

On Features and Applications of the Compact High-Q Optical Reference Cavity

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Miniature high-Q ultrastable cavities are of great interest for both Earth-based and space applications like precision spectroscopy, time&frequency dissemination, coherent reflectometry, measurement of gravity field. We created a 20 mm optical cavity operating on 1550 nm with finesse about 100 000 and extremely low internal losses that led to on-resonant transmission more than 60%. With such a cavity, it is possible to observe and investigate the phenomenon of optical bistability that causes dependency between shape of the cavity resonance line and circulating power. Complete study of this effect can be used to determine major mirror characteristics like losses and thermal response time. Ultrastable laser system based on this cavity can be used for GRACE-like precision interferometric measurement of inter-satellite distance. We managed to demonstrate the measurement of linear displacement with uncertainty below 10 nm.