The periodic table of the elements and the corresponding periodic properties are built up by adding electrons according to the rules of quantum mechanics. The electrons are classified according to their four quantum numbers. Each electronic shell, characterized by a principal quantum number [17], contains subshells classified according to their angular momentum quantum numbers, $\ell = 0,1,2,3 \cdots n-1$. These latter states are generally labeled $S(\ell = 0)$, $p(\ell = 1)$, $d(\ell = 2)$, $f(\ell = 3)$, etc. The electrons build up regularly from element to element, filling first the 1s shell (2 electrons) then the 2s, 2p (6 electrons)etc., up to potassium. In potassium, however, the last electron enters the 4s state leaving the 3d shell empty; calcium has two 4s electrons and an empty 3d shell. Similarly the valence electrons on rubidium and strontium are in the 5s state while the 4d shell is empty, and cesium and barium have 6s valence electrons with an empty 5d shell. The transition metals are characterized by partially filled 3d, 4d, or 5d shells with two electrons in the s shell of next higher principal quantum number. In the rare earth elements there are 6s electrons with an empty 5d shell and a partially filled 4f shell.

Let us now look at the electronic structure of an alkali metal, say cesium. The lattice is body centered. There is a spherically symmetric band which is related to the 6s atomic level and contains one electron per atom. This is, of course, the conduction band. In the free atom the 5d shell is five fold degenerate, that is, it contains five substates of equal energy, each capable of containing two electrons. In the crystalline field of the lattice two bands appear connected with the 5d shell, one capable of containing six electrons per atom and one with a capacity of four electrons. Both these bands are higher in energy than the band arising from the 6s shell, and, of course, contain no electrons.