Semi - Dirac Metals

Why in News

Researchers from the Indian Institute of Technology - Bombay have discovered special properties in a class of materials called “semi-dirac metals”.

How Semi - Dirac Metals differ from other metals?

- In general, metals are **good conductors** of electricity.
- A key aspect that decides the quality of conduction is the way **energy depends on the momentum of electrons.**

- **Dirac metals** differ from normal metals in that the **energy depends linearly on the momentum of electrons.** This difference is also responsible for their unique properties.
- **Semi-Dirac metals behave like Dirac metals in one direction and like normal metals in the perpendicular directions** (since their microscopic structure is different along the two directions).
- **Examples** of semi-dirac metals are systems such as TiO_2/V_2O_3 nanostructures (Oxides of Titanium and Vanadium).

Properties Discovered

- The direction-dependence of microscopic properties gives Semi - Dirac material **special optical properties.**
    - Semi-Dirac materials have very high optical conductivity of electromagnetic waves (light waves). These waves are of a specific frequency and a specific polarisation.
    - **Optical conductivity** is a measure of the opacity offered by the material to the passage of light through it.
        - Semi - Dirac materials would be transparent to light of a given frequency and polarisation when it is incident along a particular direction.
        - These materials would be opaque to the same light when it falls on it from a different direction.
        - There are many known applications for transparent conducting films – the common example being touch screens used in mobiles.
- The material possesses interesting **thermoelectric properties.**
    - Thermoelectricity is a **clean energy technology** that uses waste heat to produce electricity typically in low power applications.
    - This technology is used in efficient cars, where it is used to keep the lights on and to warm seats.

Source: TH