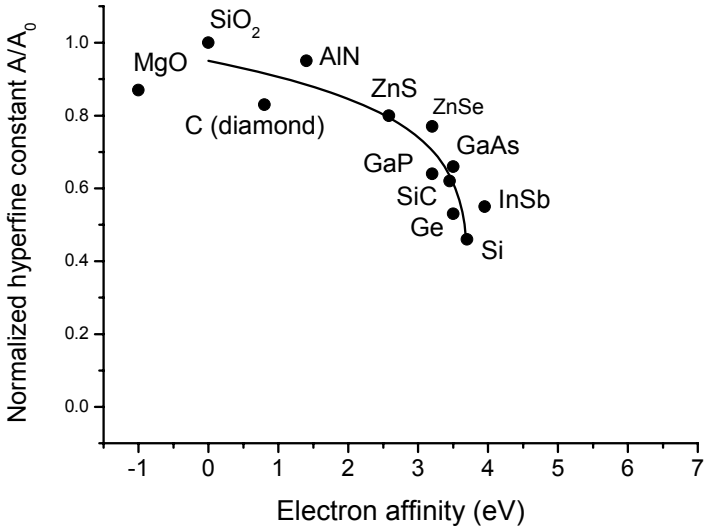

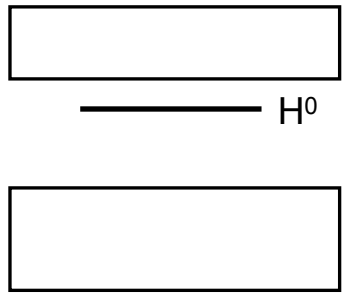

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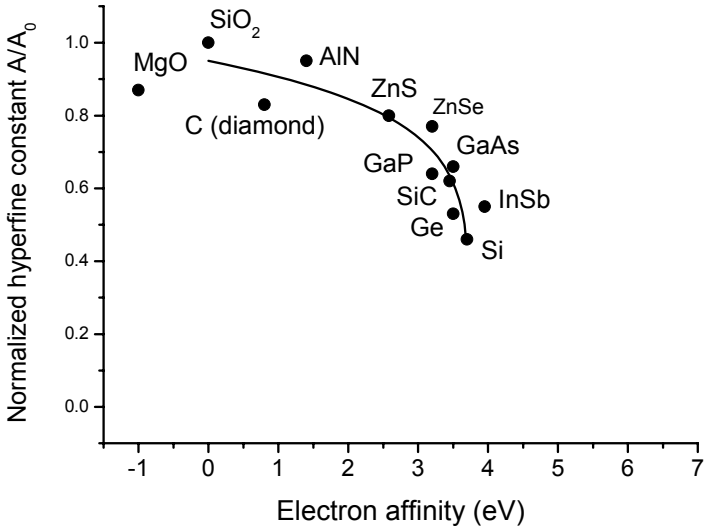
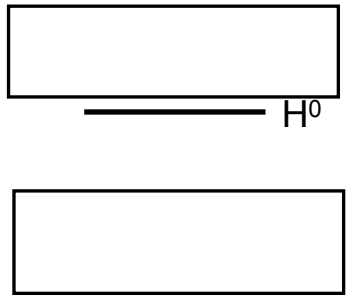
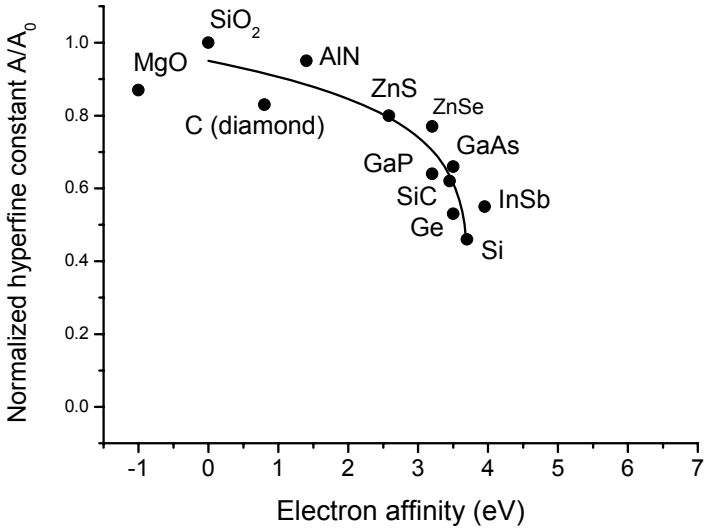
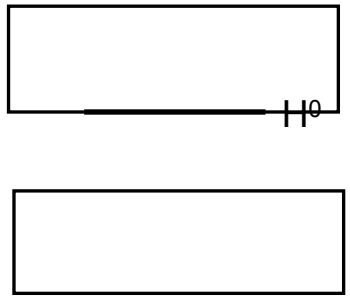




