Seeing the Invisible

Unveiling Hidden Details through Advanced Image Acquisition Techniques

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The Cost of Correction

Capturing images with suboptimal equipment.

Relying on software correction - time-consuming and resource-intensive.

Trying to enhance a poorly shot photo in Photoshop—significant effort with limited results.

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Two Concepts we're going to cover

Optical Aperture

- (Basic)

Multispectral Imaging

- (Advanced)

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Lens Aperture

The Quest
for Clarity

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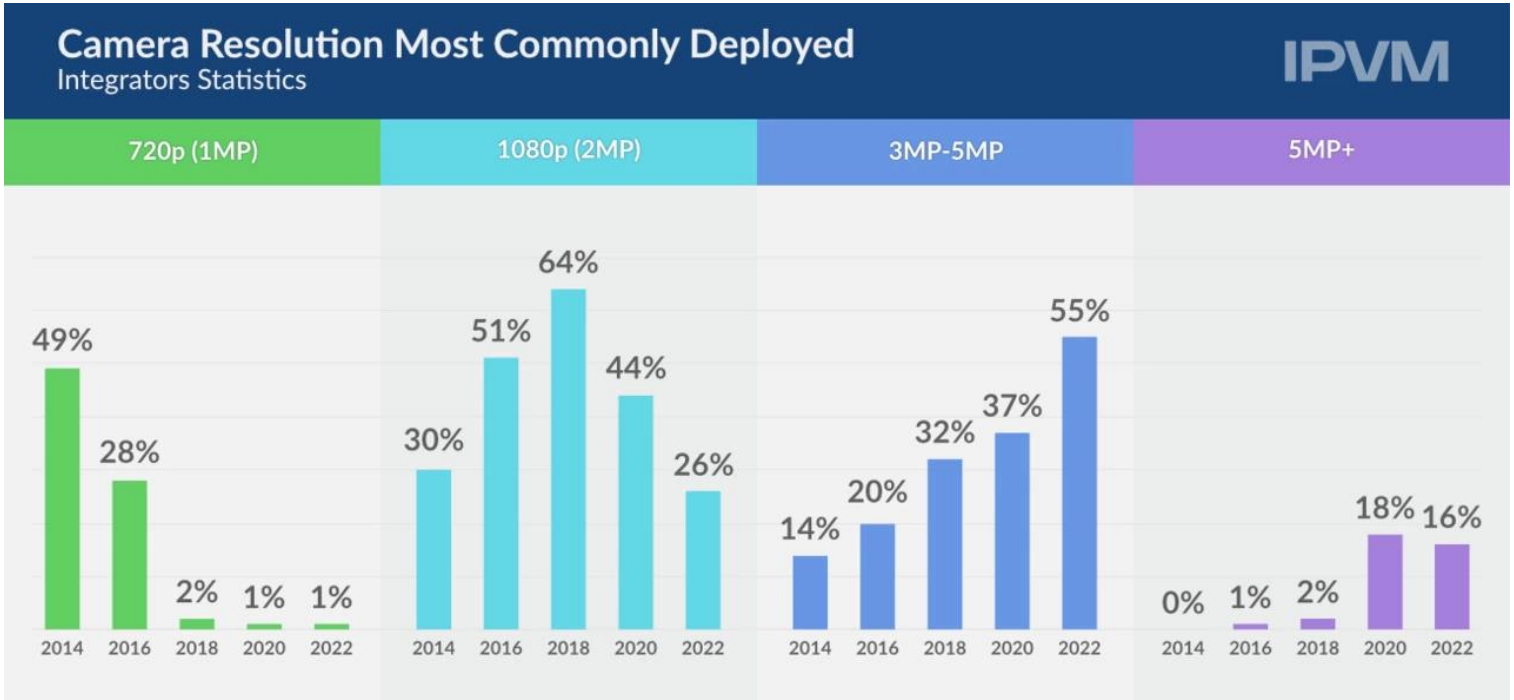
The Surge of High-Megapixel Cameras



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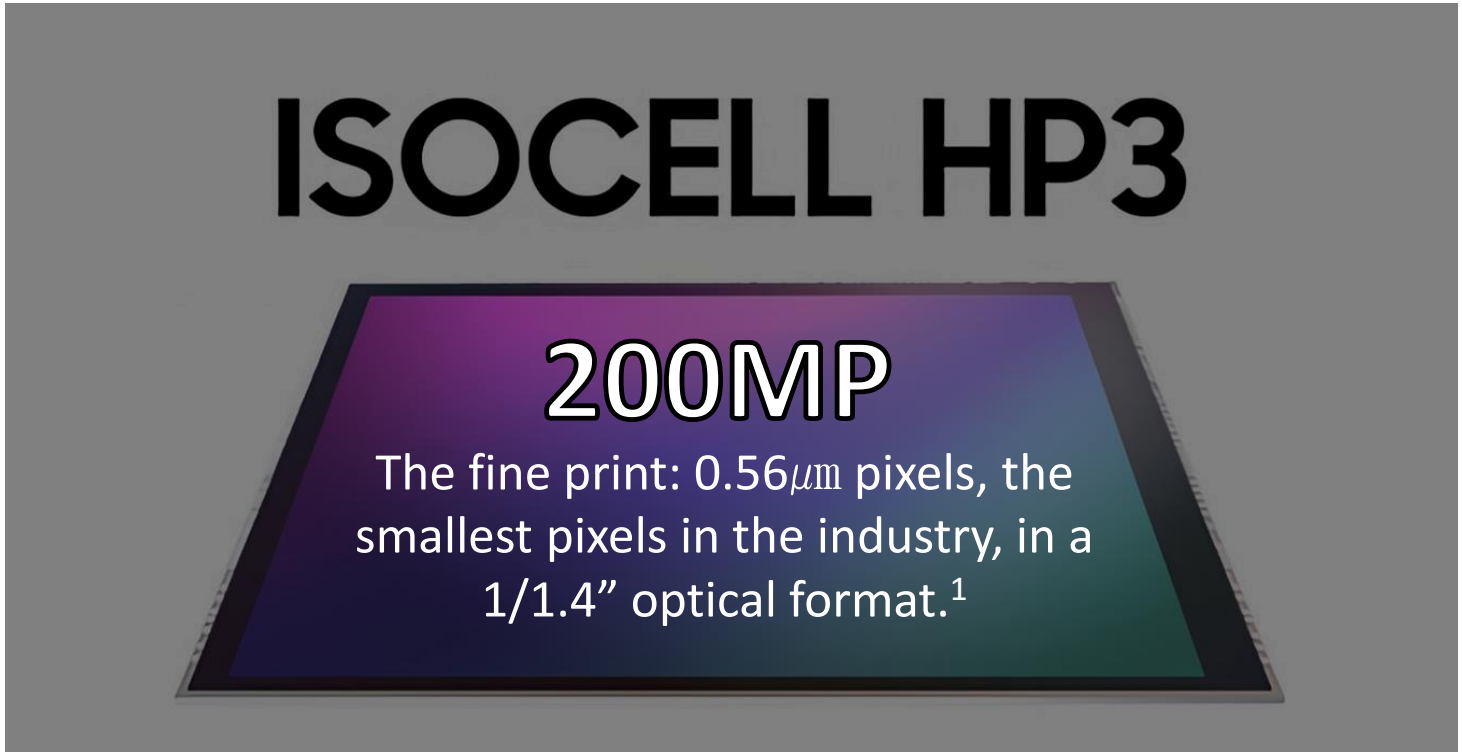

