A ^{3}He-^{4}He Dilution Refrigerator for Microgravity Experiments on a Small Jet Plane

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Ultra-low temperature experiments under zero gravity condition have drawn attentions[1] but not many experiments have been carried out due to the experimental difficulties[2]. Dilution refrigerators, a common device to get ultra-low temperatures, usually require the gravity for the continuous operation but special care have to be paid for the use in zero gravity. We developed a dilution refrigerator for microgravity experiments of ^{4}He crystal produced by a jet plane's parabolic flight. The jet plane was so small that the cryostat has to clear some restrictions such as experimental space, available electric power and total weight of the experimental system including refrigerators, vacuum pumps, measuring instruments and so on. The cryostat consisted of a dilution refrigerator and a GM refrigerator and was made to be compact and meet these restrictions. The dilution refrigerator unit was ordinary one and was not specially designed for the microgravity. The jet plane provides the microgravity for 20 s and we expected that it should work in this short period. We carried out the performance test of the dilution refrigerator under the microgravity environment this March to find it keeping its lowest temperature of 150 mK through the parabolic flight.

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