Inside the Wavelength: 
seeing really small objects with light

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Light, though our eyes, gives us the most direct means of observing the world. Using a microscope we can see many objects invisible to the naked eye, but even the microscope has its limitations: it is impossible with a conventional microscope to resolve anything smaller than the wavelength of light. Typically this sets a resolution limit of about 0.5 microns. To do better than this and to ‘get inside the wavelength’ scientists have been seeking a deeper understanding of light and its component electric and magnetic fields in order to control these fields on a sub wavelength scale. I shall report on schemes for harvesting light to a focus much smaller than the wavelength and hence to very great energy density. Practical limitations will be discussed and shown not to prevent substantial enhancements to non linear phenomena and to spectroscopy.

Incident radiation at $\omega_1, \omega_2$ interacts non linearly to produce $\omega_1 + \omega_2$ and $\omega_1 - \omega_2$. The process is enhanced by harvesting energy to the site of the nonlinear material.