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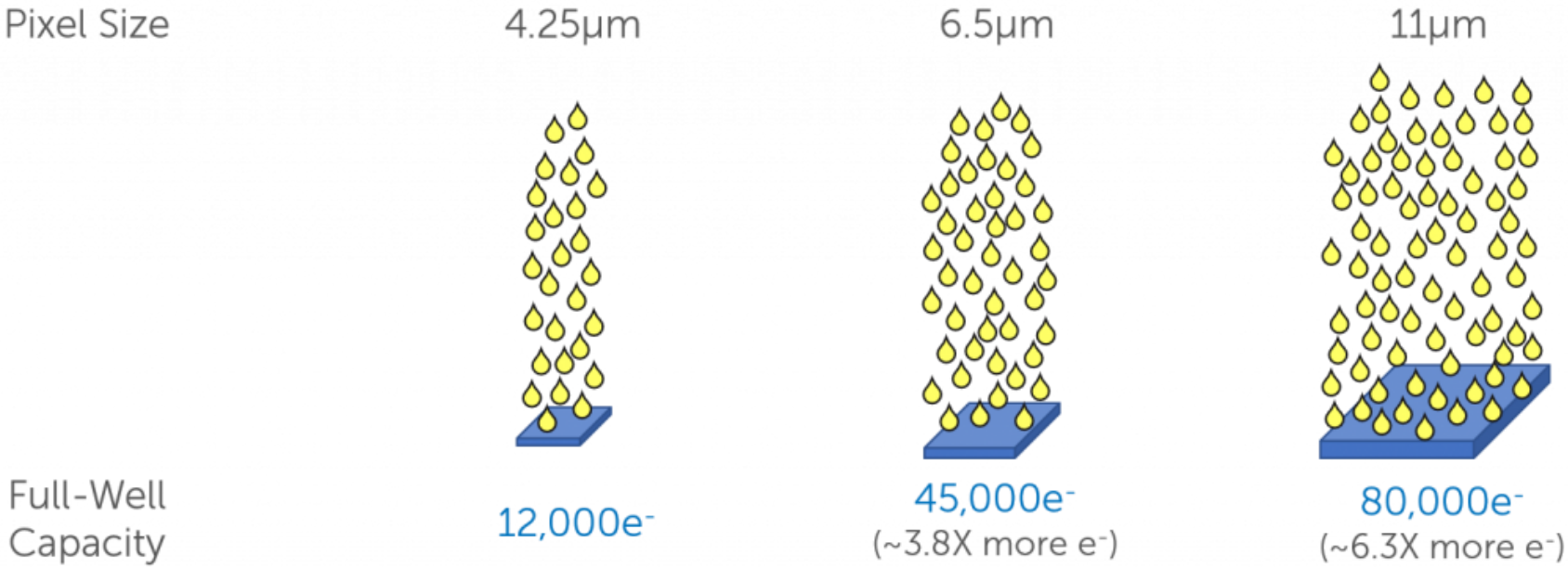
The Resolution-Sensitivity Trade-off

Source: Princeton Instruments



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Aperture: Improving your focus

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Diffraction

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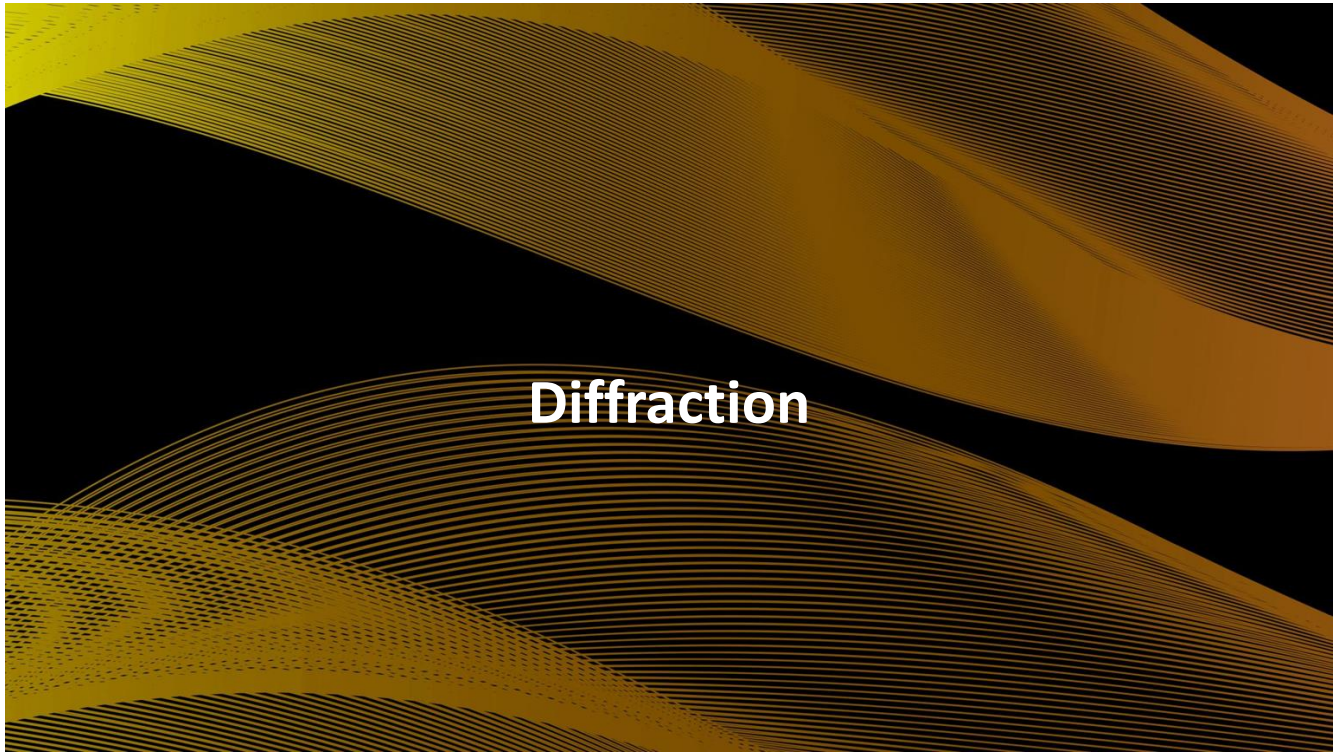

