

A Novel Idea in Confocal Scanning Microscopy

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The techniques that, by virtue of their capability for producing superior resolution, fall into two classes. The first involves the use of shorter wavelength radiation, such as in electron or x-ray microscopy. The second includes the various forms of scanning probe microscopy, of which scanning tunneling microscopy is the best known example. That these methods have not already largely supplanted optical microscopy is attributable to the fact that, in the request for higher resolution, a bargain has been struck so that in each method, several of the attractive features of optical microscopy have been sacrificed such as nondestructiveness, low cost, high speed, reliability, versatility, accessibility, ease of use, and informative contrast. In this paper we describe a novel confocal scanning optical microscopy, perhaps it is a promising microscopy in the area of higher resolving power microscopes.

It is exciting if we can diminish the Airy central core to some degree by apodization, for example, one tenth of the original width, then the only question that remains in getting superior resolution details is its low contrast owing to large diffraction effect, but this can be overcome by confocal technology. When a pupil coating is applied to a diffrac-

tion limited pupil of modest aperture, it causes the point amplitude diffraction pattern to collapse inward, as if the resultant pupil were still clear and diffraction limited but now with a predetermined times larger aperture. Thus the image is formed as the coating had physically extended the given aperture outwards in space, and by a designed amount. It accomplishes this by diffracting outside the field of view all light which would otherwise tend to broaden the pattern into an ordinary airy disk. If a lense of this kind is used solely, the imaging quality can not be good enough, because all light that diffracting outside the view becomes a strong background and degrades the image contrast. But we can suppress the background by another diffraction limited lens just as the setup in confocal microscopy. So we put forward the idea of implementation of apodization in confocal system, perhaps it is a practical way to solve the problem of bargain between higher resolution and attractive features of optical microscopy.

The theoretical development and calculated results are depicted thoroughly in this paper, in addition to comparison with results obtained by inserting annular pupils.