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## Effect of DC flow on a three-stage Stirling pulse tube cryocooler working at liquid helium temperatures

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Multi-stage Stirling pulse tube cryocoolers (SPTC) have great potentials in liquid helium temperatures applications with advantages of high reliability, low vibration, and convenience of stage coupling for lacking cold moving parts.

Studies have shown that performance of GM type pulse tubes working at liquid helium temperatures can be improved by introducing DC flow, which decreases regenerator loss at liquid helium temperatures and increases cooling capacity. However, few study of DC flow in multi-stage Stirling pulse tube has been reported. In this study, we report the calculation results on a numerical model built on a home-made three-stage SPTC working at 4.2K, and its hot end of the third-stage pulse tube and third-stage regenerator are connected by a capillary tube to introduce DC flow. The results indicated that a suitable DC flow can significantly improve the performance of the pulse tube cryocoolers. Several capillary tubes with different diameters and lengths were tested. Temperature distributions along the pulse tube were measured and DC flow was monitored in our experiments. Also parameters of the capillary tube were optimized for different operation conditions and the performance of STPC was improved.

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