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C4Or1A-01: The Continuous Adiabatic Demagnetization Refrigerator for PRIMA: Dual Instrument Cooling

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The Probe far-Infrared Mission for Astrophysics (PRIMA) contains two instruments: an imager (PRIMAGER) and a multi-band spectrometer (FIRESS). These two instruments require detector cooling to 100 mK and require parts of the optical train to operate at 1.0 K. From a base temperature of 4.5 K, provided by a James Webb Space Telescope-like cryocooler, a 5-stage Continuous Adiabatic Demagnetization Refrigerator (CADR) will provide this cooling to both instruments. Cooling two separate instruments comes with several challenges including operating temperatures, somewhat remote locations and shared parasitics. The CADR will provide 700 microW of lift at 1.0 K and 9 microW of lift at 100 mK to meet the two instruments (PRIMAGER and FIRESS) cooling requirements with a factor of 2 margin. This paper will describe these challenges to the CADR design, requirements, and operation. In addition we will discuss the CADR heritage and design features incorporated into the development model CADR.

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