Pitt Research

Western Pennsylvania Quantum Information Core

Quantum Design PPMS DynaCool System

The Quantum Design PPMS DynaCool system is a cryogen-free, fully automated physical property measurement system designed for a wide range of low-temperature (50 mk to 400 K) and magnetic field (-12 to 12 kOe) experiments. The system operates without the need for liquid cryogens and incorporates a built-in cryopump to achieve high-vacuum conditions (<10^{-4} Torr). It integrates precise temperature control and magnetic field generation, and is compatible with a wide range of PPMS measurement options, making it ideal platform for materials characterization and quantum transport studies.

Temperature

- Range: 1.8 K to 400 K
- Cooling rate: 300 K to 1.8 K in approximately 50 mins
- Stability: ±0.1% for T < 20 K

  ±0.02% for T > 20 K

Magnetic Field

- Range: -12 kOe to 12 kOe
- Ramping rate: 0.2 to 100 Oe/s
- Field uniformity: ±0.1% over 5.5 cm axially

Electronic transport measurement (ETO)

- **AC resistance measurement**

➢ Measurement range: 10 μΩ to10 MΩ (standard 4-probe configuration)

2 MΩ to 5 GΩ (high-impedance 2-probe configuration)

➢ Sensitivity: 10 nΩ RMS

- Frequency: 0.1 to 200 Hz
- Source current: 10 nA to 100 mA

- **DC resistance measurement**

- Measurement range: 10 μΩ to 5 MΩ (standard 4-probe configuration)
- Sensitivity: 15 nV RMS
- Frequency: 5 Hz square wave
- Source current: 10 nA to 8 mA

- **Van der Pauw measurement**

- Measurement range: 10 μΩ – 5 MΩ
- Source currents: 2 nA – 8 mA

Dilution Refrigerator Option

- Temperature: 50 mK -300 K
- Cooling rate: 300 K to 50 mK in approximately 5 hours
- Temperature stability: ±0.2 %
- Accuracy: ± 10 % for T = 50 mK

  ± 2 % for T = 300 mK

  ± 1 %, for T = 4 K
- Closed cycle system ensures the valuable 3He/4He gas mixture is not lost in normal operation
- Compatible measurement options including AC susceptibility, heat capacity, and electrical transport

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Horizontal Rotator

- Rotate range: -10° to 370°

- Angular step resolution: 0.0133/step (standard resolution); 0.0011°/step (high resolution)

Multiple Function Probe

- 48 measurement lines
- customized measurement setup is supported
- Integration of user-provided devices is supported