[ID-10] Design of CQUEAN (CCD Camera for QUasar in Early uNivers)

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We are developing CCD camera, CQUEAN (Camera for QUasar in Early uNivers), that can detect Y-band (λ=1.005m) for observing quasars at z > 7 in the early universe. The detector consists of two HPK 2k × 4k CCD with a pixel size of 15 m. The thick back illuminated CCD is fabricated on high resistivity silicon. The advantages of the device are its thicker depletion layer, which improves the QE(40% at Y-band) and the absence of interference fringing. The camera will be placed on the McDonald 2.1m telescope (Otto Struve telescope) of the University of Texas at Austin. With the telescope diameter of 2.08m (82inch) and F/13.7, the pixel scale will be 0.11 arcsec/pix and the CCD FOV is 7.4 × 7.4 arcmin. In this presentation, we will show the conceptual design for CQUEAN and thermal analysis for the cryostat. We willuse controller electronics from ARS, Astronomical Research Camera, Inc., and the control software will be developed on the Linux platform. We plan to see the first light by the end of 2010.

[ID-12] Development of tantalum based superconducting tunnel junctions

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We report the successful fabrication and I-V curve superconductivity test results of the Ta-based superconducting tunnel junctions(STJ). STJ device is a candidate detector for next-generation astronomy. Because it is capable of counting photons from X-ray to NIR while exhibiting a high quantum efficiency, a high temporal response and an energy resolution much better than that of semiconductor-based devices. STJ with side-lengths of 20, 40, 60 and 80 μm were fabricated by deposition of Ta/Al/AlOx/Al/Ta 5-layer thin films incorporated on a 2-inch silicon wafer. These STJ thin-films were fabricated using UV photo-lithography, DC magnetron sputtering, reactive ion etching(RIE), and chemical vapor deposition(CVD) techniques. I-V curve superconducting state test for STJ was succeeded in 4K with liquid helium cooling system. Their performance indicators such as energy gap, normal resistance, normal resistivity, dynamic resistance, dynamic resistivity, and quality factor were measured from I-V curve. The STJ material analysis results obtained from x-ray diffraction(XRD) and scanning electron microscope(SEM) are also presented.

[ID-13] Ultra Fast Flash Observatory to observe the prompt photons from Gamma Ray Bursts

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UFFO (Ultra Fast Flash Observatory) is an ultra-fast optical/UV telescope which can slew to targets within 1 msec using MEMS (Micro-Electro-Mechanical Systems) micromirrors. It is utilized for observations of prompt optical/UV photons from GRBs (Gamma Ray Bursts), permitting the first ever systematic study of optical/UV emission far earlier than 1 sec after trigger. Topics of interest include short vs. long GRB prompt emission, which may have different emission time scales and mechanisms, and potential prompt emission from otherwise "dark" GRBs. We describe a concept and optical designs of the UFFO, and report lap-test results using a prototype telescope

[ID-14] Development of a Correlation Tracker System for New Solar Telescope: Software

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New Solar Telescope (NST), which will be the largest solar telescope in the world, is under construction by New Jersey Institute of Technology (NJIT), University of Hawaii (UH), and Korea Astronomy and Space Science Institute (KASI). There will be active optics (aO) and adaptive optics (AO) in order to improve image quality, and a Correlation Tracker (CT) system which is the simplest form of AO will be applied to Nasmyth focus bench. Especially in this presentation, we will introduce the CT software and its computing performance. The software has been developed via Microsoft Visual C++. The software enables us to take images from the high-speed CMOS camera, to calculate those displacements between the images by using sum of absolute differences (SAD) algorithm, and to control the tip-tilt mirror. We adopted the parallel programming technology (SIMD and OpenMP) based on the Intel Core 2 Quad processor without any additional processing system (FPGA or DSP) for high-speed performance. As a result, we can successfully make a tip-tilt correction over 700 Hz with 64 × 64 pixels in a closed loop mode. The CT system will be installed on the NST in 2009.

[ID-15] A New Calibration of Deep MMT 6.5m Transit Survey Data for Variability Research

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Increasing number of wide-field optical surveys are being conducted for studies of interesting variability such as exoplanet transits and transients. The deep time-series imaging observation by the MMT 6.5m transit survey program did not reveal any transiting planets, but it does provide a rare opportunity to explore optical variability at relatively high temporal resolution (30s ~ 90s). This is the primary goal of our present research project; i.e. the detection of fast and unusual variables. We find however that the light curve archive from the original image subtraction procedure exhibits many unusual outliers, and more than 20% of data get rejected by a simple filtering algorithm. In order to achieve much more accurate photometric precisions and also to make the most efficient use of the data, we are re-processing the entire image database with multi-aperture photometry and carefully tuned calibration procedures. We also added a new index that isolates peculiar situations where photometry returns misleading information. In this presentation, we demonstrate the improvement of data statistics and accuracy as well as potentials for the detection of micro-variability and extremely temporal variability.