Large area Charge Coupled Devices (CCDs) are currently the sensor of choice for ground-based astronomical observations in the UV, visible, and near IR wavelengths. These sensors are based on mature technology that began development in earnest in the late 1970’s. This sensor technology is expected to be eclipsed in the near future by sensors built using CMOS processes, and these sensors should have numerous advantages over current CCD sensors. Parallel with CMOS sensor development will be development of operational methods to best utilize the capabilities of the sensor while minimizing the effects of any less desirable features. One detrimental feature of CMOS sensors is an effect known as Random Telegraph Signal (or Noise) RTS, which affects a subset of pixels or columns of pixels, and causes noise outside of the normal Gaussian distribution. RTS is a quantized step or steps in the output level of a transistor in the pixel caused by electron traps that are populated or not, and is seen in CMOS image sensors due to the small physical size of the transistors in the pixel.

Spectral Instruments has begun evaluating a new type of large-area CMOS sensor for potential use for ground-based astronomy (see: http://www.specinst.com/BrochuresDatasheets/NDR_CMOS_Whitepaper.pdf). This sensor has a number of unique characteristics, but suffers from RTS noise as do all current CMOS sensors. We believe that by characterizing the RTS noise of each pixel, the effect can be reduced or eliminated in post-processing of the data, a capability that is possible only by using the non-destructive readout feature of this particular sensor. What we would like to see done is:

1) Characterize the RTS noise for each pixel in a sensor array.
2) Find a figure of merit that describes the sensor noise performance in terms of both the white (Gaussian) noise performance and the RTS noise component.
3) Develop an algorithm to identify the state of the trap(s) in a pixel, and use this Information to effectively eliminate the effect of RTS noise in a processed group of multiple images.

The project will be supervised by Dr. Bill Schempp, Ph. D. Physics and Astronomy, University of Hawaii.

Ideal skills of applicant:
Math proficiency, particularly in statistics.
Programming experience, but the exact language is unimportant.

Non-US citizens may apply.