Ultra-low temperature high magnetic field quantum transport and manipulation experimental station

The phase coherence of quantum states needs to be maintained as long as possible in the operation process, so that the quantum information will not be lost. Therefore, the relevant experiments must be carried out under the extreme low temperature. According to different refrigeration methods and corresponding different temperature divisions, the system belongs to the quantum state control system of extreme conditions.

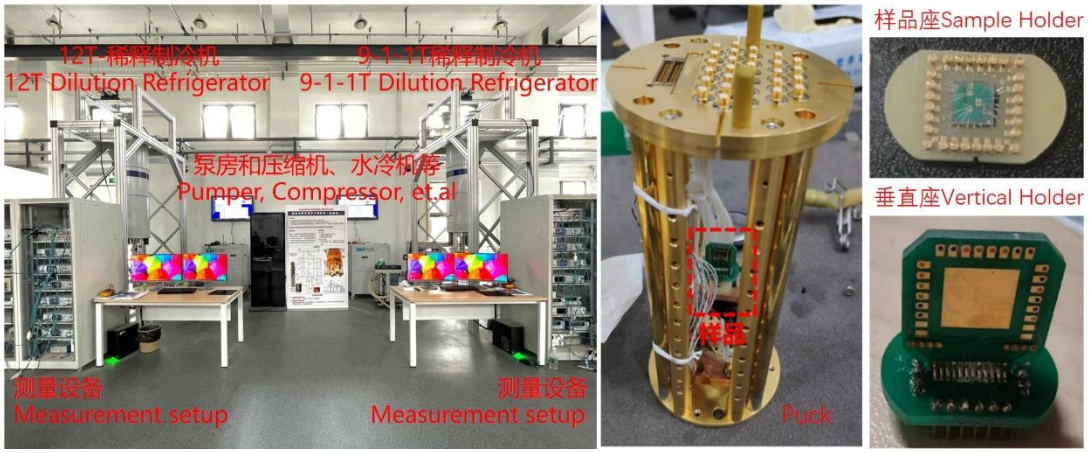


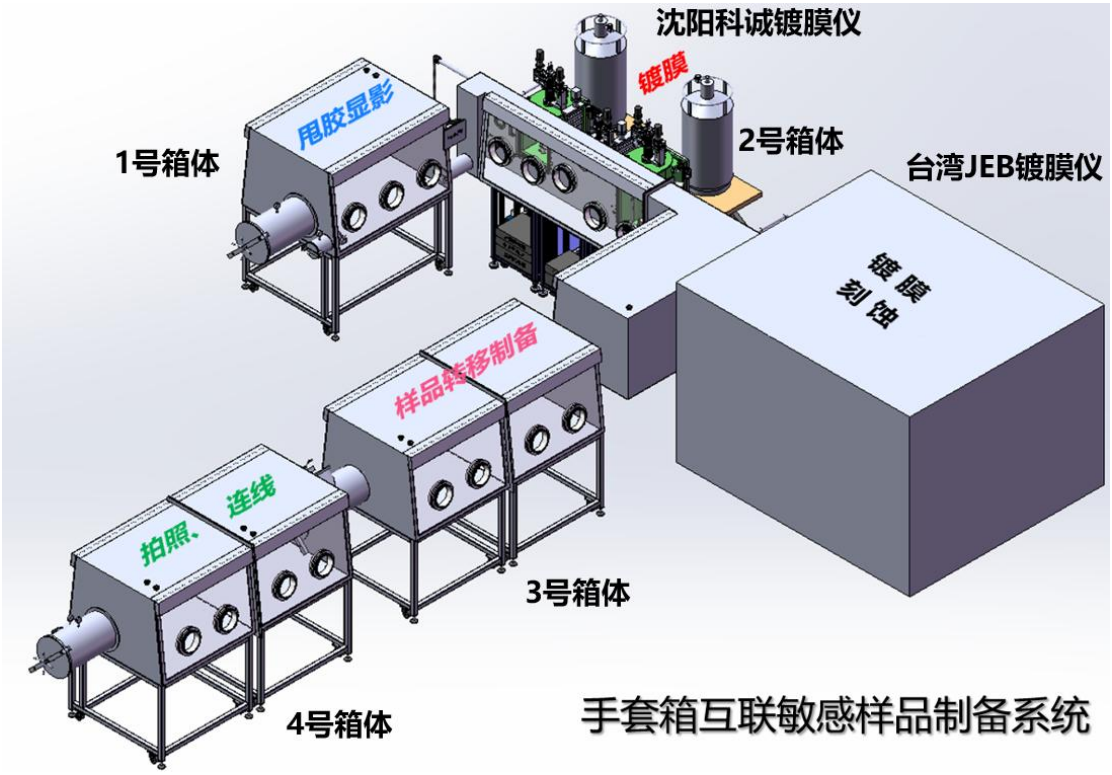
Photo of the experimental station

Ultra-low temperature high magnetic field quantum transport and manipulation experimental station is equipped with extremely low temperature measurement circuit in the microwave frequency regime, and an electrical measurement and control instrument at room temperature to realize the measurement and control of quantum states at extremely low temperatures, which is used for the experimental research for solid-state quantum computing in many mainstream directions worldwide. The system consists of two sets of liquid-helium-free dilution refrigerators and measuring equipment. The pump room, compressor and water cooler are in the auxiliary room to reduce the large amount of noise generated during the operation of the equipment. Based on our past experience, a properly designed shock absorption grounding and filtering can meet the experimental requirements, so there is no separate shielding room for the device.

The liquid-helium-free dilution refrigerators have equipped with multi-channel weak signal measurement, all levels of signal amplification and noise isolation or filtering system, room temperature measurement and control instrument, and low temperature microwave circuit, etc. The two sets of equipment achieve the requirement: the minimum temperature below 30 mK, the magnetic field is up to 12 T for vertical magnetic field and 9 T for Z-axis, 1 T for Y axis, and 1 T for X-axis of 3D vector magnetic field, respectively.

Glove box system:

Glove box system can realize air-sensitive devices fabricating in an inert gas atmosphere. It will fulfil the dry transferring and metal film coating of van der Waals devices and twistronics devices, and optimize device electrical performance, like high mobility and good Ohmic contact. The Glove box system provide a good platform to investigate low dimensional topological quantum states. This system offers plasma cleaning, dry transferring, metal film coating, wire bonding, and four probe electrical testing for device fabricating. The schematic of glove box system is shown blow, including four glove boxes:



Box 1: for spin coating and developing.

Including: spin coater and baking station

Box 2: for plasma cleaning and electron beam evaporation.

Including: two electron beam evaporation equipment and plasma cleaner.

Box 3: for dry transferring and van der Waals devices fabricating.

Including: Olympus microscope, Zeiss microscope, and microscope with electronically controlled dry transfer station.

Box 4: for ozone cleaning and wire bonding

Including: ozone cleaner, westbond wire bonding machine, and probe station.

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