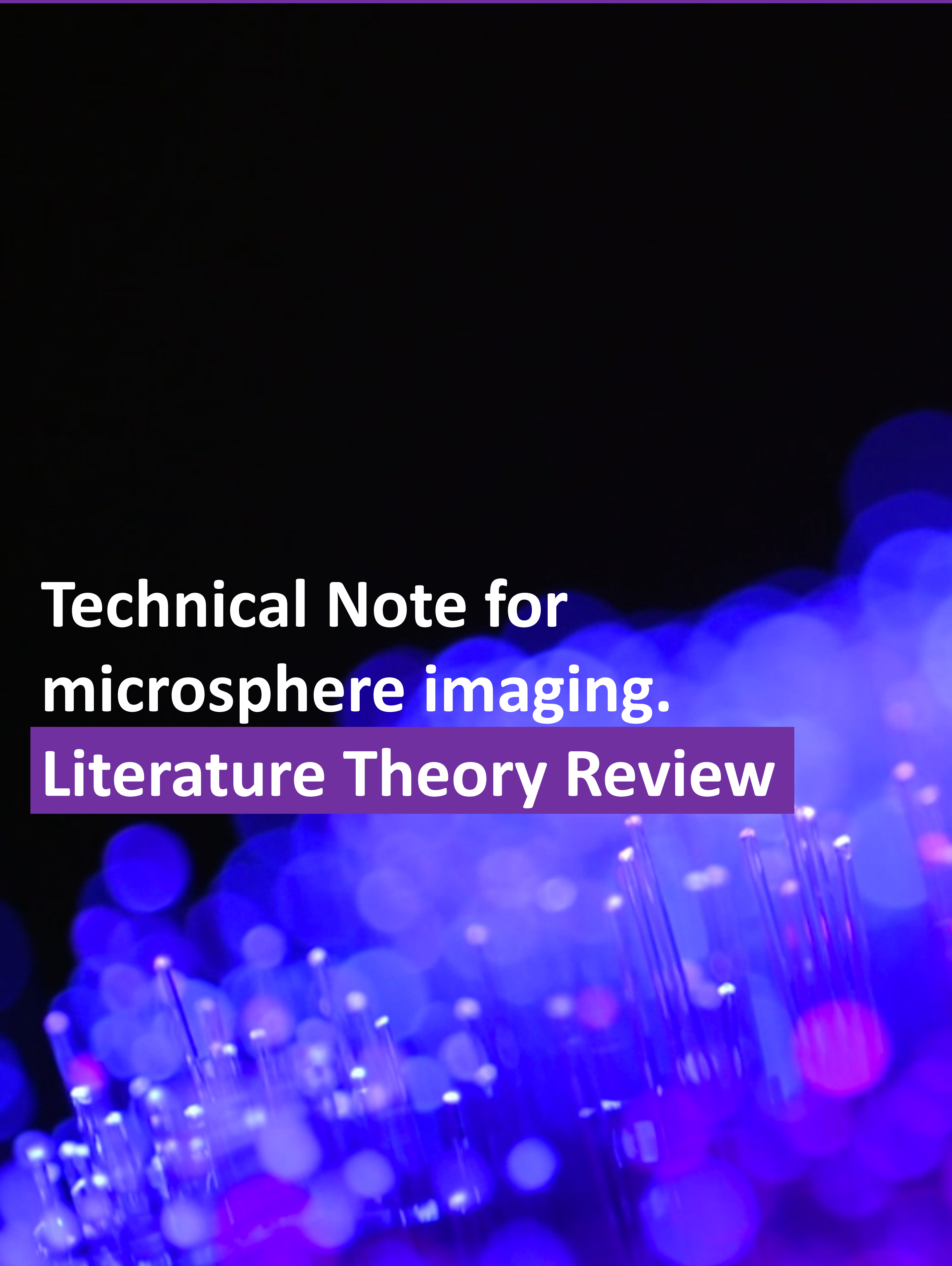

Technical Note for microsphere imaging.

Literature Theory Review

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Introduction

Microsphere Imaging: Democratizing super-resolution

Our Super-resolution Microsphere Amplifying Lens (SMAL) enables users to extend the reach of bright-field optical microscopy past the diffraction limit of visible light (maximum resolution ~ 200 nm if using blue light). This Technical Note follows with a review of the current literature on microsphere theory, how it functions, and how it can increase the resolving limit of optical microscopy.

Literature Review

In 2011 Prof. Lin Li and Dr Wei Guo et. al. observed that the use of silica microspheres placed on a surface allowed optical imaging beyond the conventional resolution limit (approximately 200 nm for a blue light source, and larger for white light sources) [1]. The findings of this and subsequent studies using microspheres on a surface were published in several high impact journals [2,3]. The same phenomenon has been independently reported by other groups [4–9]. The exact physical description of the underlying mechanism of microsphere super-resolution microscopy is the subject of rigorous research.

There are three theoretical models for microsphere imaging: the photonic nanojet model [1,5,6], the enhanced constructive light model (or Whispering Gallery Mode) [11,12] and the super-resonance theory [12,13].

Other phenomena, such as substrate effects [14], partial or oblique illumination [7], microsphere partial immersion [15] and a coherent illumination effect [16] are all considered to contribute, to a lesser extent, to microsphere resolution.

The exact physical mechanism by which microsphere imaging allows resolution of objects far beyond the conventional resolution limit is still a source of debate. However, the general consensus points towards a complex theory in which all the previously described phenomena contribute to some extent, making microsphere super resolution microscopy an exciting and promising field.

We are currently exploiting our position as the world leaders in applied microsphere imaging to work on a novel theory that explores the impact of each of these proposed factors on the physics of microsphere imaging.

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