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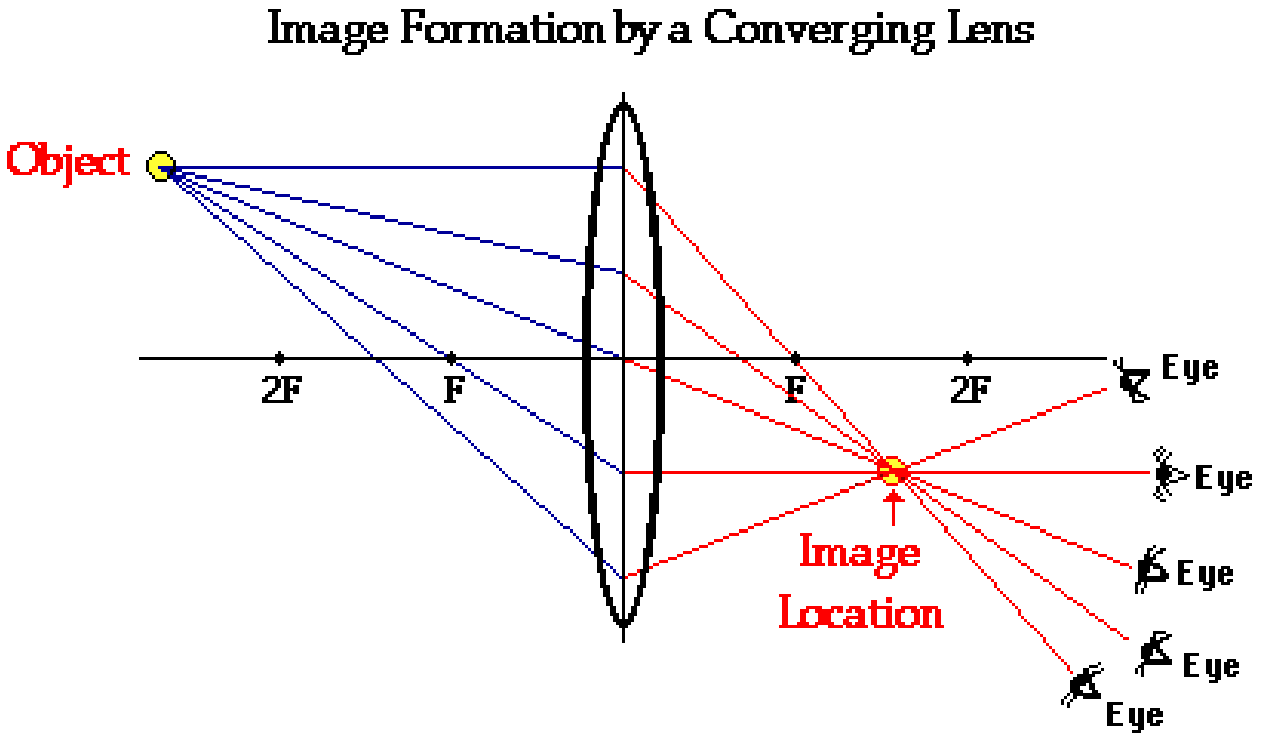
Basics of Lens and Diffraction



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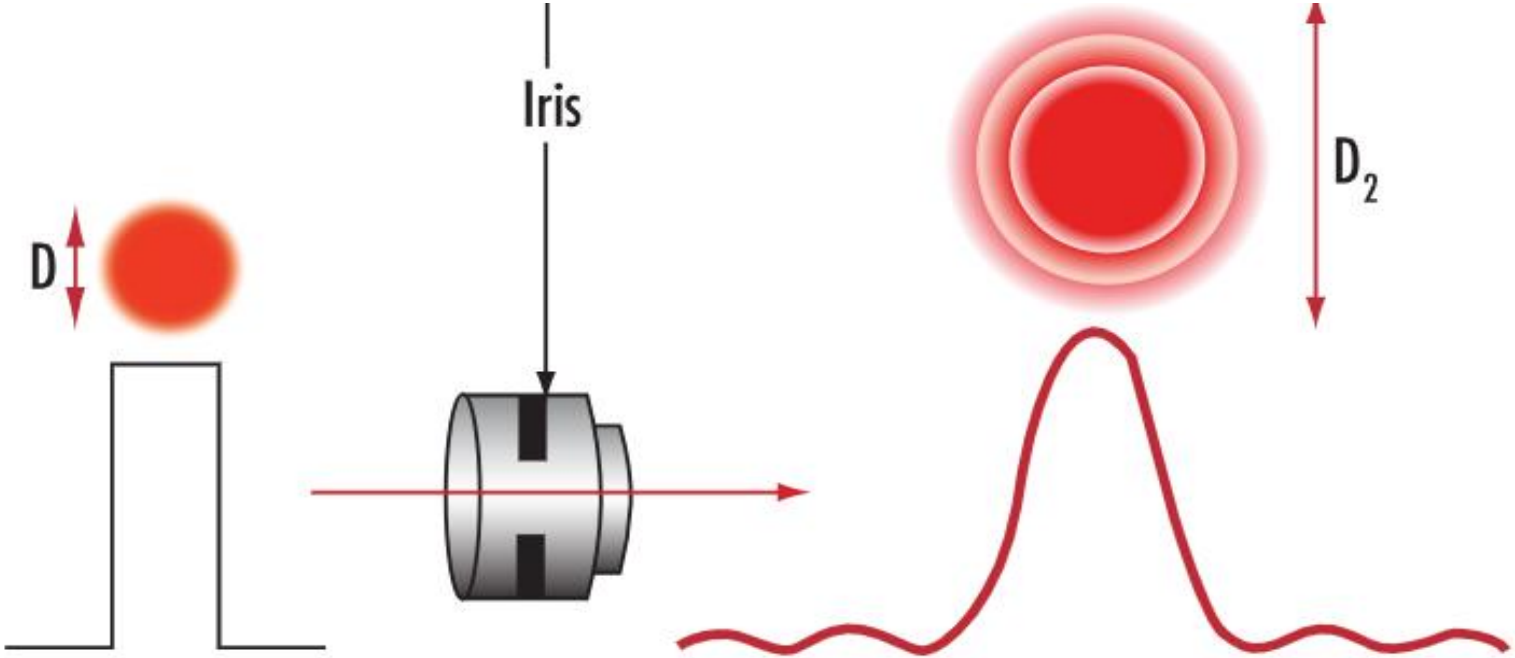
Diffraction Pattern: Airy Disc



