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# Plasmonic Liquid Photonic Crystal Fiber: Phase 1

1. **Structure and materials:**
   Figure 1 presents a cross-sectional view of the designed HPLC-PCF coupler. This coupler is constructed using a base material of fluorite crown (FK51A type). It features cladding air holes, each 2 um in diameter, arranged in a hexagonal lattice with a lattice constant of 3.75 um. A gold wire, also 2 um in diameter, is integrated into the central hole to improve mode coupling between the two cores. This enhancement is achieved by increasing the birefringence difference between even and odd modes. The structure also includes two larger holes, each with a diameter of 3.4 um filled with Nematic Liquid Crystals (NLC).

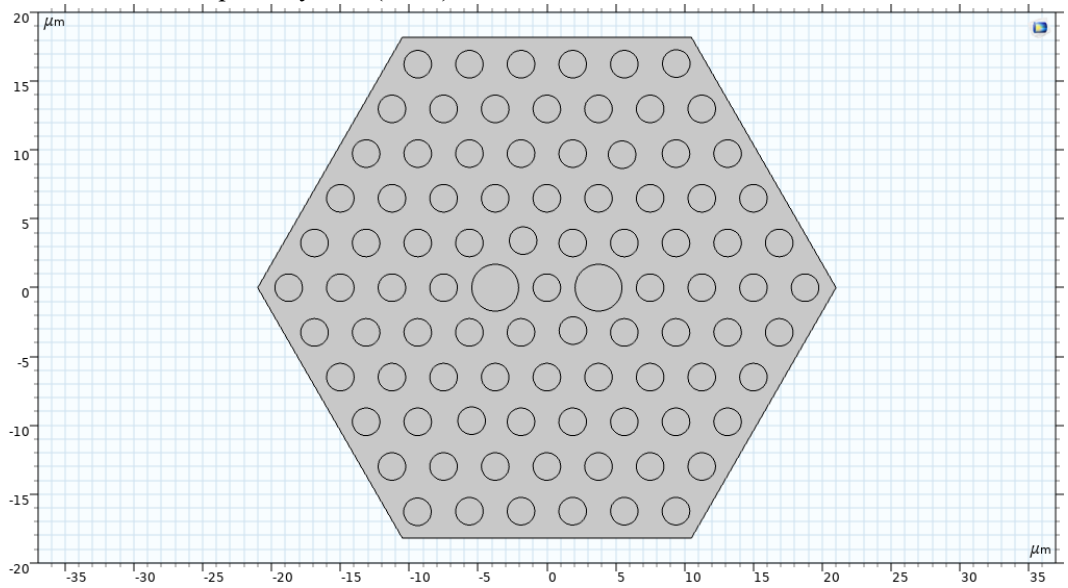


*Figure 1 Cross-sectional view of the designed HPLC-PCF coupler.*

**2. Meshing:**

The region of interest is applied with maximum mesh density as shown in Figure 2.

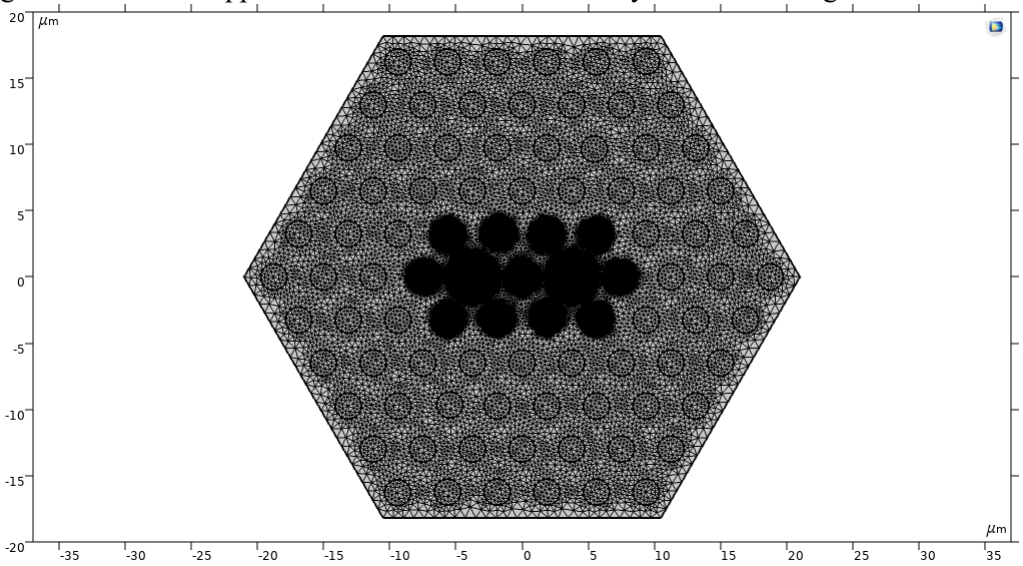


*Figure 2 Mesh with higher density at the regions of interest*

## 3. Results of phase1

In photonic crystal fibers with metal inclusions, Surface Plasmon Modes (SPMs) are the modes that propagate along the surfaces of metallic nanowires within the core. These modes facilitate the transition of light guided by the fiber core to Surface Plasmon Polaritons (SPPs) when the phase conditions align. The transmission of light in these plasmonic PCFs is heavily influenced by the wavelength. Specific wavelengths are required for the interaction between core-guided light and leaky SPPs in these structures.