The deep-to-shallow instability





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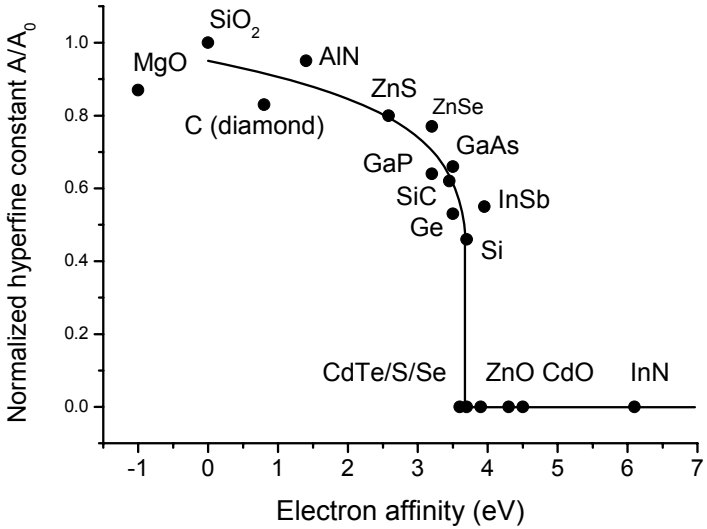
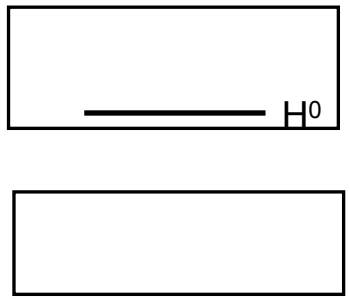
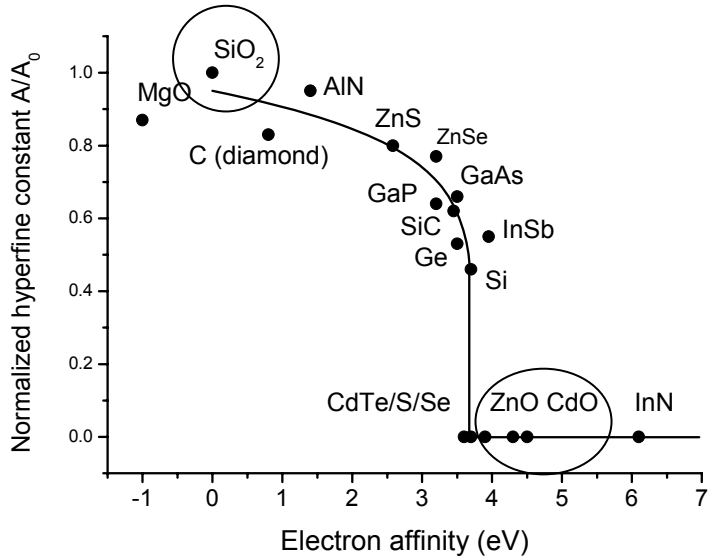
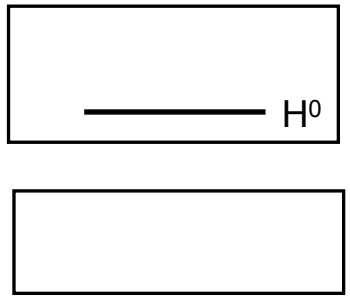


$H^0 \rightarrow H^+ + e_c$



The deep-to-shallow instability





$H^0 + O^{2-} \rightarrow OH^- + e_c$

Other oxides and high-k dielectrics

+ other new electronic materials...