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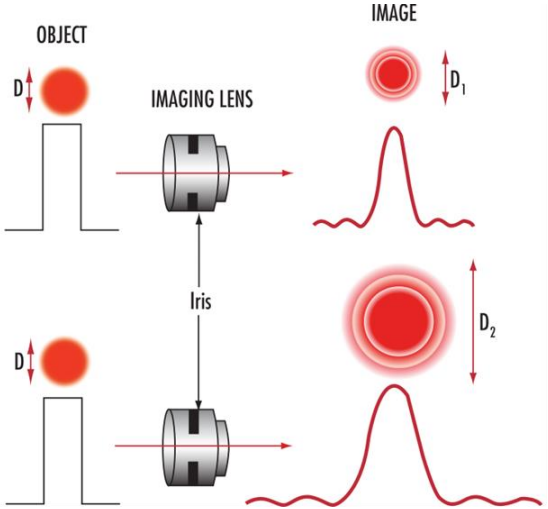
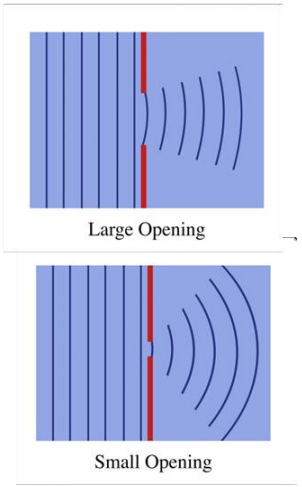
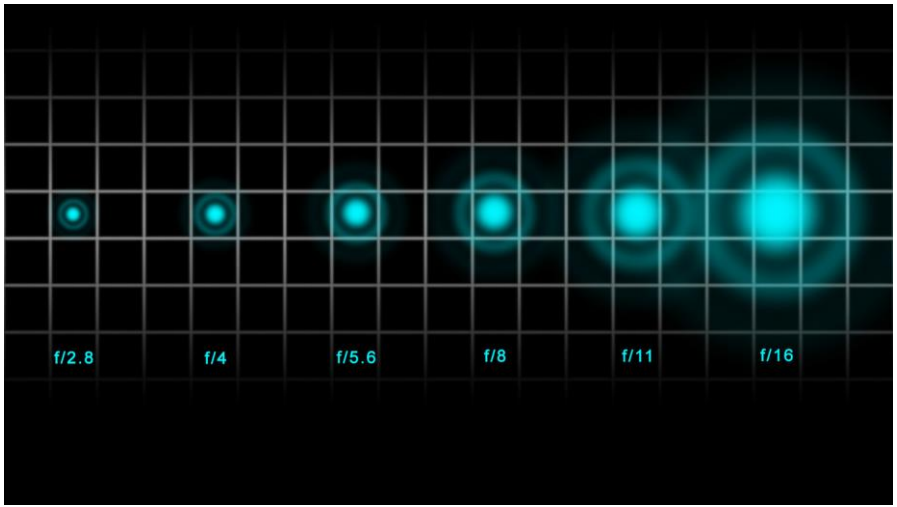
Effect of Aperture size on Image ‘sharpness’







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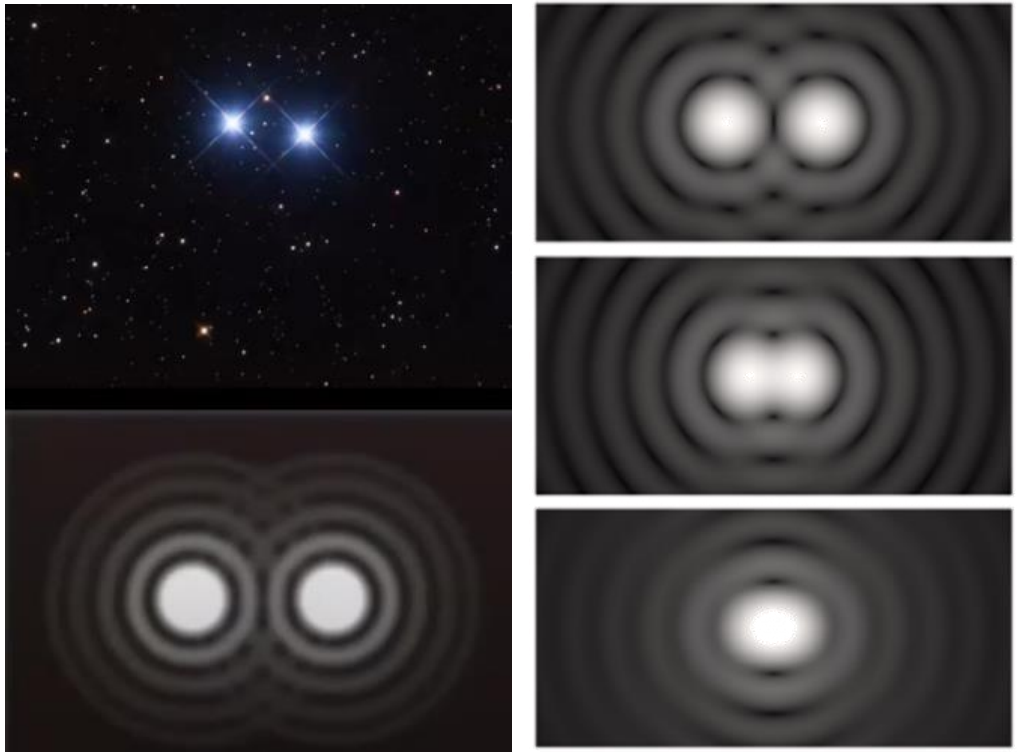
Diffraction Effect when disk size > pixel size



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DoF (Depth of Focus)?

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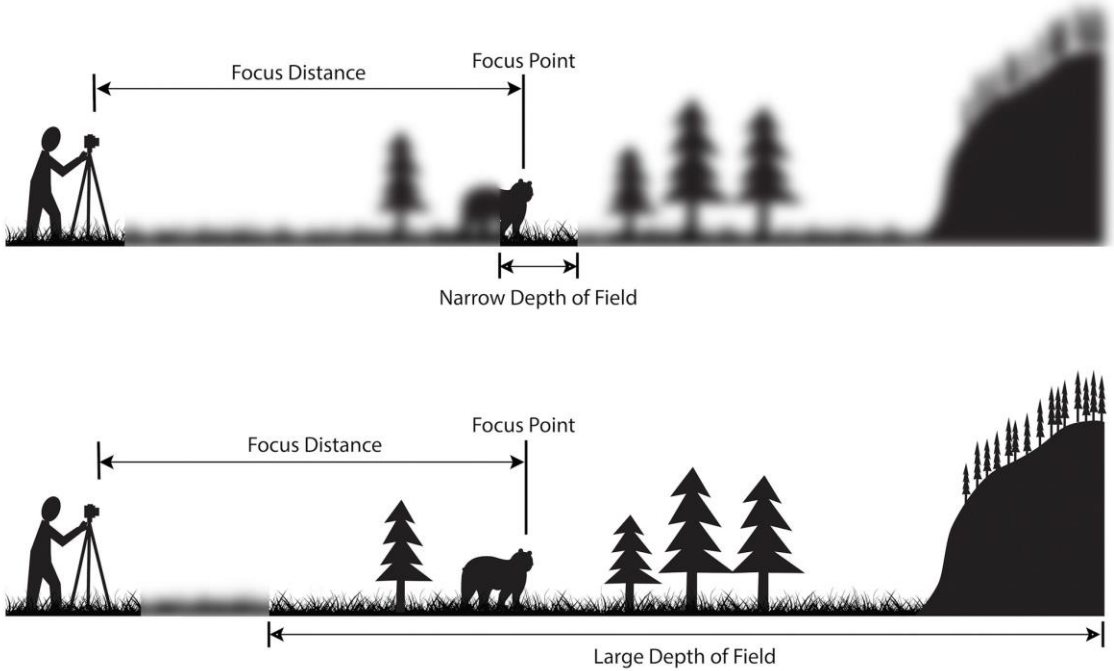
Definition

