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Prototype Power Regulation System for the Deterministic Preparation of an Ultracold Few-Fermionic System[1] JUSTIN NIEDERMEYER, Washington State University Department of Physics and Astronomy, VINCENT KLINKHAMER, SIMON MURMANN, ANDREA BERGSCHNEIDER, SELIM JOCHIM, Physikalisches Institut, Ruprecht-Karls-Universitaet Heidelberg — Recently developed technology allows for the preparation of systems consisting of a few interacting ultracold fermionic particles (such as lithium-6). This allows for the study of a few-body quantum system consisting of one to ten particles with $\sim 90\%$ fidelity by creating magneto-optical microtraps with narrowly separated, tightly focused lasers. However, the components of the research apparatus undergo thermal drifts when exposed to the laser light and power fluctuations when varying the output parameters. To correct this, a prototype control system was created, and the proof of its concept was demonstrated. This prototype control-loop system was able to correct power fluctuations on the order of 500 Hz, and continuing development with higher-quality equipment will allow fluctuation correction on the order of 1 kHz. Once this threshold is achieved, new systems of multiple microtraps will become feasible. This will allow for the highly accurate study of systems which may further the understanding of high-temperature superconductors and may lead to the realization of quantum computing and spintronics.

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