

## **Rayleigh's Criterion**

(Lord Rayleigh, 1842–1919)

A theory by John William Strutt, alias Lord Rayleigh, defining the limit of spatial resolution in ideal optical system.

(Definition) Minimum distance between the centers of two resolvable points for either self-luminous points or incoherently illuminated optics.

$$\mathbf{d = 1.22 \times \lambda / (NA_{obj} + NA_{cond})}$$

Where, d = lateral resolution,

$\lambda$  = wavelength,

NA<sub>obj</sub> = numerical aperture of objective,

NA<sub>cond</sub> = numerical aperture of condenser

Example-1: Transmission system illuminated with green (546 nm) monochromatic light and equipped with high NA (1.4) objective and condenser lenses.

$$d = 1.22 \times 546 / (1.4 + 1.4) = 238 \text{ nm}$$

Example-2: Epifluorescence system illuminated with blue (480 nm) light and equipped with high NA (1.4) objective.

$$d = 0.61 \times 480 / 1.4 = 209 \text{ nm}$$

(Note) With relevance to MTF, in Rayleigh's criterion, the minimum contrast difference must be at least 26.5% for incoherent illumination, or 34% for coherent illumination.