The dispersion characteristics, illustrated in Figure 3, show x-polarized even and odd core modes, along with the SP2 mode.

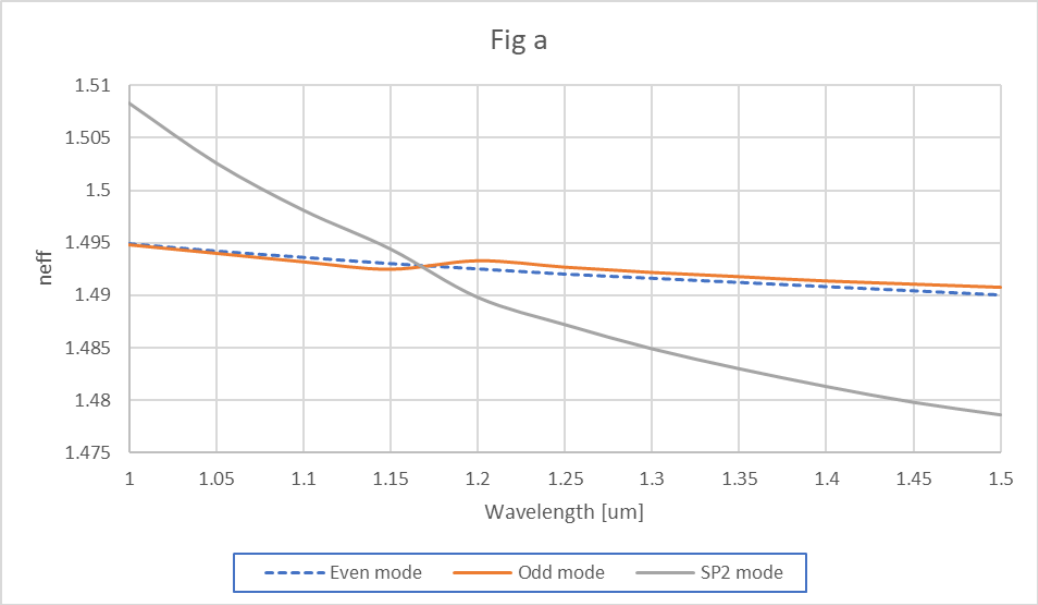


*Figure 3 Dispersion curves of the different core modes*

Figure 4 displays the attenuation profiles for these even and odd modes.

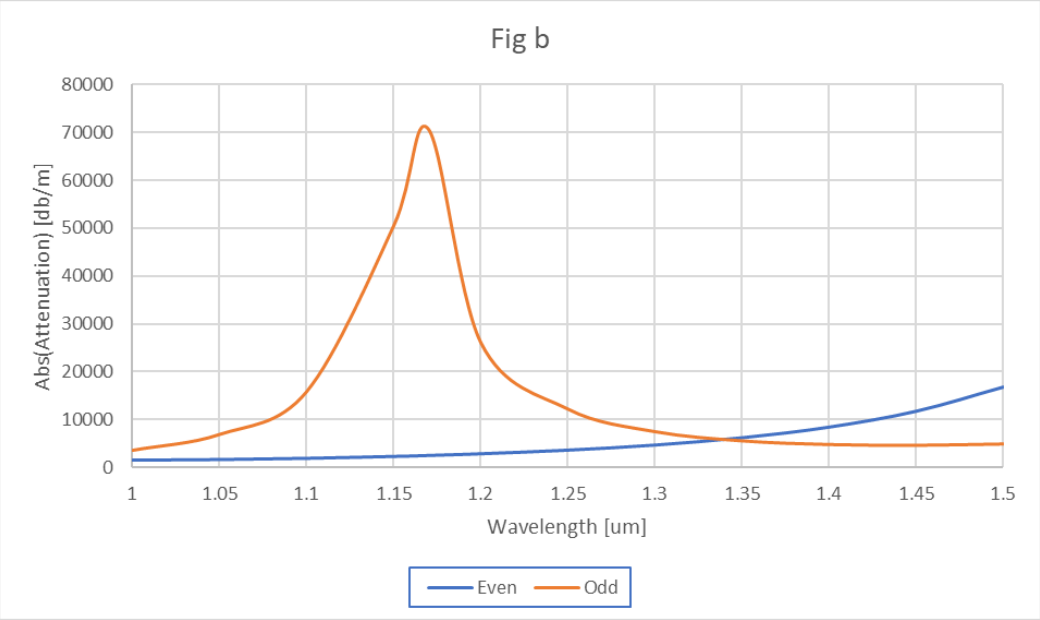


*Figure 4 attenuation curves of the even and odd dual-core guided modes.*

Figures 5 to 10 exhibit the mode profiles for x-polarized even and odd core modes, as well as the SP2 mode, at wavelengths $\lambda = 1.15$ μm and $\lambda = 1.3$ μm.

