60.05

Instrument Concepts for the Next Generation Space Telescope (NGST)

P. Bely (STScI), C. Lillie (TRW), M. Margulis (Lokcheed Martin)

We present the scientific rationale and requirements for NGST's science instruments, and describe the various instruments concepts which have been studied. The proposed suite of instruments includes a wide field near infrared camera, a multi-object near infrared low resolution spectrograph and an optinal thermal infrared camera/spectrograph combination. Specific issues concerning detectors, multi-object spectroscopy and active cooling are discussed.

60.06

A Reflecting Polymer Film Petal Concept for the NGST Primary Mirror

G. Horner, D. Stoakley, A. StClair (NASA LaRC)

A low cost, light weight reflecting polymer film is proposed as the primary mirror for Next Generation Space Telescope. The concept discussed in this paper is based upon the TRW High Accuracy Reflector Development (HARD) concept. The TRW HARD antenna concept has six hexagonals surrounding a center hexagonal. The proposed hexagonal reflecting polymer film is fabricated such that the assembled petals lie on the surface of a paraboloid of revolution to give the desired telescope aperture and focal length for the primary mirror. Each of the six surrounding hexagonals is identical so that the polymer film for each hexagonal can be fabricated by replication which is the most cost effective means. We will discuss recent advances in polymer film research which gives hope that high reflectivities can be achieved. Fabrication concepts which integrate the polymer film to a hexagonal backup structure will be described. Actuators will be integrated into the backup structure to correct for distortions in the film that may occur once the petals are deployed. These actuators will shape the polymer film to the desired surface accuracy. Some concepts for actuators that will be discussed include, electrostatic, electromagnetic, and superconductors. Some of the material and structures issuses related to the problems of mirrors, actuators, and backup structures at cryogenic temperature will be discussed.

60.07

New Technology for Ultra-lightweight Mirrors with Application to the NGST

R. Angel, B. Martin, S. Miller (Steward Obs.), D. Sandler, D. Bruns (ThermoTrex Corporation), D. Tenerelli (Lockheed Martin)

Virtually all optical telescopes make use of the standard mirror paradigm, a metallic reflecting film on a glass substrate free of distorting forces. Glass is the preferred substrate material, giving the best balance of mechanical rigidity, temporal, thermal and chemical stability. For the very large, diffraction-limited and very lightweight mirror needed for the NGST, the paradigm breaks down. We describe a new solution, which takes advantage of active control to exploit light structures of stiffer but less stable materials. The glass is reduced to membrane thickness, correctly figured on small scale, while an underlying carbon fiber structure provides the large scale spatial rigidity and short term temporal stability. The two are rigidly linked by many screw type actuators. Long term thermal and mechanical deformations of the carbon fiber are decoupled, with occasional adjustments of the actuators to preserve the surface figure. We call this new technology GMARS (Glass Membrane with Active Rigid Support).

Since very large monoliths are possible by this method, the choice between segmented or monolithic mirrors is not driven by optical fabrication limitations but can be made on grounds of reliability and costs for launch and deployment. As an example, a 6 m primary for diffraction limited resolution at 1 micron wavelength (0.03 arcsec) would use a membrane 2 mm thick and 2700 50 g actuators, yielding a total mirror system weighing 600 kg. It could be launched, fully assembled and tested, in an expanded rocket fairing to an orbit taking it as far as 3 AU from the sun for low zodiacal sky background.

A 0.5 m prototype GMARS spherical mirror has been constructed with commercial piezo driven screw actuators and 2 mm membrane. A surface accuracy of 93 nm rms was achieved, already good enough for diffraction limited imaging at wavelengths longer than 3 microns.

60.08

Next Generation Space Telescope Integrated Performance Modeling

D. Redding, A. Kissil, M. Milman (JPL), R. Beaman, L. Craig, P. Luz, M. Nein, G. Schunk (NASA/MSFC), G. Mosier, M. Femiano, C. Congedo (NASA/GSFC)

The imaging performance of a NGST is degraded by thermal deformation, vibration, attitude control noise, imperfect optics and other effects. Performance is restored through active and adaptive optical control, coupled with a system design process that crosscuts the structural, thermal, optical and control subsystems. Integrated computer modeling tools enable accurate prediction of NGST performance as a function of design parameters from these subsystems. Detailed closed-loop imaging performance results are presented to illustrate specific system architecture issues.

Session 61: Formation and Structure of the Milky Way Oral Session, 2:00-3:30pm Harbour B

61.01

High Velocity Clouds: Remnants of Local Group Formation

L. Blitz (UCB), D. Spergel (Princeton), P. Teuben (UMd), D. Hartmann (CfA), W.B. Burton (Leiden)

We re-evaluate the evidence for the nature of the High Velocity HI clouds (HVCs) and show that they are most plausibly explained as members of the Local Group of galaxies. We examine the three large scale HI surveys performed to date and show that a large and important subset of the HVCs is centered on the barycenter of the Local Group. If the Magellanic Stream is deleted from the sample, The velocity centroid of the entire HVC cloud ensemble has the same kinematic radial velocity centroid as the Local Group. Furthermore, only clouds gravitationally bound to the Local Group are found in the surveys. We show further that if the clouds are stable entities, with formation and destruction timescales long compared to their crossing times, that upper and lower distance limits placed by gravitational boundedness and tidal stability place the clouds, on average, at distances consistent with membership in the Local Group. We show also that the clouds exhibit a relation between their angular sizes and their velocities relative to the Local Group Standard of Rest, with clouds inferred to be closer to the Milky Way having larger angular sizes. Three individual clouds are presented in detail. One, in the plane of the Milky Way, is shown to have a distance greater than about 40 kpc. Two others are positionally associated with the most massive memebers of the local group, M31 and M33. The observed metallicities of the clouds from HST observations are consistent with the Local Group hypothesis, but not with a galactic fountain hypothesis. No other explanation can account for all of these observed properties. In the accompanying paper, we present a dynamical simulation that successfully reproduces the spatial and velocity distribution of HVCs on the sky.