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Optics with microwaves in heavy fermions DAVID BROUN, Simon Fraser Univ — In so-called "heavy-fermion" metals, the hybridization of the conduction band with electrons localized in partially filled f orbitals leads to the formation of heavy quasiparticles, for which the effective mass can be renormalized by a factor of 100 or more. However, the itinerant nature of these quasiparticles competes with a tendency to form more conventional, magnetically ordered states. These materials are therefore situated near a quantum critical point — a zero-temperature phase transition driven by the competition between kinetic energy and potential energy — a conflict between itinerancy and localization that lies at the heart of all correlated electron materials. Along with mass enhancement, the scattering dynamics in heavy fermion compounds also undergo a strong renormalization. This critical slowing-down brings important electronic timescales, such as electronic scattering rates, down into the GHz range, where optical-type measurements and analyses can be carried out with microwaves. We have developed a dilution-refrigerator-based system for carrying out these measurements, and have used it to study a range of heavy fermion materials such as $CeCoIn_5$, UBe_{13} and URu_2Si_2. An overview of our most striking results will be presented.

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