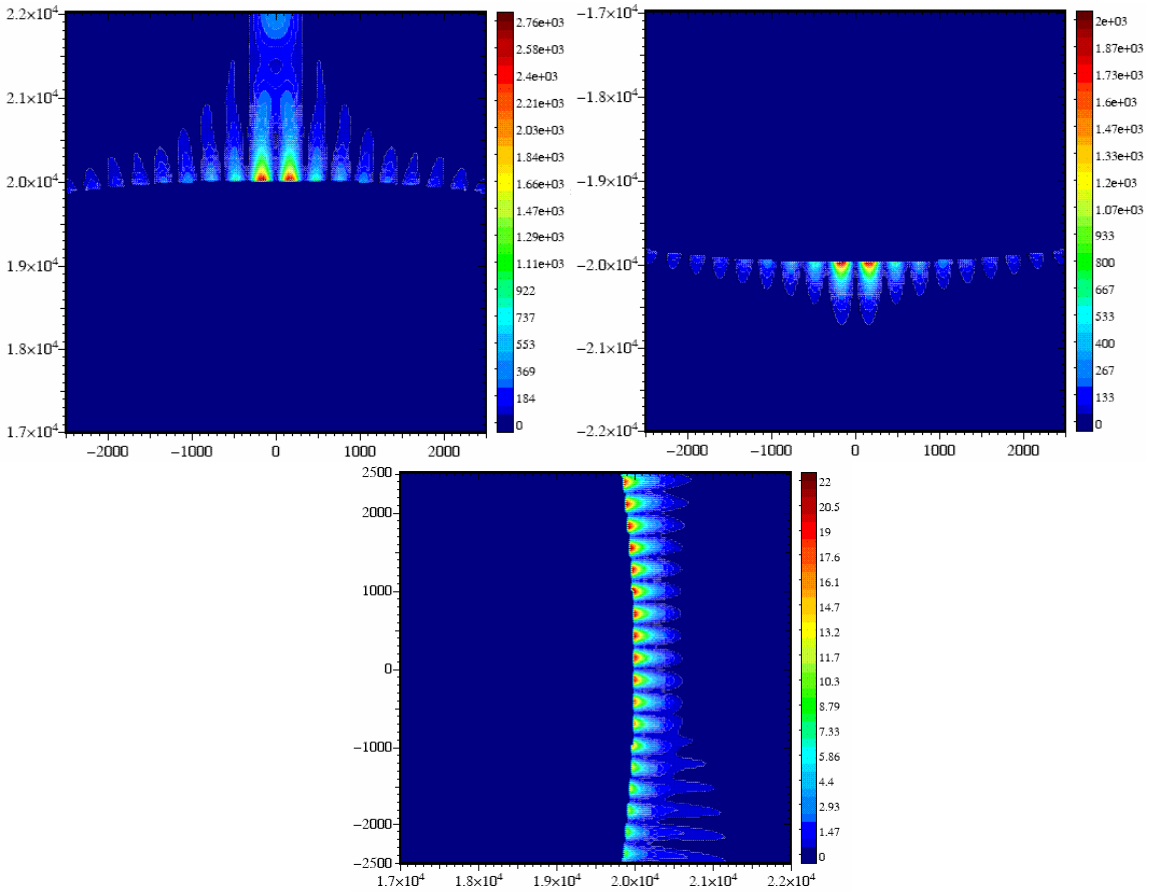
4.1.7 USING WHISPERING GALLERY MODE RESONANCES FOR BIOLOGICAL SENSORS

J. Prober, S. Zou, G. Schatz, "Sensing Capabilities of Whispering Gallery Mode Resonances in Glass Spheres," submitted to *Science.*

Whispering gallery mode (WGM) resonances were originally discovered in the cathedrals of Europe, where it was found that for certain size and shapes of rooms (galleries), it was possible to hear someone whispering at a great distance, due to a geometrical relationship between the wavelength of sound waves, and the circumference of the room. Typically the room circumference is a multiple of the wavelength for this to happen. The same effect can occur with light, especially for micron size water droplets or glass spheres. Recently, the NSEC has developed a technique for optical sensing that is based on this effect, here using glass spheres, and detecting the small change in wavelength that occurs when biomolecules bind to the surface of the sphere. The researchers have developed a classical electrodynamics code which makes it possible to calculate the WGM resonance wavelength, and its shift with biomolecule adsorption. Since proteins produce shifts in the WGM wavelengths due to electromagnetic interactions between polarization in the particle and protein, this application could play a significant role in the disease detection.



These figures show the electric field pattern around a glass sphere (radius 10 microns) that is illuminated at a wavelength of 778.9688 nm. If molecules are adsorbed on the surface of the sphere, the resonance wavelength changes by a tiny but detectable amount (few hundredths of a nm), thus providing a powerful tool for detecting the presence of the molecules.