TITLE: Coherent Diffractive Imaging and Fluctuation Microscopy

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Fluctuation microscopy is a statistical analysis technique which examines mid-range order present in a partially ordered sample. Information about the presence of mid-range order may be determined by examining the variations in diffraction patterns from distinct neighbouring regions of a sample. By altering the size of the probing beam it is possible to extract length scales of mid-range order. At present it is not possible to invert fluctuation microscopy results to determine an exact model of the sample. By using the iterative imaging techniques of coherent diffractive imaging it is hoped to determine the exact structure of a sample at the mid-range.

Coherent diffractive imaging techniques require some a priori information about a sample. It is common to use the support constraint or physical extent of the sample to enable reconstruction. Algorithms will be investigated using the length scales of the medium as an additional constraint to aid reconstruction of the object function.

Samples have been investigated at optical wavelengths using fluctuation microscopy experiments. Simulations will be performed to investigate the feasibility of recovering the structure of a sample using a speckle pattern obtained during a fluctuation microscopy experiment. The structure of samples consisting of disordered arrangements of microspheres will be determined using a combination of fluctuation microscopy and coherent diffractive imaging. The techniques explored are fully applicable to shorter wavelengths.