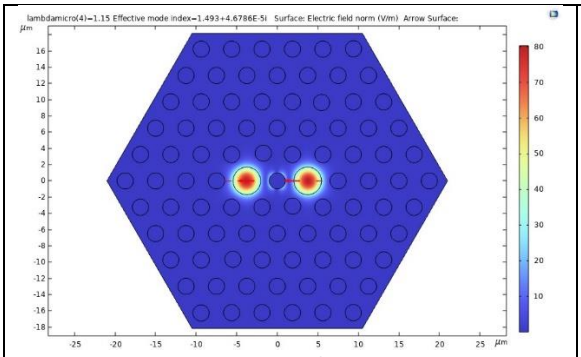


*Figure 5 Even mode at 1.15um*

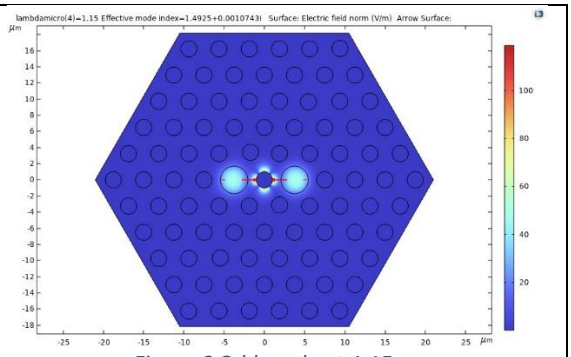


*Figure 6 Odd mode at 1.15um*

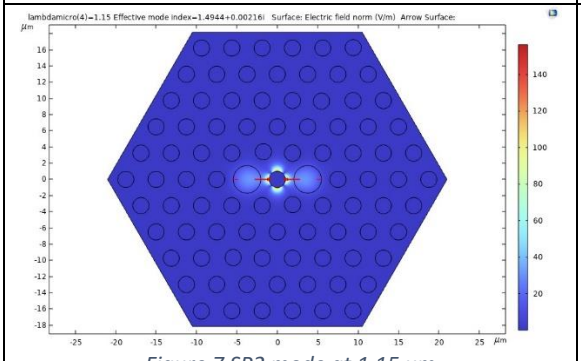


*Figure 7 SP2 mode at 1.15 um*

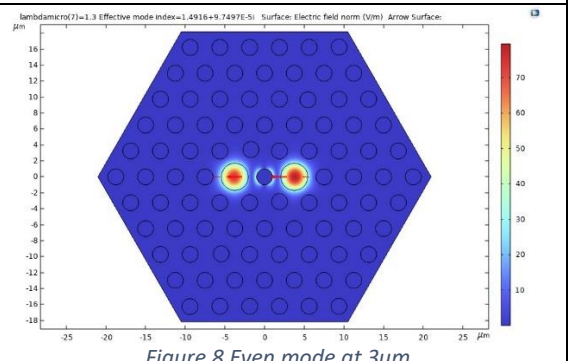


*Figure 8 Even mode at 3um*

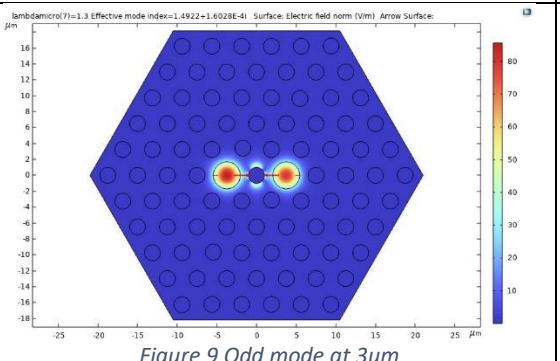


*Figure 9 Odd mode at 3um*

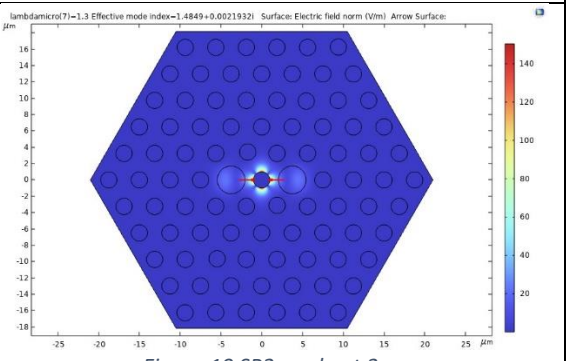


*Figure 10 SP2 mode at 3um*