2.4 Photon-phonon coupling and manipulation of optical forces

Strong field gradient and scattering forces in the near-field of resonant photonic and plasmonic structures are widely used for trapping and manipulation of micro- and nano-objects and can also be harnessed to actuate optomechanical devices. Sun *et al*. [21] demonstrate wheel-shaped optomechanical resonators that are fabricated on a CMOS-compatible all-integrated Si photonics platform and operate at GHz frequency with high mechanical Q factor in ambient air, opening the way for developing high-speed systems for sensing and wavelength-selective signal routing. Wang and Rakich [22] introduce a generalized response theory of optical forces, which treats electromagnetic systems as multi-port systems with multiple mechanical degrees of freedom, and demonstrate a fundamental link between the scattering properties of an optical system to its ability to produce conservative or non-conservative optical forces. In turn, Rubin and Deych [23] extend the theory of optical forces exerted by the field of an optical cavity on a polarizable dipole to the case when the cavity modes are modified due to interaction with the dipole, which alters the properties of the force and makes all the vector force components non-conservative. Finally, Alexeyev and colleagues [24] propose a novel approach to recovering evanescent waves in the far field, which relies on shifting the frequency and the wave vector of near-field components via scattering on acoustic phonons and enables subwavelength-resolved imaging and spatial spectroscopy.

3. Conclusions, acknowledgments and outlook

The guest editors are very grateful to all invited authors for their effort in preparing high quality manuscripts that highlight the state-of-the-art in fundamental physics and applications of collective phenomena associated with coupling of confined photonic, plasmonic, electronic and phononic states. We hope that the publication of this focus issue will spur further research in this area to address the remaining fundamental and technical challenges, potentially enabling development of novel classes of high-performance devices for light generation, optical sensing, and information processing. We also would like to thank the Optics Express Editor-in-Chief Martijn de Sterke for his strong support of the idea of this Focus Issue and OSA staff and, in particular, Meghan Cook for the technical assistance with the Focus Issue preparation and publication.

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