46.03
A New Telescope for Wide-Band Gamma Ray Astronomy: The Silicon Compton Recoil Telescope (SCRT)

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A new proposed balloon-borne prototype Compton gamma ray telescope is described which is sensitive from 0.3 MeV to above 100 MeV. The Silicon Compton Recoil Telescope (SCRT) uses multi-layers of silicon strip detectors as a Compton gamma ray converter. Recoil electrons are tracked with the silicon strip detectors and their energy losses and directions are measured. When the direction and energy of the Compton scattered gamma rays are measured with CsI(Tl)-photodiode detectors, unique direction and energy values are found for each incident gamma ray. SCRT is the first Compton telescope that can image the gamma ray sky directly. Above 10 MeV pair production becomes an important mode of detection, extending SCRT's sensitivity to above 100 MeV. Typical resolutions are 3% (FWHM) at 2 MeV and 0.5° (1-σ). The prototype SCRT instrument has a sensitive area of 650 cm^2, a high detection efficiency of 3% and a sensitivity of 15 milliCrabs for a typical Compton Observatory exposure. SCRT's innovative design fully utilizes the sensitivity of the Klein-Nishina formula for gamma ray source polarization measurements.

46.04

GRATIS: Pointing and Tracking System

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The Gamma-Ray Arc Minute Telescope Imaging System (GRATIS; see companion paper by Harrison et al.) requires a balloon-borne stabilized platform capable of 20 arc second absolute pointing accuracy. We have developed a system which uses computer-based inertial-guidance control of an azimuth-elevation pointing mechanism for the telescope. An innovative computer-based star pattern recognition system automatically generates drift corrections from an image acquired by a Peltier cooled CCD camera.

The inertial guidance system provides three axis pointing information with approximately 12 arc seconds precision. This is a true inertial guidance system with gyros, accelerometers, and an integral navigational processor. The gyros have high relative pointing precision, but a slow drift component degrades their absolute accuracy.

Control of the elevation position is accomplished through a torque motor that is directly coupled to the telescope. Azimuth control is accomplished through an active zero-stiction bearing at the top of the gondola and a reaction wheel at the bottom.

The pointing system has been fully constructed and tested and has been mated with the telescope. We present the results of an extensive series of tracking tests.

46.05

GRATIS: a hard x-ray telescope with arcminute resolution

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The Gamma-Ray Arcminute Telescope Imaging System (GRATIS) is a balloon-borne coded aperture experiment sensitive in the energy range 20 - 200 keV. This is the first experiment in this energy band capable of resolving sources on arcminute scales. The design incorporates an array of thirty-six imaging scintillation detectors coupled to one-dimensional coded masks which collectively yield a two-dimensional map over a field of view of 0.75 degrees. The payload is fully constructed and calibrated and will be launched for the first time this coming Spring.

In this poster we present an overview of the conceptual design of the instrument optics and detector system as well as laboratory data demonstrating the imaging performance of the telescope. We also discuss our proposed observing plan and present calculations of our expected sensitivity. A companion paper will discuss the telesope guidance and pointing system.

46.06

Prometheus Update

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Prometheus I is a very low background 0.03 - 6.5 MeV gamma-ray balloon - borne imager. It eliminates the activation component of instrumental background through use of: (a) A gamma ray detector that is segmented in two dimensions; (b) An active collimator fabricated from low - Z matter , and which has a 10 keV threshold; (c) An active collimator that vetoes prompt events due to fast neutrons; (d) A radiationless absorber of slow neutrons. The segmented detector rejects beta rays emitted by internal NaI activated nuclei because a beta causes only one segment to pulse, but a gamma ray interacting through Compton scattering causes several segments to simultaneously pulse. It also serves as a position sensitive gamma - ray detector for the coded mask that fills the collimator's aperture. The low - Z matter is plastic scintillator, which has only a few spallation products. Gamma rays from them are vetoed because they are accompanied by charged particles that are all vetoed. The plastic moderates all fa st neutrons down to slow speeds, through (n,p) scatters by the hydrogen in the plastic. It is surrounded, outside and inside, by LiF or Li foil, which absorb slow neutrons. Because of its low background, the 3 σ spectral - line sensitivity at 1 MeV of Prometheus II is expected to be 5 x10 $^{-5}$ photons cm $^{-2}$ sec $^{-1}$, given six hours observing time at midlatitude balloon altitudes. Prometheus will be used to produce a 0.5 - degree map of the entire sky, in an energy band above that of the hard X-ray band, but below that of the COMPTEL sky map. The map will be the principal scientific objective of two Long Duration Balloon flights that are planned for 1994 and 1995.

Prometheus has an in-flight selectable field of view (FOV) that ranges from 4 deg x 4 deg to 38 deg x 38 deg, and 30 arc-minute angular resolution. The localizability of bright sources is about 3 arc minutes. Since there is no unvetoed activation gamma radiation from the collimator, the energy spectrum of the aperture radiation may be unambiguously determined, by measuring the dependence of counting rate upon size of the FOV. This has implications for an independent means of measuring the "MeV bump" in the spectrum of the diffuse extragalactic background.

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46.07
SkyView: A General User Facility to Look at Digital All-Sky Data.

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SkyView is a facility which allows astronomers access to digital all-sky survey data. Users can display digital maps of given regions of the sky, overlay images in different wavelength regions, compare survey data with their own observations, display objects from various catalogs, make finding charts, and perform a variety of other tasks. The essence of the system is that all data at all wavelengths is easily intercomparable and comparable with user data in a variety of formats.

Surveys which will be included are the IRAS Sky Survey Atlas, scans of the Palomar Sky Survey and ESO Southern Sky Survey produced