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A widely tunable laser frequency offset lock with digital counting[1]

JOSHUA HUGHES, CHAD FERTIG, University of Georgia, Department of Physics and Astronomy — We have developed a hybrid analog+digital electronic lock to stabilize a dynamically tunable RF frequency offset between two lasers. Our method features an 80 MHz capture range, ± 7 GHz tuning range, frequency agility of 1 MHz/μs, and low (< 30 ppm) drift in the absolute optical frequency difference after $\sim$1000 s. With this scheme, multiple slave lasers can easily be referenced to one stable master laser, while each remains rapidly and accurately tunable over the wide frequency ranges encountered in typical laser cooling and trapping experiments. We present the results of experiments assessing the stability, accuracy and agility of the lock, as well as a theoretical analysis of the performance limits set by quantization error due to digital sampling.

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