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### **Prototyping a thermal monitoring system for the one-metre aperture Lunar Laser Ranger tube assembly based at the Hartebeesthoek Radio Astronomy Observatory**

The Hartebeesthoek Radio Astronomy Observatory of South Africa is currently developing a lunar laser ranger (LLR) system in collaboration with National Aeronautics and Space Administration (NASA) and the Observatoire de la Côte d'Azur (OCA). This LLR will add to a limited number of operating LLR stations globally and it is therefore expected to achieve sub-centimetre range precision to the Moon. Key to this expected achievement is the development of a thermal monitoring system for the LLR telescope structure that can account for thermal effects, mainly induced by the telescope's interaction with the varying thermal environment. In particular, we present a prototype of the thermal monitoring system in which resistance temperature detectors (RTD) sensors were used to measure and predict thermal gradients on the tube assembly. The results obtained will be used to complete the development of a temperature monitoring and control system for accurate pointing of the LLR telescope. In order to measure and predict the temperature gradients across the tube surface, two sets of RTD sensors were installed. One set was used to measure temperature and the other set was used to validate the predicted temperature. Temperature regions (without sensors) of the telescope tube were mapped at the RMS that varied between 0.19 and 0.24 °C which confirms the accuracy of the interpolation method. For tube temperature in the range 19-21 °C, the calculated thermal gradients were found to be about 1.06 °C. The larger gradients ( $> 1.0$  °C) ought to be regulated to minimize their influence on pointing.