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## **SESSION 5: Sub-Kelvin Coolers**

Paper 5.4

Tuesday ORAL Session

5:00 PM

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### ***Measuring the Liquid Helium Volume on XRISM and Predicting the Liquid Lifetime***

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The X-ray Imaging and Spectroscopy Mission (XRISM) was launched on Sep 7, 2023 from Tanegashima Space Center in Japan. One of the two instruments, Resolve, has a liquid helium dewar and mechanical cryocoolers that serve as heat sinks for the Adiabatic Demagnetization Refrigerator (ADR) which cools the microcalorimeter detectors to 50 mK. The liquid helium and the series of cryocoolers serve as complimentary, semi-redundant cooling systems. To maintain its temperature below 1.2 K the liquid helium slowly boils off. Using the available instrumentation it is important to determine when the liquid helium will be exhausted to plan the mission. The methods to determine the liquid helium volume on the ground included a superconducting level detector and ADR mass gauging. We used measured boil off rate and thermal models to interpolate between infrequent direct volume measurements. On orbit the ADR mass gauging is used. We also used the tank temperature and temperature drop across the porous plug, comparing ground tests and on-orbit results. This paper will describe these methods and their limitations to determine the initial fill and boil off rate of the superfluid helium before and after launch. We will also give the status of the XRISM cryogenic system.