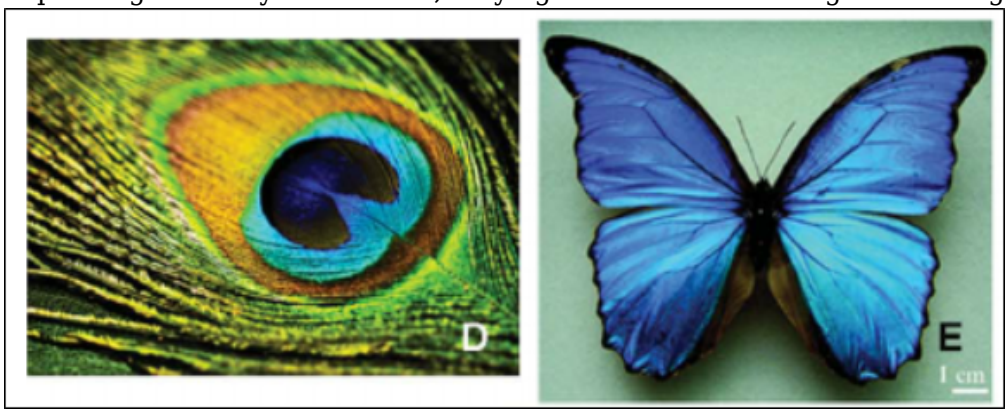
Structural Coloration

Prelims: *Science and technology | Current events of national and international importance*

Why in news?

Recently, scientists at the Centre for Nano and Soft Matter Sciences (CeNS) have now found a way to harness a property known as structural coloration.

Centre for Nano and Soft Matter Sciences (CeNS), *an autonomous institute of Department of Science and Technology (DST) under Ministry of Science and Technology is located in Bengaluru.*

- **Structural coloration** – It refers to colors in materials that is caused a result of the physical structure of the material.
  - **Example**: The *colour of the peacock's feathers* & radiant *wings of a butterfly* change depending on how you look at it, varying between shimmering blues and greens.
  - 

- **Research work** – It explores how size-reduced monolayers of self-assembled polystyrene (PS) nanospheres exhibit angle-dependent optical properties due to collective light-matter interactions within the monolayer.

Structural colors arising from nanoscale geometry can be finely tuned by varying both the size of colloidal spheres and the angle of light incidence.

- **Polystyrene Nano spheres** - These are about 400 nanometers wide which *naturally arrange themselves* into a flat, hexagonal pattern when floated on water.
- This self-assembly, driven by simple surface forces, results in what the scientists call a ***close-packed monolayer***.
- **Reactive ion etching** — It is a kind of *nano-scale sandblasting*, to gently shrink the spheres without disturbing their neat arrangement once a monolayerr is formed.

- This size reduction leads to a "non-close-packed" layout.
- **Property of light** – It behaves differently as it hits the altered surface.
- When light reflects off this nanostructured layer, its interaction with the tiny spheres causes *certain wavelengths (colors) to be amplified or diminished.*
  - **For instance**, by tilting the surface or changing the viewing angle, the reflected color shifts—typically towards blue.

- This phenomenon is predictable and tunable due to the way in which the spacing and size of the spheres affect light's path.
- **Advantages** – They do not rely on harmful dyes or complex fabrication processes and are durable and vibrant.
- **Applications** – It is used to *create tunable color-shifting materials* using tiny plastic beads that can be used for
    - Wearable sensors, anti-counterfeit tags, display technologies and even eco-friendly paints.

Reference

PIB| Tuning Structural Coloration in Laboratory