

Energy is what drives civilization. The exploitation of energy sources has distinguished what all the cultures that we have identified as civilized versus those that are not.

Neil deGrasse Tyson



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SES 194

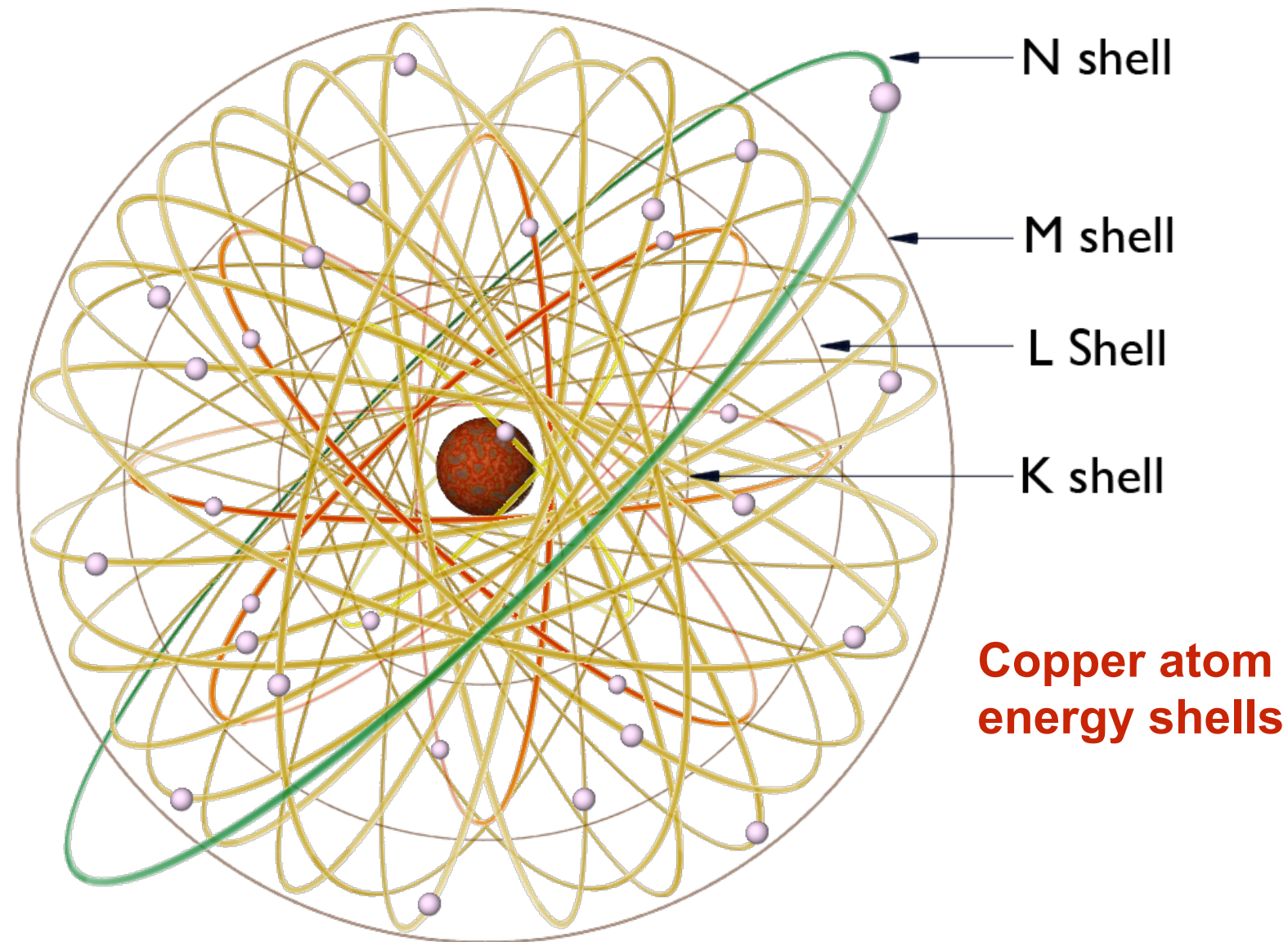
Energy in Everyday Life

Atomic Energy Levels

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Electrons take “positions” (orbitals or shells) around the nucleus. The first electrons occupy the lowest energy rungs, giving up the most energy to become part of the atom.



