

## **IEEE's Hands on Practical Electronics (HOPE)**

### **Week 5: Silicon, Breadboards**

#### **Definitions:**

*Conductor:* A material that contains many free electrons and allows electricity to flow.

*Insulator:* A material that contains no free electrons and doesn't allow electricity to flow.

*Semiconductor:* A material with electrical conductivity that is between an insulator and a conductor. The number of free electrons and holes can be changed by doping.

Semiconductors do not follow Ohm's Law.

*Hole:* The absence of an electron, thought of as a positively-charged particle. Holes move, just as electrons do, but flow in the opposite direction.

*Silicon (Si):* A semiconductor element, atomic number 14

*Lattice:* A solid form of silicon in which each atom is connected to exactly four others.

*Donor:* An element from group 5 of the periodic table.

*Acceptor:* An element from group 3 of the periodic table.

*Dopant:* A donor or acceptor atom.

*Doping:* The process of intentionally introducing dopants into a semiconductor so that it conducts electricity. This cannot increase the electrical conductivity enough to make it more conductive than metal; conductivity is still between insulators and conductors.

#### **Silicon:**

*N-type silicon:* Silicon doped with elements that have 5 valence electrons (e.g. P, As).

N-type material has an excess of electrons.

*P-type silicon:* Silicon doped with elements that have 3 valence electrons (e.g. B, Al).

P-type material has an excess of holes.

#### **How to use Breadboards:**

There are wires already inside the breadboard.

They are wired so that:

- The rails (red and black in the diagram) are connected vertically.
- The terminal strips (blue in the diagram) are connected horizontally.

To connect components, simply insert their leads into slots that are connected inside the breadboard.  
(See the breadboard diagram on the right.)

