



Figure 3.3 Simplified energy level and transition diagram for mercury

The result of any collision between an electron and an atom is largely dependent on the energy of the electron. If the energy of the electron is less than that necessary to raise the atom to the first excited state then the collision will be elastic.

The most common transition is between the ground state of the atom and the first excited state. Radiation from the atom returning to ground state tends to dominate the output of the discharge; this radiation is known as resonance radiation.

In low pressure discharges, such as low pressure sodium, the light output tends to be at a series of discrete wavelengths, each corresponding to a particular energy transition in the atoms of the gas. In high pressure discharges the atoms of the gas interact with one another and this coupled with the higher electric and magnetic fields in the discharge cause the individual wavelengths found in the low pressure discharge to broaden into wider bands of radiation output. In developing lamps the selection of atoms or molecules that have energy transitions that correspond to radiation in the visible and ultra-violet is important (Figure 3.3).

Starting a discharge can be difficult because if there are no ions and free electrons present, the gas will not conduct a current. Most lamps use either a high voltage pulse or heated electrodes covered in special powders to get started.

The electrical properties of the discharge are unusual and in general discharges do not obey Ohm's Law. This is because the current in a discharge is carried by electrons and ions and their number is generally a function of the current, thus at higher currents it is easier for the charge to pass through the discharge and the voltage drops. In order to maintain a steady current through a lamp most discharge lamps require control gear.