Diffraction Limit

Source: TH

The **resolution limit** of an **optical instrument** that uses light is constrained by the **diffraction limit**, a fundamental boundary that **prevents improvement** beyond a certain point.

- This diffraction limit affects the instrument's **ability to distinguish** between two close objects**.**
- Due to the diffraction limit, scientists could use the light microscope to **see cells but not the proteins inside them** or a **virus attacking them**.
- However, **optical microscopes** can **see inside cells** and even things as small as **atoms**. This technique is called **super-resolution microscopy**, and it is **not bound by the diffraction limit.**
    - Instead of using light to illuminate the cells in the microscope, special molecules called **fluorophores** were attached to the **cells**.
    - These molecules **glowed when exposed to radiation**, allowing the microscope to also **detect their surroundings**.
    - A microscope's **resolving ability** indicates how well it can **distinguish between two closely spaced distant objects**, with higher resolution resulting in better performance.
- The **Nobel Prize in Chemistry 2014** was awarded jointly to **Eric Betzig, Stefan W. Hell and William E. Moerner** for the development of **super-resolved fluorescence microscopy.**

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