Source: https://photographylife.com/



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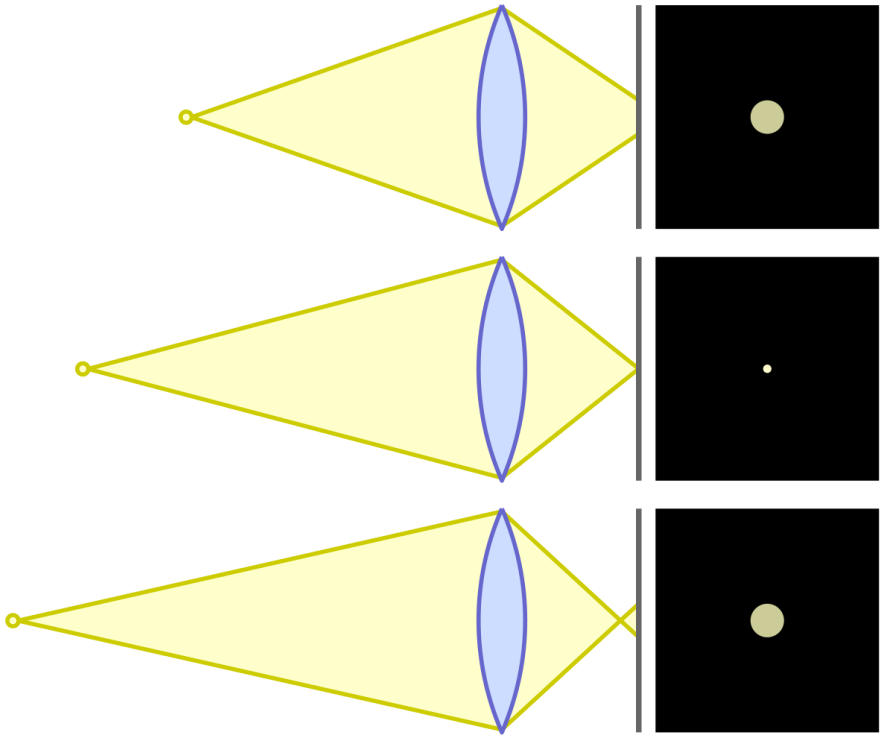
Circle of Confusion



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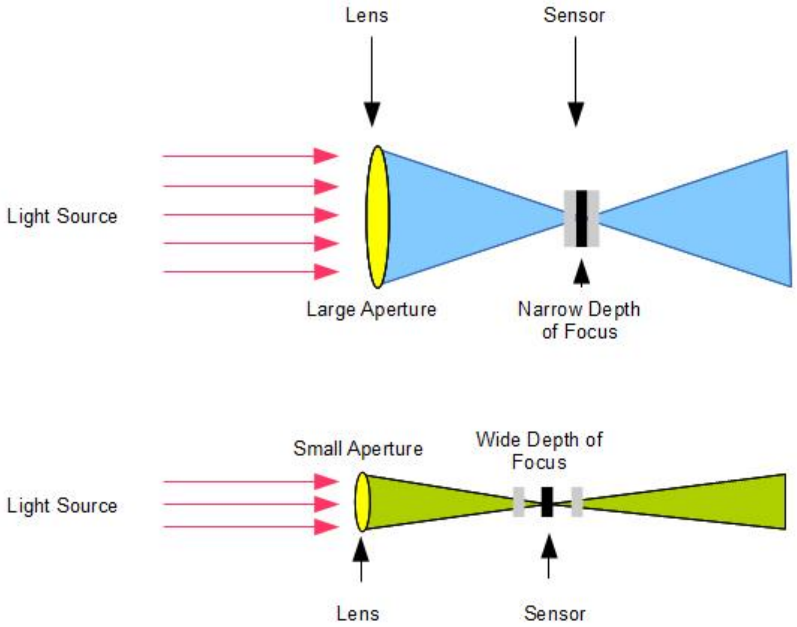
Aperture and Effect of DoF



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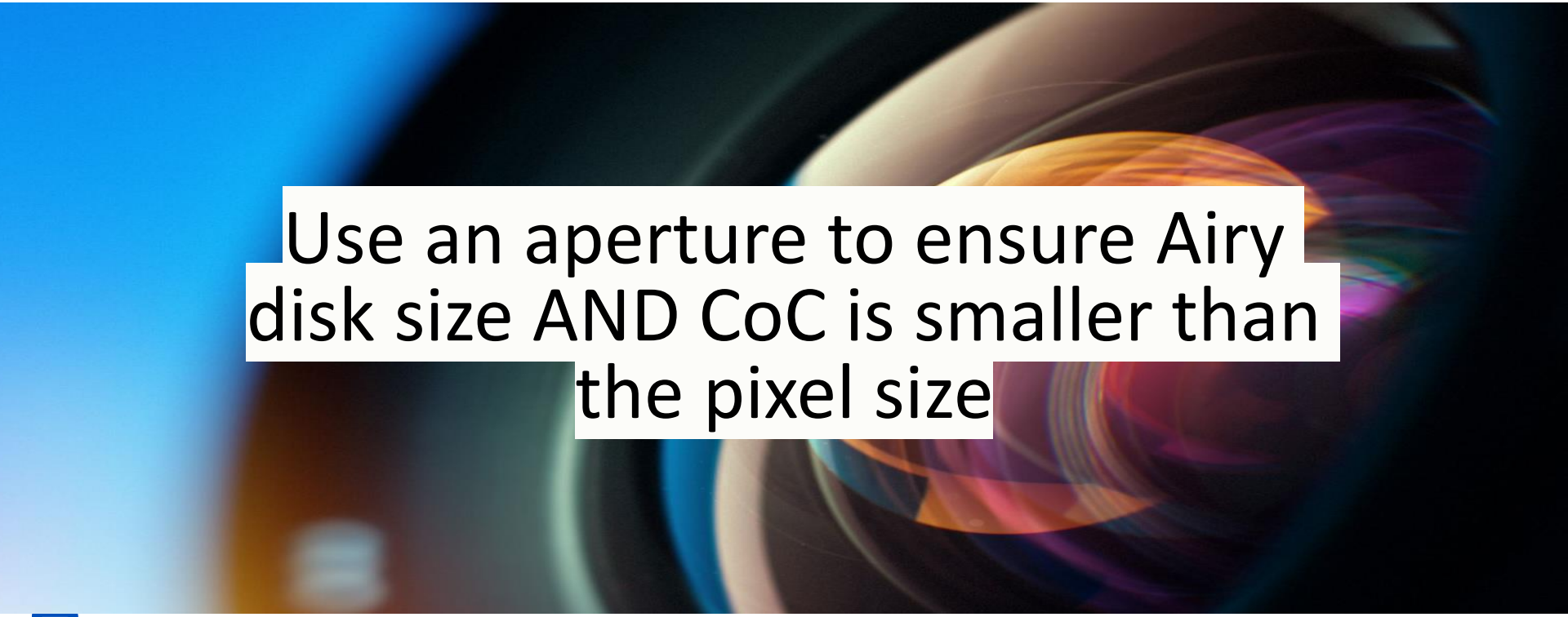

Use an aperture to ensure Airy disk size AND CoC is smaller than the pixel size

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Concept 2: Multispectral Imaging

