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Compact, add-on sub-Kelvin modules extend the working range of 4K mechanical pre-coolers to temperatures below 1K

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The technology for low-power sub-Kelvin cooling is is now established and products are available that offer simple operation, with reliable and repeatable performance at relatively low cost. Self-contained, sealed sub-Kelvin modules can be added-on or retro-fitted to low-power mechanical (GM or PT) pre-coolers to extend their operating temperature downwards, from 4K into the sub-Kelvin range. A system using this technology offers fully automated operation requiring little or no cryogenics expertise and superior performance when compared to systems relying on pre-cooling with liquid cryogens. When tested in a liquid-helium-cooled cryostat, tests on more than 30 individual sub-Kelvin modules manufactured over the past two years yielded base temperatures averaging 825±20mK under no load, rising to 858±26mK under an external load of 100μW. Run times (before recycling was needed) were typically ~29±3 hours, though could be as high as 40 hours. With a low-power GM pre-cooler and automated operation, the average operating temperatures of these modules were lower and the run times significantly longer, up to ~100 hours, Highly compact systems offering extended or even continuous operation below 1K, using two sub-Kelvin modules cycled in antiphase under fully automated control, are the next development in this rapidly maturing field.

Less than 5 years of experience since completion of Ph.D

Y

Student (Ph.D., M.Sc. or B.Sc.)

N

Primary authors: Dr CHASE, Simon (Chase Research Cryogenics Ltd); Ms RONSON, Emily (Chase Research Cryogenics Ltd); Dr KENNY, Lee (Chase Research Cryogenics Ltd)

Presenter: Ms RONSON, Emily (Chase Research Cryogenics Ltd)

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