Thermodynamic Modeling of Astronomical Infrared Instruments

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This project models the thermal performance of cryogenic astronomical instruments, particularly of the OH-Suppressing Infra-Red Imaging Spectrograph (OSIRIS). OSIRIS is an infrared imaging camera and integral field spectrograph designed specifically for the Keck Observatory Adaptive Optics System. The previous OSIRIS thermal model describes how the various internal components cool to cryogenic temperatures, but this model is now inaccurate since many components have been modified during the construction phase of the instrument. In updating the program we need to determine which components changed, calculate their thermal energies, determine their heat loads, and calculate the new cool down and warm up times of the system as a whole. The existing computer model is being updated using the IDL computer language, and the results from our thermal simulations are compared to real thermal data from the instrument in order to determine consistency and the accuracy of our models. Finally, this program will be adapted to model the next generation of integral field spectrographs, the Extreme Adaptive Optics Coronagraph (ExAOC). ExAOC is currently a conceptual design study for the Gemini Observatory, and the thermal analysis provided herein is critical to the final design of this instrument.