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Proceedings on Exploring the Miniature Dilatometer Based upon AFM Piezocantilever LIRAN WANG, DAVID GRAF, JU-HYUN PARK, TIMOTHY MURPHY, STANLEY TOZER, ERIC PALM, National High Magnetic Field Laboratory, Florida State University, Tallahassee, Florida 32310, USA, GEORGE SCHMIEDESHOFF, Department of Physics, Occidental College, Los Angeles, California 90041, USA, JOHN SARRAO, JASON COOLEY, Los Alamos National Laboratory, MST-10, Los Alamos, New Mexico 87545, USA — We report on the improved design of a miniature AFM cantilever based dilatometer. Compared to the traditional capacitance dilatometer and fiber bragg grating (FBG) dilatometers, this dilatometer has unique merits. This dilatometer has the ability to measure very small samples with lengths at sub-mm levels, low temperature and field dependence, is compact to allow for rotation, and works well irrespective of being in a changing liquid or gas environment (i.e. within a flow cryostat or mixing chamber). Moreover, this technique shows suitability for application in oscillatory magnetostricton measurements. The final advantage of it is shown by successful simultaneous multiaxis dilation measurements, which are considered to be a challenge for the other dilatometer techniques. To illustrate the capabilities of this dilatometer, the low temperature thermal expansion and magnetostriction measurements on the heavy fermion superconductor $CeCoIn_5$ and its analog $LaRhIn_5$ will be presented. Measurements on $CeCoIn_5$ were made at various temperatures as well as rotating in field allowing a complete 3D-phase diagram to be constructed. In addition, angle-dependent quantum oscillations in $LaRhIn_5$ at ~ 25 mK were successfully observed.

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