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Test Performance of a Closed Cycle Continuous Hydrogen Sorption Cryocooler *

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The Jet Propulsion Laboratory (JPL) is developing a continuous closed cycle hydrogen sorption cryocooler for the ESA Planck mission, which will measure the anisotropy in the cosmic microwave background. The sorption cooler is the only active cooling for one of the instruments and it is the first of a chain of three coolers for the other instrument on Planck. This cooler has been designed to provide a cooling capacity of 1.1 W at a temperature below 20 K with a temperature stability requirement of 100 mK over a compressor cycle (667 s). The cooler performance depends on many coupled operating parameters (such as the temperatures of precooling thermals shield and the warm radiator) and can only be assessed through a detailed testing of the cooler as a system. A breadboard sorption cooler was built for this purpose. We present the results of this testing which include measurements of input power, cooling power, cold end temperature and cold end temperature fluctuations, heat load on the pre-cooling stages, and heat flow to the warm radiator. In addition, these results are compared to predictions from a comprehensive thermal model of the heat-mass transfers within the cooler that had been developed from previous testing of individual components.

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