EXACT MODEL FOR SCANNING OPTICAL MICROSCOPES AND DVDS

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KEY WORDS: High aperture theory, rigorous numerical modelling, optical data storage, scanning microscopy, confocal microscopy

1. INTRODUCTION

It has traditionally been rather difficult to model optical microscopes and optical data storage (ODS) devices when the object imaged or detected is any more complex than a point scatterer. For that case full vectorial models exist [1-3] that predict general behaviour of imaging with good accuracy. There have been attempts to model more complex objects, such as large spheres or coarse surfaces, but problems associated with limitations in modelling and mathematical complexity prevailed.

In this presentation we describe, to our knowledge, the first model based on full, truly three dimensional (3D) vectorial, high numerical aperture theory that can model imaging of objects of almost arbitrary complexity, including biological cells, nonlinear media and ODS devices.

2. THE MODEL

The key feature of the model is that it combines analytic and rigorous numerical methods to calculate the image, which can either be result of scanning or the actual image appearing on the camera. We use analytical methods to calculate the electromagnetic field distribution close to the sample/object. Subsequently light propagation is modelled by rigorous numerical methods (FDTD, FEM, integral equation method, BPM, etc). Two other modules are then used to calculate the image. Our model uniquely features a full analytical model of the optical system forming the image.

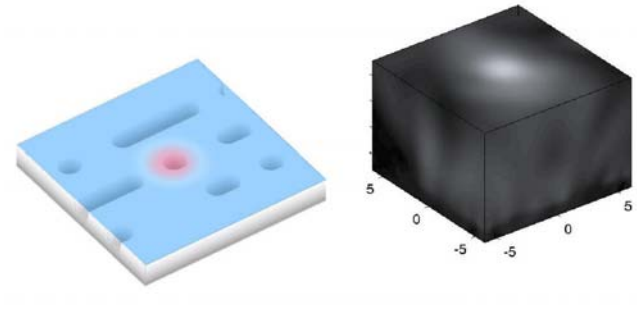

Figure 1: Details of the model: surface of a BluRay DVD and illumination (left) and the scattered light surrounding the surface.

3. RESULTS

In this presentation we show images of a variety of specimens as seen by an observer. In addition, we also present results of simulations for state-of-the-art ODS devices, an example of which is shown in Fig. 1.

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