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An Environmental Chamber to Investigate Liquid Saline Water in the Martian Polar Region

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We present the design of an environmental chamber to simulate the diurnal and seasonal cycles of the Martian polar region. This chamber is being built to aid in the investigation of liquid saline water in Mars' Richardson Crater (72° S, 179° E) and the Mars Phoenix Lander site (68° N, 126° W). Our objective is to: (i) determine the environmental conditions at with brines, formed from perchlorate salts found by the Mars Phoenix Lander, are stable on the surface of Mars and (ii) determine the optical properties of liquid saline water flows hypothesized to exist in Mars' Richardson Crater.

The environmental chamber system consists of a vacuum chamber with six internal thermal plates. The plates are arranged to form a cubic thermal cavity that can be cryogenically cooled by liquid nitrogen. Additional thermal control is attained through the use of resistive patch heaters, which are fixed on the thermal plates. The vacuum chamber inlet is connected to a carbon dioxide dry gas stream, which can be throttled to control the chamber's humidity. The vacuum chamber outlet passes through a chilled mirror hygrometer to measure the chamber humidity before the air exits the vacuum pump.

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