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Study on Stabilizing the Laser Frequency in 10^-14 Level by Optimizing Modulation Transfer Spectroscopy on the 87Rb D2 Line

In this study, we present a high-performance laser frequency stabilization method that utilizes modulation transfer spectroscopy (MTS) on the rubidium 87 D_2 transition line. The frequency instability is evaluated with beating signal of two frequency-locked external cavity diode lasers (ECDL), and reached a short-term stability of $4.5\times10^{-14}/\sqrt{\tau}$ and did not exceed 2×10^{-12} until 10^5 s. To the best of our knowledge, this is the best performance reported with the rubidium 87 D_2 transition.

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