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Accession number:20113814337667
Title:Mechanical tuning of whispering gallery modes over a 0.5 THz tuning range with MHz resolution in a silica microsphere at cryogenic temperatures
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Source title:Optics Express
Abbreviated source title:Opt. Express
Volume:19
Issue:19
Issue date:September 12, 2011
Publication year:2011
Pages:17966-17972
Language:English
E-ISSN:10944087
Document type:Journal article (JA)
Publisher:Optical Society of America, 2010 Massachusetts Avenue NW, Washington, DC 20036-1023, United States
Abstract:We experimentally demonstrate the mechanical tuning of whispering gallery modes in a 40 μm diameter silica microsphere at 10K, over a tuning range of 450 GHz and with a resolution less than 10 MHz. This is achieved by mechanically stretching the stems of a double-stemmed silica microsphere with a commercially available piezo-driven nanopositioner. The large tuning range is made possible by the millimeter long slip-stick motion of the nano-positioner. The ultrafine tuning resolution, corresponding to sub-picometer changes in the sphere diameter, is enabled by the use of relatively long and thin fiber stems, which reduces the effective Poisson ratio of the combined sphere-stem system to approximately 0.0005. The mechanical tuning demonstrated here removes a major obstacle for the use of ultrahigh Q-factor silica microspheres in cavity QED studies of solid state systems and, in particular, cavity QED studies of nitrogen vacancy centers in diamond. © 2011 Optical Society of America.