The Spectrum Beyond Sight

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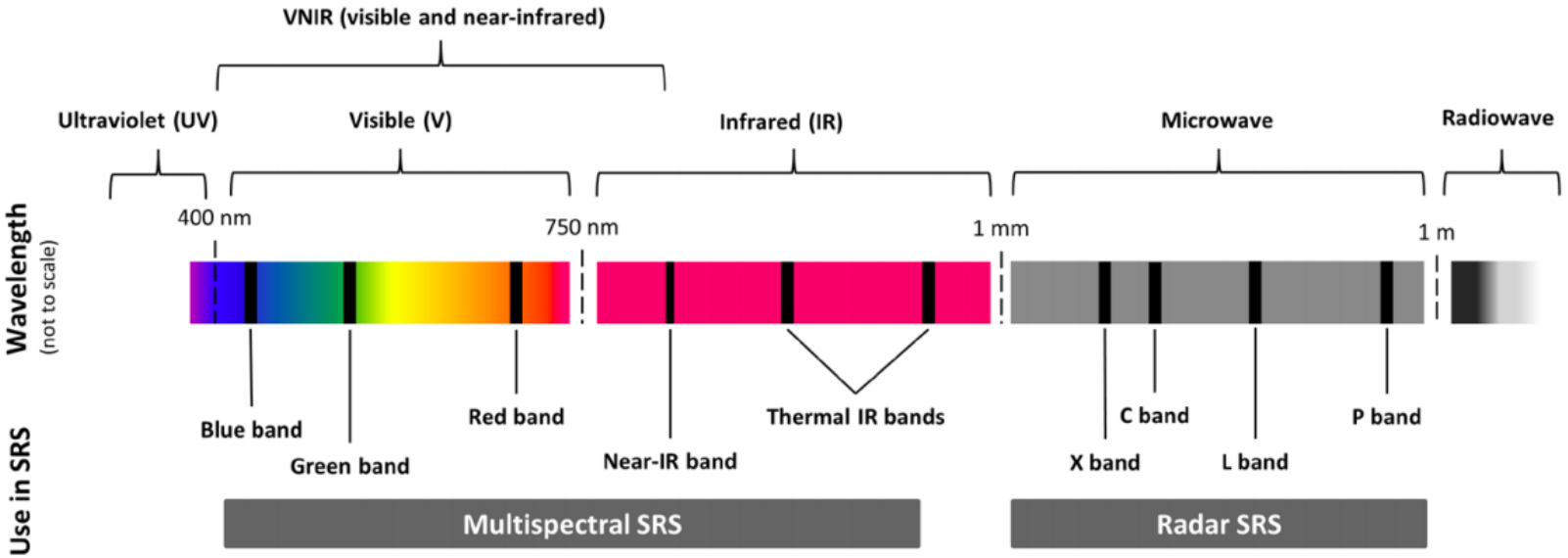
Expanding Vision: Beyond RGB



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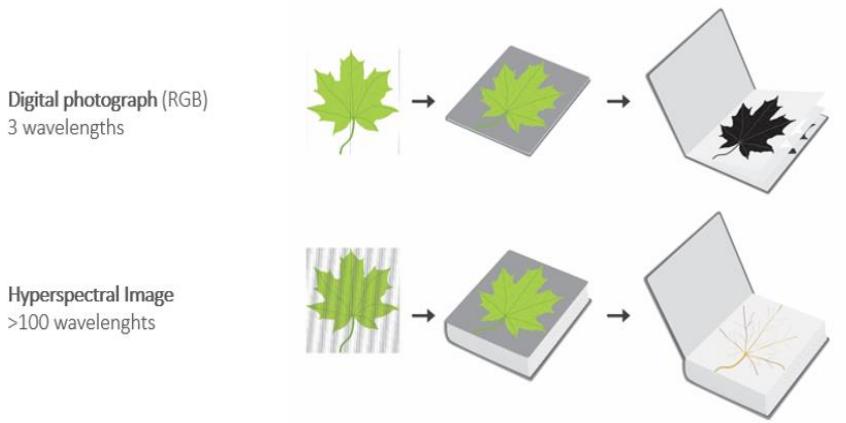
The Multidimensional Image

Regular Image

- 3 Page Book (RGB)

Multispectral Image

- 100s of pages!



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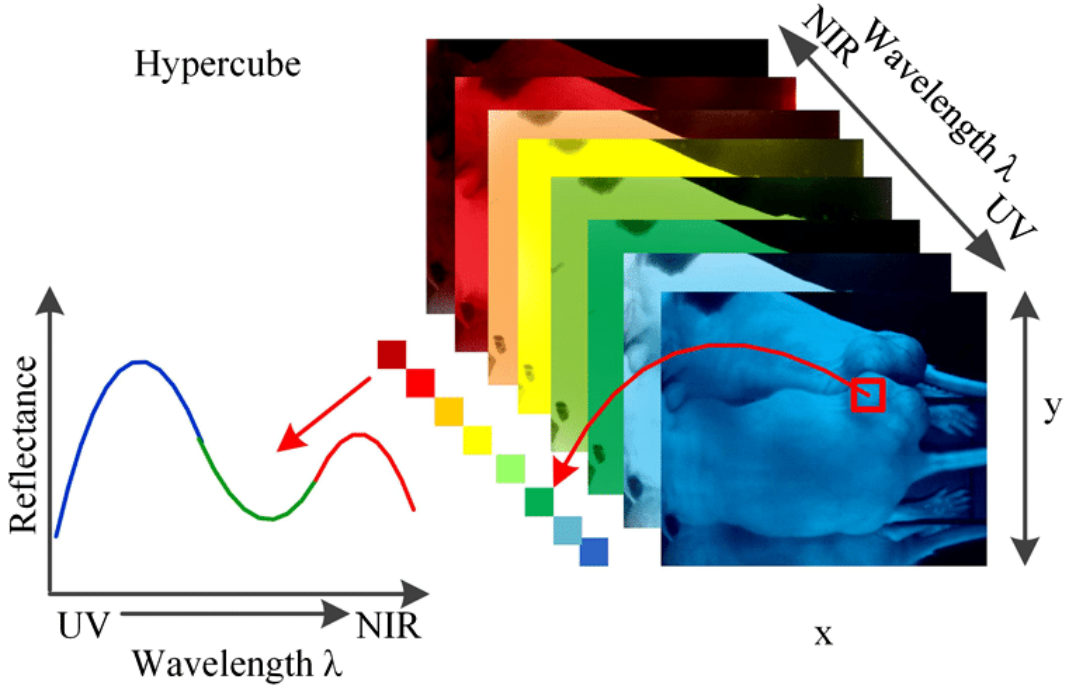
Spectral Cube