Subsequent electrons added to the atom give up less energy and are more easily removed from the atom.

As an analogy, consider a eucalyptus tree with pair of leafy branches going up the tree trunk and koalas eating the leaves.



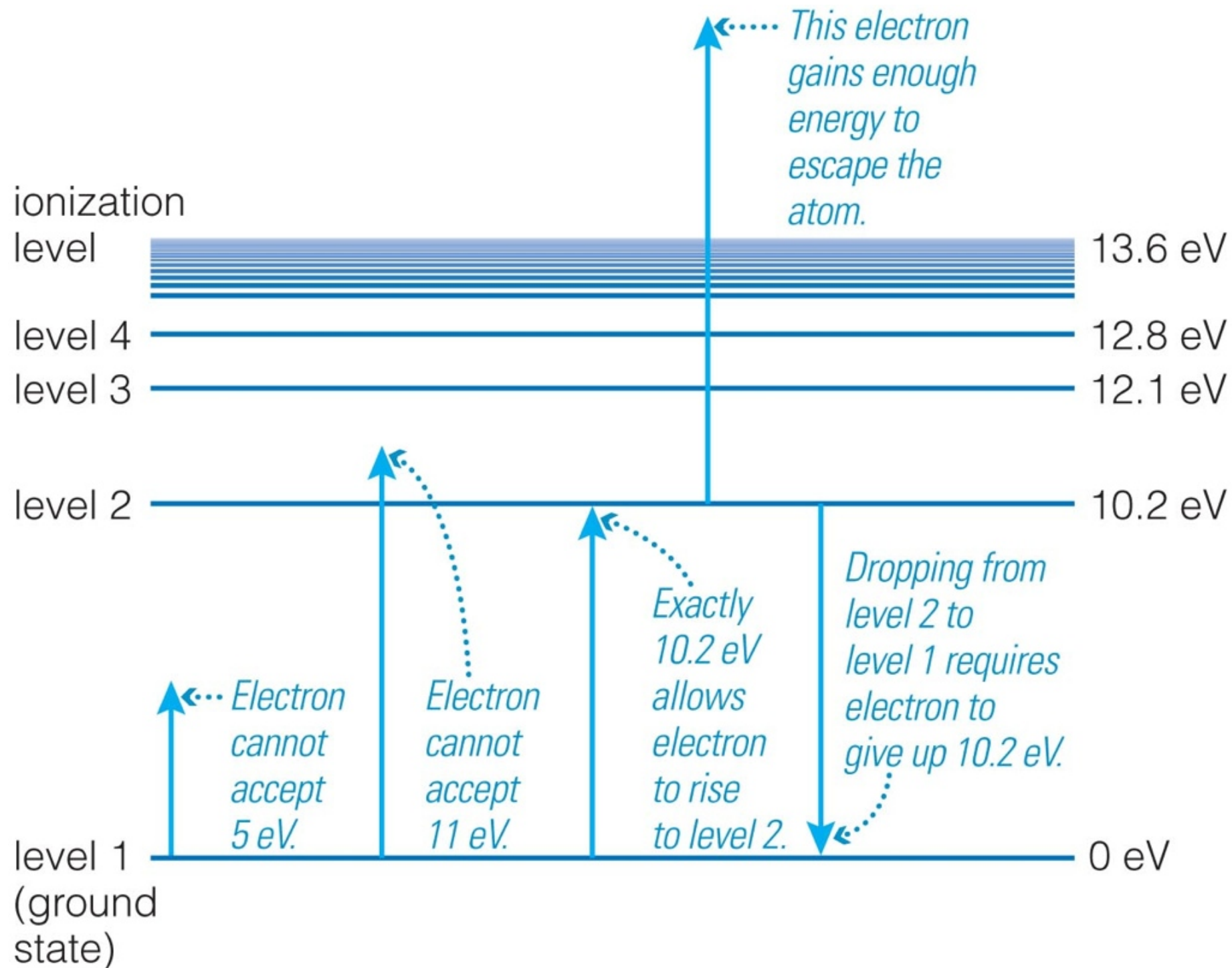
Because koalas have mass we imagine that they would break the thin branches if more than one koala sits on a branch.

Since each branch can hold only one koala, a new koala climbing the tree would have to climb to the next available free branch to have a perch on which to eat the eucalyptus leaves.

