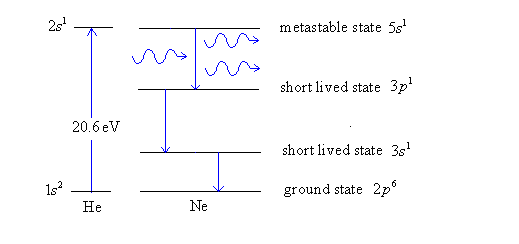
**Lasers**

Consider a He-Ne laser. These consist of 90% He and 10% Ne. The construction is as follows. We pass a current through the He-Ne gas. The current will excite the He in its ground state (1s2) to a meta-stable state (its first excited state at the 2s1 level) which is 20.6eV above the ground state. The purpose of the He is, I suppose, to siphon off 20.6eV of energy from the current, thus readying a lot of precise energy packets to be transferred to the Ne. If we just sent the current through the Ne initially, then all sorts of energies might be intercepted, and all sorts of excitations could occur, as we can see that there are plenty of excitations within the 20.6eV range in Ne. But the He predominantly intercepts the current (since it is 90% of the contents of the gas), and 20.6eV energy packets are prepared. The He excited state is meta-stable because it cannot transition to the ground state directly as that would correspond to Δℓ = 0. This will give it enough time to collide with Ne, in its excited state, and transfer the energy that way. 20.6eV happens to be an excited state of Ne so this will pump a 2p6 electron up to the 5s1 level.



The excited Ne electron is now in a metastable state. But eventually some will decay to 3p1, emitting a photon (perhaps many or most would decay to the ground state, but then these would be bumped up to 5s1 again by the He atoms, maintaining population inversion). Now this photon has a good chance of interacting with another Ne in the 5s1 state (since it is metastable) which will excite the electron and then cause it to emit two such photons to drop directly from its excited state above 5s1 to 3p1 (it is probably important that 5s1 + photon not be an excited state of the Ne atom). Thus one photon become two. These two photons will be phase coherent. Then the 3p1 electron decays rapidly to the ground state. This process will continue – the number of photons will amplify resulting in a relatively strong coherent beam. It is important that the particular photons (lasing photons) emitted from 5s1 to 3p1) not be absorbed by any other process that won’t result in amplification. And this is accomplished by having a substance with intermediate states between the lasing states and the ground state.