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## Introduction

Recently we observed an explosive development of research in the areas of photonic crystals, nanoplasmonics and metamaterials. From the first sight the topic of microresonators looks different from these areas because it is a relatively well-established subject which has been gradually evolving from the beginning of XX century when the theory of Mie resonances was first introduced. This development was accelerated during last two decades due to applications of microspheres, cylinders, rings, and toroids in active and passive chip-scale devices such as tunable optical filters, laser cavities and sensors. The quality ( $Q$ ) factors of whispering gallery modes (WGMs) in cavities have been steadily increasing during this period reaching extremely high values  $\sim 10^9$ .

Within the past several years, however, this area has experienced a mighty boost which has resulted in an exponentially growing number of publications in the field. The gradual improvement of technology created conditions when new physics becomes available in these structures leading to a wealth of novel applications. Due to extremely strong resonant energy build-up in cavities with associated increase of radiative pressure purely electromagnetic properties becomes to be coupled to mechanical and thermodynamic properties of such systems. Extremely long dwelling times of photons in cavities make possible dynamic tuning of their frequencies on the scale of the life time for photons. An old subject of focusing of light has been revisited resulting in development of a concept of "photonic nanojets". New physical properties available in such structures include cavity quantum electrodynamics effects, excitonic and plasmonic strong coupling, electromagnetic cooling, dynamical frequency tuning and switching, resonantly enhanced nonlinearity, configuration interaction and coherent effects in coupled cavities, effects of disorder and percolation of WGMs in lattices of high- $Q$  cavities and many other interesting properties.

Due to these developments this area shows promise of becoming a new frontier of research in photonics, optoelectronics and optics. It should be noted that this area encompasses not only photonics, but also material science and engineering. Systems of multiple coupled cavities can create materials with unprecedented electromagnetic properties and functionality including slow light, engineered dispersion, and enhanced light-matter coupling. Due to the fact that the size of their building blocks is comparable to the characteristic wavelength they can be called *mesomaterials*. In contrast to metamaterials conceptualized through the process of homogenization, the optical properties of *mesomaterials* are essentially based on the properties of constituting cavities.

The intention behind this workshop is to bring together experts working on theory, technology and applications of microcavities. We believe that this workshop will serve as a basis for publishing a Focus Issue of Optics Express devoted to Physics and Applications of Microresonators in 2007.

To conclude this introduction, I would like to thank the speakers for accepting our invitation to come to Charlotte and to take part in this exciting event.