

magnet bearings (HSMB) can be made that are stable, small in mass, passive (i.e. no power required to maintain configuration), and essentially frictionless. Since there is no mechanical contact between the rotor and stator in a HSMB, the bearing does not wear out with use and requires no maintenance. The very low friction in a HSMB permits electronic positioning control with exceedingly fine resolution. Work is currently in progress at NASA/GSFC, U. of Houston, and elsewhere to produce a working telescope model with HSMBs. We demonstrate the operation of a HSMB to show that currently available HTS materials can already meet the requirements for lunar applications. We discuss the workings of a HSMB, cooling requirements, and the effect of long term radiation exposure on HTS.

10.03

Advanced Technology Lunar Telescopes III. Radiation Resistant Detectors

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A practical lunar telescope requires high resolution imaging array detectors that are immune to (or can be easily shielded from) solar flare particle radiation and cosmic rays. Charge-coupled devices (CCDs), the detectors of choice for ground-based applications, fall short in this respect because of their high susceptibility to radiation induced bulk traps and loss of charge transfer efficiency (CTE). Blooming in CCDs also limits the dynamic range and degrades resolution, while the well known red leak problem hinders observations in the ultraviolet. We describe an ongoing program at NASA GSFC to develop intensified random-access Charge-Injection Devices (CIDs), a new generation of space uv detectors which do not have the shortcomings of CCDs. CIDs, like CCDs, are silicon array detectors. Unlike CCDs, however, CIDs have more than 100x greater tolerance to ionizing particle radiation. Since CIDs do not transfer charge, CTE degradation has very little effect on the overall sensitivity and noise level. CIDs can perform extremely fast windowing of selected regions of interest with high signal levels (e.g. bright cores of galaxies or strong emission lines, etc) while monitoring the remainder of the array at lower rates. This selective readout ability plus the lack of blooming give CIDs a high dynamic range of operation but with minimal demands on the memory storage and telemetry data bandwidth. We demonstrate the operation of a row-windowing CID and discuss the potential applications of these devices to astronomical research from the moon.

10.04

The *Edison* Infrared Space Observatory: Design and Status

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The *Edison* infrared space observatory was recently accepted for consideration by the European Space Agency as a candidate mission for that agency's post-2000 launch opportunities. Consequently, for the professional lifetime of most readers of this abstract, the project may be the only large-aperture observatory to operate in space over the wavelength range $\sim 3 - 100+ \mu\text{m}$.

In its current baseline configuration, *Edison* possesses a 1.7 m telescope within a spacecraft with overall dimensions of about $2.4 \text{ m} \times 5.4 \text{ m}$, weighing about 2360 kg. This is about the same size and mass as the ISO spacecraft and means that the observatory can be launched by vehicles available from Russia, ESA, or the US. The telescope will be cooled via radiation to about 20 K, with near-future mechanical refrigerators proposed to cool some elements of the instruments to as low as 2.5 K or less. As an alternative, small amounts of cryogenics may be applied to cooling only components of the instruments. At a telescope temperature of about 20 K, photometry and broadband imaging is limited ultimately only by the celestial thermal or confusion background throughout the proposed wavelengths of operation. As an attractive alternative

to purely radiative cooling, a RAL-developed Joule-Thomson/Stirling cooler, now in advanced laboratory testing, may be used to refrigerate the entire optical system. We estimate at present that this will achieve an equilibrium telescope temperature of 5 – 10 K and will allow spectroscopic observations at the celestial thermal background throughout the infrared.

The poster paper will discuss recent design work on *Edison* and the status of the mission within ESA.

10.05

The Advanced Gamma-Ray Astronomy Telescope Experiment (AGATE): Space Instrumentation Beyond EGRET

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The continued development of the Advanced Gamma-Ray Telescope Experiment (AGATE), the "next generation" high energy gamma-ray telescope, will be presented. In addition to having the same advantage as EGRET of a low background for 30 MeV to 30 GeV gamma-rays, AGATE will also have a sensitivity that is almost an order of magnitude higher than that of EGRET, extended energy range up to 100 GeV, and improved angular resolution. AGATE will have an area of $2 \times 2 \text{ m}^2$ and will consist of a stack of drift chambers as the tracking detector. The drift gas used will be xenon, thus eliminating the need for high Z conversion foils, reducing the scattering of electrons and positrons before the track position can be determined. To test the concept, a smaller prototype consisting of a 10 layer stack of $\frac{1}{2} \times \frac{1}{2} \text{ m}^2$ drift chambers has been constructed and successfully tested using atmospheric muons. Results on position resolution and efficiency for different gas mixtures will be presented. It is envisioned that AGATE, like EGRET, will continue to provide us with a wealth of information on active galactic nuclei, pulsars, diffuse emission, solar flares, and gamma-ray bursts.

10.06

SOPHOS – South Pole High-altitude ObServatory: Aperture Configuration and Imaging Performance

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SOPHOS is an aerostat-borne, sparsely filled 6-meter optical telescope that we plan to fly in Antarctica. This paper presents the results of studies concerning the aperture configuration and the results of simulations of the imaging performance of the telescope.

We first describe the results of a computer optimization of the subapertures following a method proposed by T. Cornwell, which consists of optimizing the coverage of the Fourier plane. When taking advantage of the earth's rotation (by taking exposures with the overall aperture rotated around the line of sight), the optimum configuration of subapertures is on a circle with unequal spacing. The effects of the spacing and diameter of the individual mirrors on the optical performance will be presented.

We then present the results of simulations in retrieving the observed object. When an object is observed at several roll angles, the point spread function is simply rotated at each roll angle and hence needs to be measured only once; it can be resampled for each observation. The images can be deconvolved using the Richardson-Lucy method, and it is possible to improve the images by deconvolving a set of images taken at different rolls using a single deconvolved image and a single (rotated) PSF. We will present examples of simulated image data, reconstructions in the presence of background and readout noise, and comparisons with images obtained with a filled-aperture telescope. We will also show the effects of imperfect cophasing of the subapertures on image reconstruction.