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FPGA-Controlled Versatile Microwave Source for Cold Atom Experiments ISAIAH MORGENSTERN, SHAN ZHONG, QIMIN ZHANG, LOGAN BAKER, JEREMY NORRIS, BAO TRAN, ARNE SCHWETTMANN, University of Oklahoma — We present our FPGA-controlled microwave source for controlling the time-dependent microwave-dressing of the ground state hyperfine levels of a Bose-Einstein condensate. Our source is based on direct digital synthesis (DDS) of low frequency (MHz) signals, and single-sideband modulation (SSM) to bring these signals up to microwave frequencies (GHz). The DDS chip is controlled by a FPGA to allow versatile programming of fast, arbitrary, time-dependent changes of amplitude, phase, and frequency. The frequency is up-shifted by SSM with a stable 1.8 GHz microwave synthesizer. A 20 W amplifier increases the signal strength to the amplitudes necessary for microwave dressing of cold atoms. A simple homebuilt antenna inside the vacuum chamber irradiates the atoms. Impedance matching of the antenna is accomplished with a stub tuner. The microwave source is modular so it can be easily reprogrammed and adjusted to fit a wide variety of experimental setups.

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