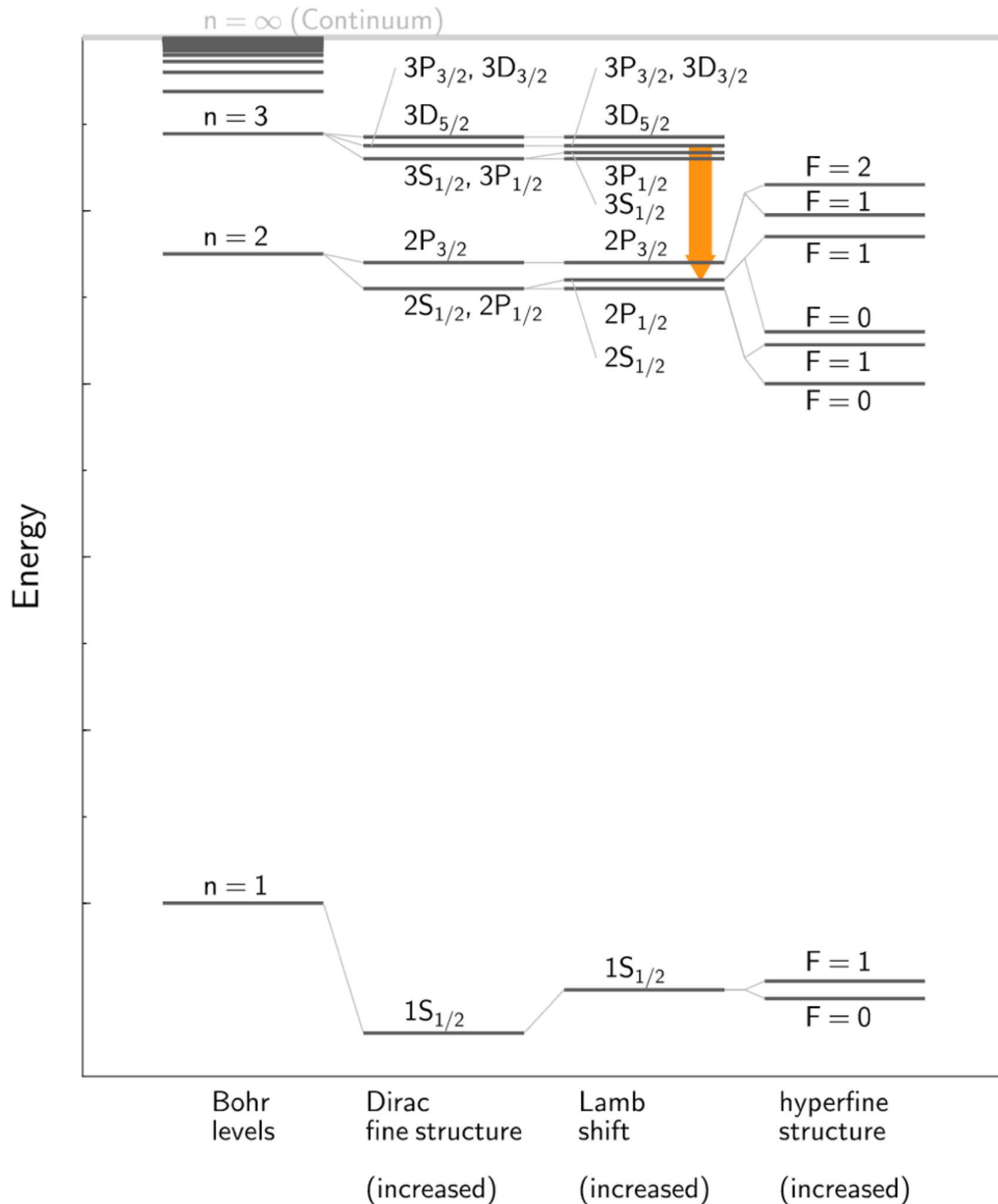


Likewise, electrons in atoms are forced by the exclusion principle to take “positions” higher in energy than those already there.