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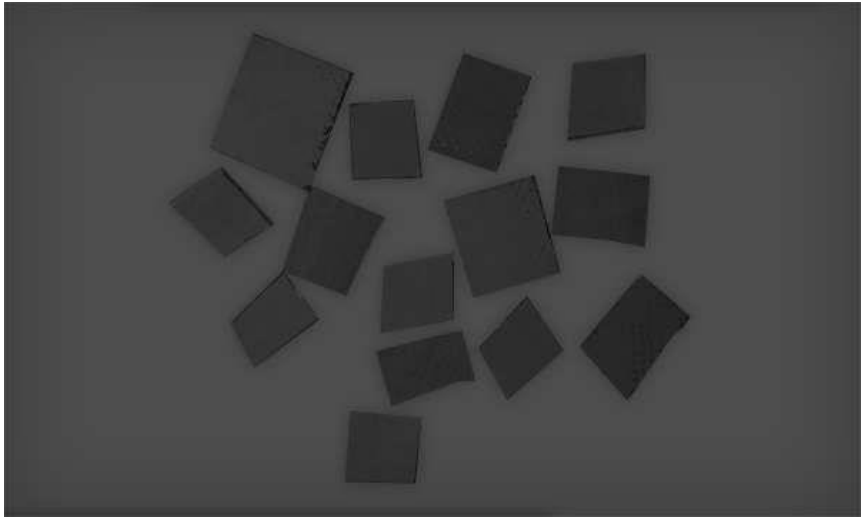
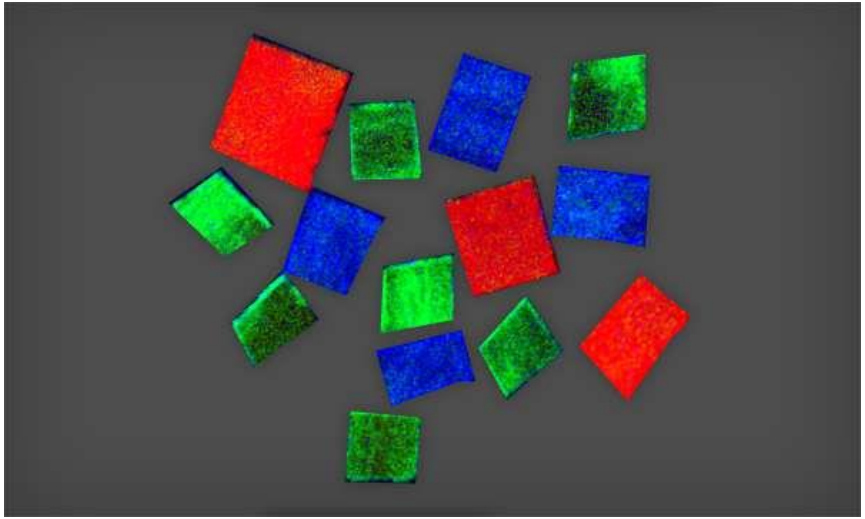
Seeing the Unseen: Material Identification





Ps Abs Pe

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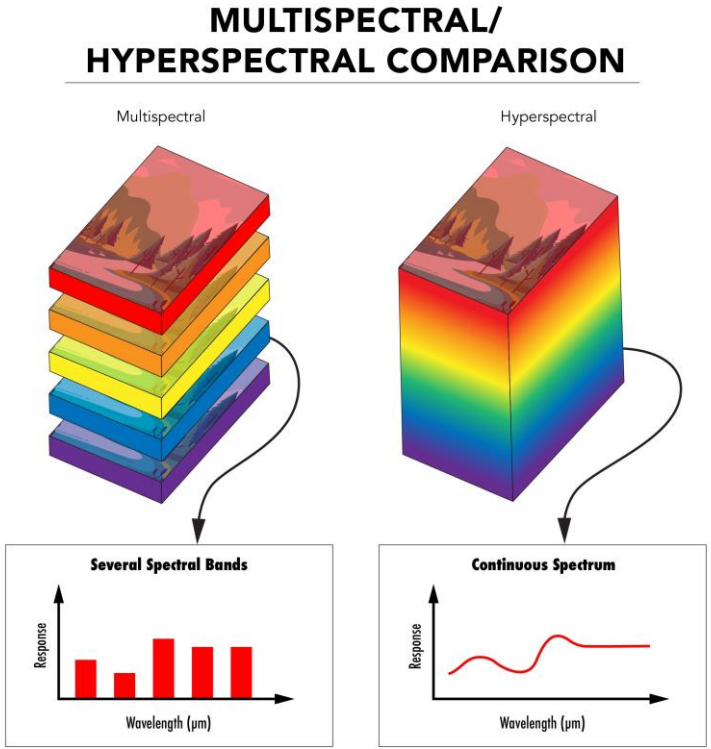
Multispectral vs Hyperspectral Imaging



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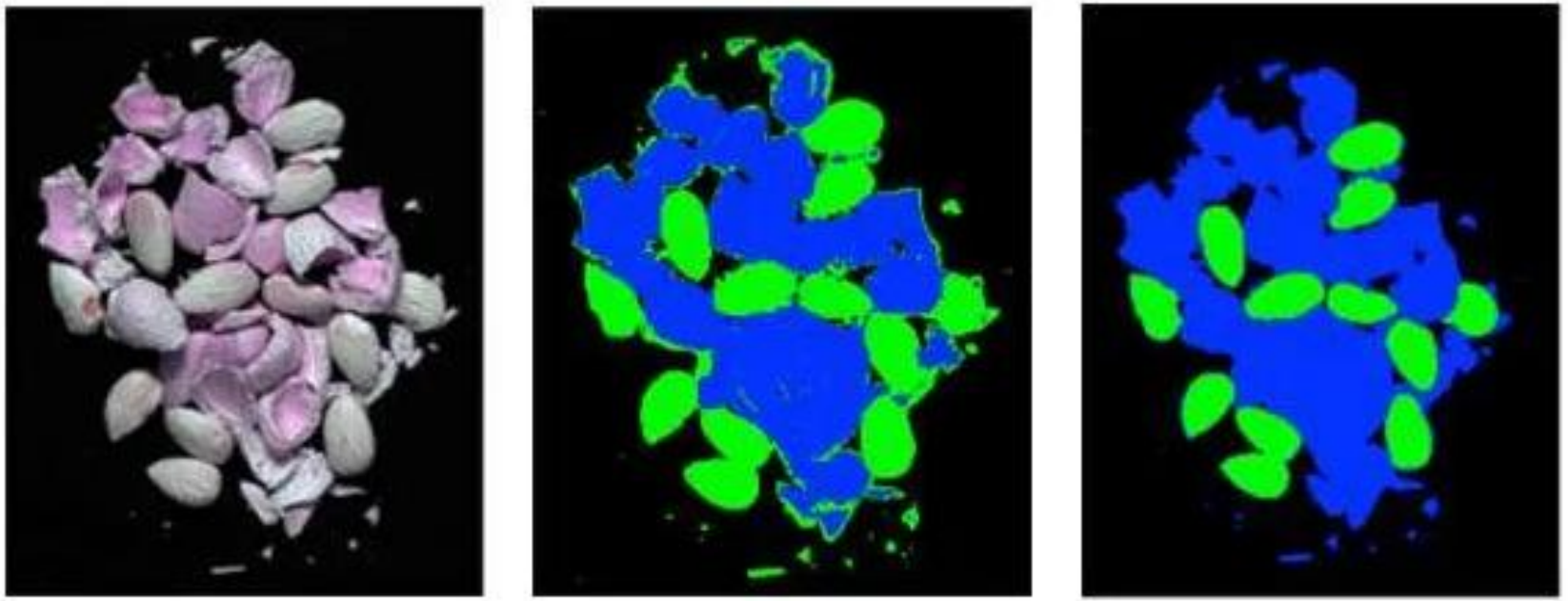
Spot the Difference: Almonds and Shells



RGB, multispectral (28 bands), and hyperspectral (224 bands) images of almonds and shells (green is almond and blue is shell).

