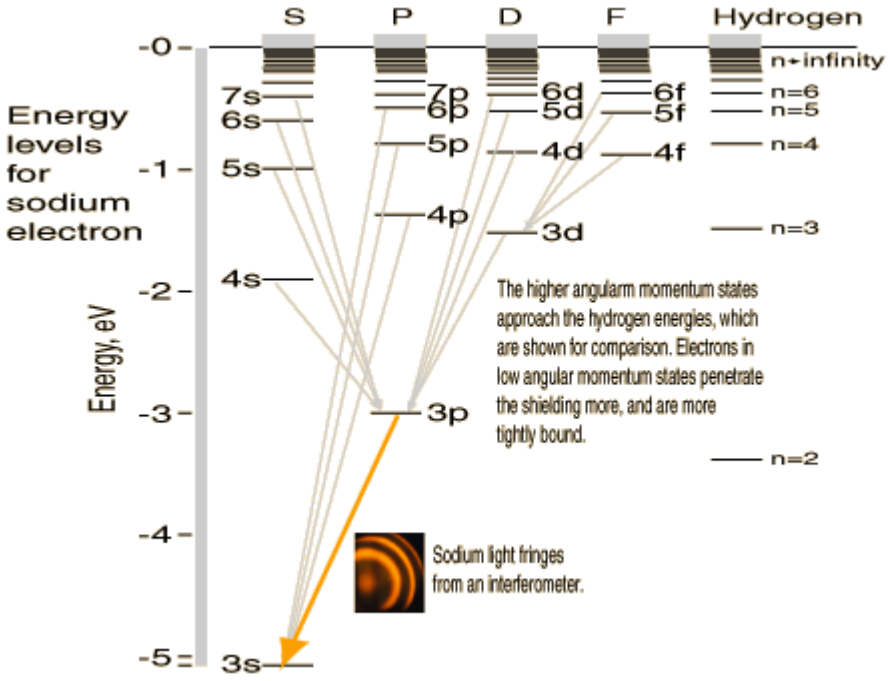
Sodium Energy Levels



Sodium spectrum | Why do levels vary with orbital quantum number?

Electron energy level diagrams

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Sodium Spectrum

The sodium spectrum is dominated by the bright doublet known as the Sodium D-lines at 588.9950 and 589.5924 nanometers. From the energy level diagram it can be seen that these lines are emitted in a transition from the 3p to the 3s levels. The line at 589.0 has twice the intensity of the line at 589.6 nm. Taking the range from 400-700nm as the nominal visible range, the strongest visible line other than the D-lines is the line at 568.8205 which has an intensity about 0.7% of that of the strongest line. All other lines are a factor of two or more fainter than that one, so for most practical purposes, all the light from luminous sodium comes from the D-lines.

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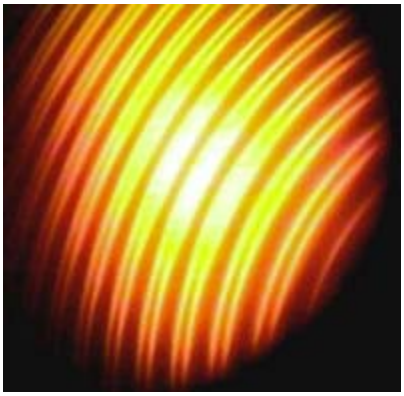
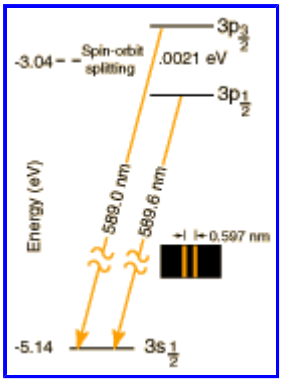
The illustration at left shows the interference pattern formed by the sodium doublet in a Fabry-Perot interferometer. At right is a sketch of the origin of the sodium doublet.



Sodium light from an electric pickle!



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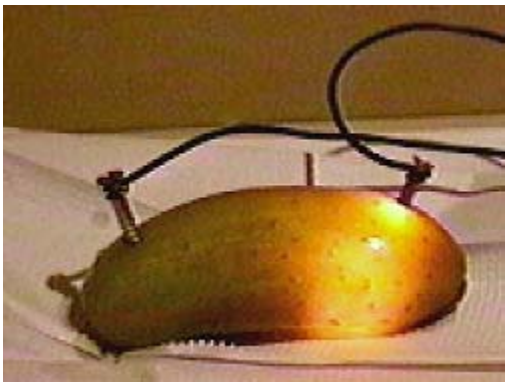
The Electric Pickle

A far-fetched example of a non-ohmic resistor is the electric pickle. A considerable amount of light can be obtained by connecting ordinary household 120 volt AC voltage across a pickle. After the pickling process, there are Na+ and Cl- ions present. The standard explanation is that the electric current excites the sodium ions, producing light similar to that of a sodium lamp.



Currents in ionic solutions are often not linearly proportional to the applied voltage. When Ohm's law is used with ordinary carbon resistors, the ratio of voltage to current is constant, but the variation in light output suggests that this is not the case with the electric pickle.

Thanks to Brian Lucy for this example.

Electric pickle movie

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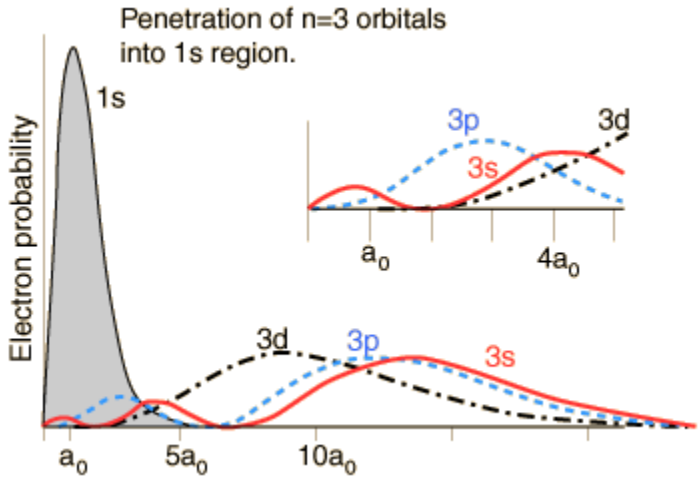
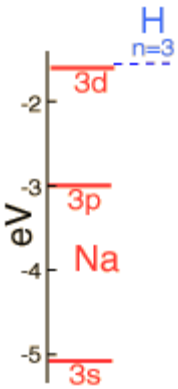
Sodium Energy Levels:Orbital Dependence



The sodium 3s level is significantly lower than the 3p because of greater penetration past the shielding of the 1s electron.



Both levels penetrate enough to be significantly lower than the n=3 hydrogen energy which they would have if the shielding were perfect.

Why do levels vary with orbital quantum number? | Sodium doublet

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