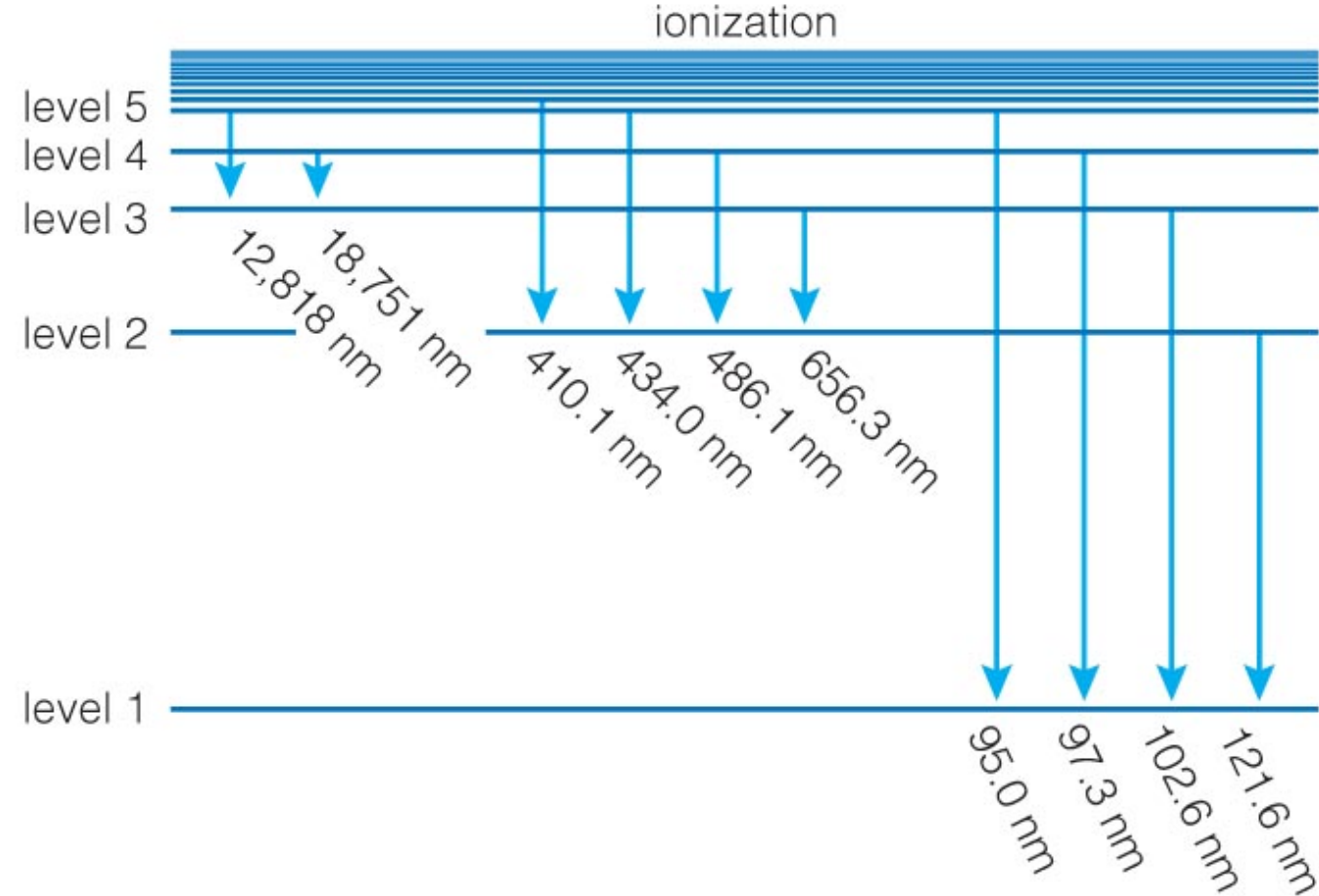
Electrons can only exist at specific energy levels in an atom. Electrons going from one level to another only occurs when an electron gains or loses just the right amount of energy.



**Hydrogen
energy levels**



Emission or absorption of light only occurs at specific wavelengths that correspond to specific energy level transitions in atoms or molecules.



a Energy level transitions in hydrogen correspond to photons with specific wavelengths. Only a few of the many possible transitions are labeled.



b This spectrum shows emission lines produced by downward transitions between higher levels and level 2 in hydrogen.



c This spectrum shows absorption lines produced by upward transitions between level 2 and higher levels in hydrogen.

Every element produces a unique set of spectral lines so we can determine composition by identifying these lines.