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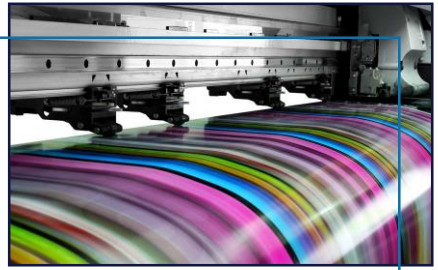
Transforming Industries with Spectral Insights

SPECIM
A Konica Minolta Company

RECYCLING AND WASTE MANAGEMENT

FOOD QUALITY AND SAFETY

OIL AND MINERAL EXPLORATION



COLOR AND SURFACE CHARACTERIZATION

PHARMACEUTICS AND MEDICAL

AGRICULTURE AND VEGETATION

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The Unseen Awaits: Recap

Optical Resolution: The critical role of aperture in balancing resolution and depth of field

Multispectral Imaging: Leveraging the power of capturing data beyond the visible spectrum to uncover hidden details and improve analysis

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Resources

- Hyperspectral Imaging
  - Specim.com
- Lens Diffraction
  - fstoppers.com
  - Cambridge In Color

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Q & A

Seeing the Invisible

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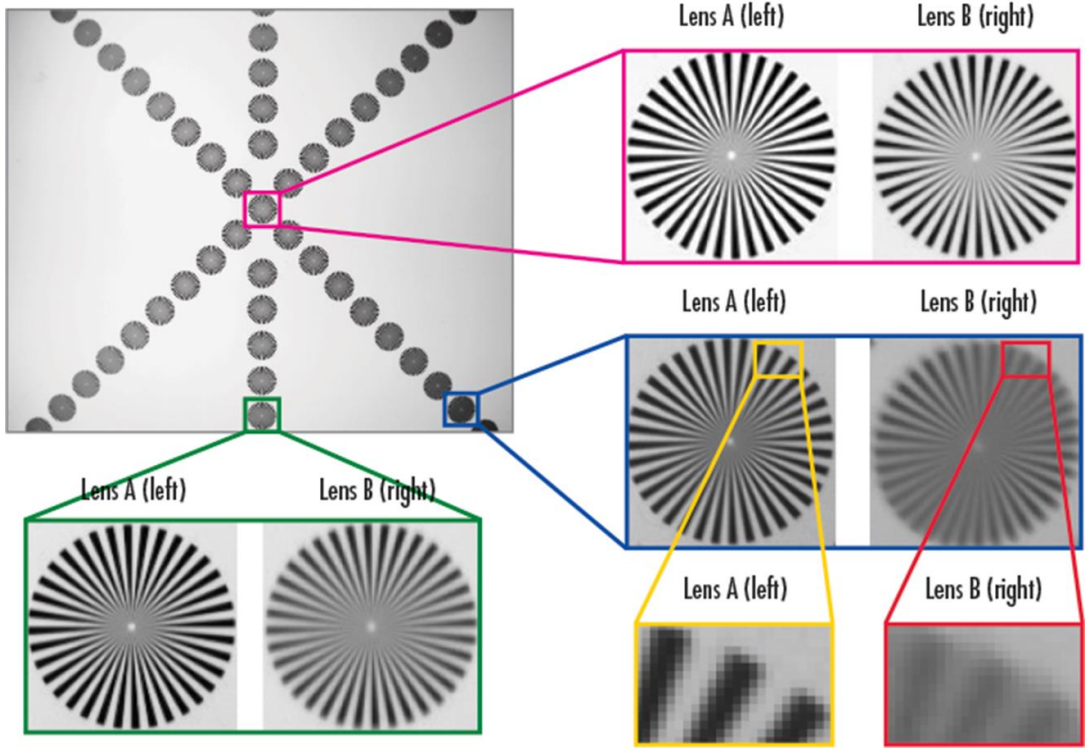
Choosing optimal optical resolution



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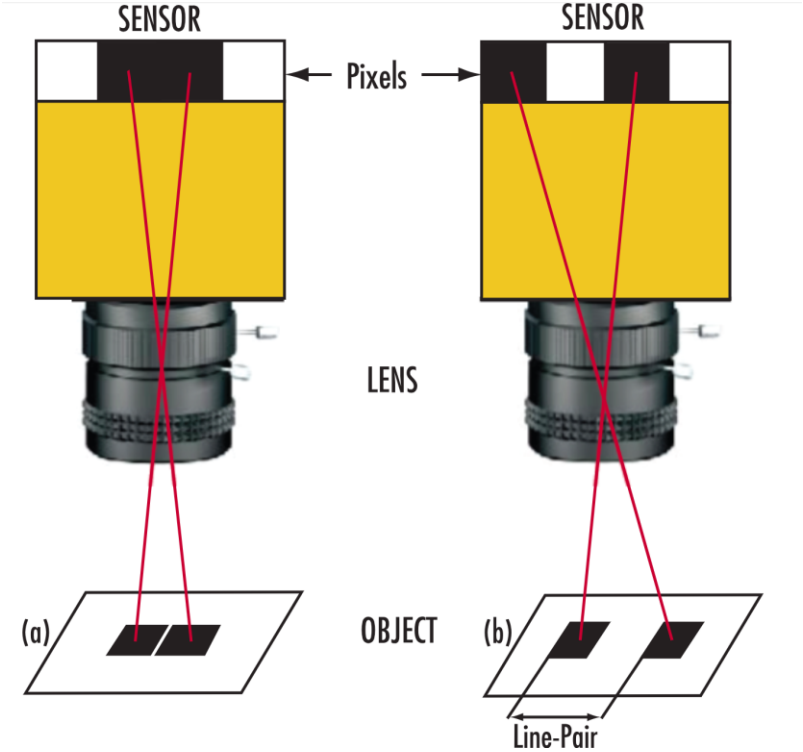
Line Pair / mm



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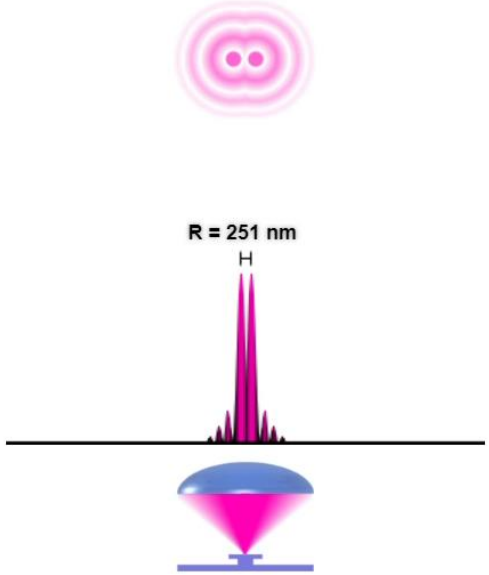
Aperture



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