Abstract Submitted
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Machining a Circuit-Housing and Sample Stage for a Precision Oscillator NICHOLAS BROWN, RYAN GORDON, Western Illinois University — My presentation will cover the design and ongoing construction of a circuit-housing unit and sample stage for a low-temperature, high precision oscillating circuit, known as a tunnel diode resonator (TDR). The focus of this project is to create an environment for the TDR circuit that will allow for making ultra-precise measurements of electromagnetic properties of materials. The TDR circuit consists primarily of an LC tank oscillator, with a natural resonance frequency of approximately 10 MHz, which is powered by a properly biased tunnel diode. Under the best conditions, the resonance frequency of the TDR can be maintained with parts-per-billion sensitivity to drift in its resonance frequency. To achieve this low noise level, it is vital to thermally anchor all components of the TDR circuit to the housing unit. In addition, for the measurement of materials, a small sapphire stage must be inserted into the TDR inductor during measurement. I will cover the details of these designs and talk about the status of the construction of this experiment in the Western Illinois University Physics Department Machine Shop.

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