50.08

"Weighing" the Universe: Searching for Distant Supernovae to Measure q_0

S. Perlmutter, M. S. Burns, G. Goldhaber, H. J. Marvin, R. A. Muller, C. R. Pennypacker (CfPA, Berkeley), W. J. Couch (NSW), and B. J. Boyle (IOA)

Observations of supernovae at cosmological distances may provide the most direct tool to measure the deceleration parameter of the universe, q_0, and thus determine whether the universe is open, flat, or closed. In a collaboration between Berkeley and the Anglo-Australian Observatory, we are now analyzing wide-field (17'x17') CCD images taken approximately once a month at the AAT 3.9 meter telescope to find supernovae with typical redshifts out to z≈0.3. Using 5 minute exposures, the image analysis software now detects events (asteroids, variable stars, and, perhaps, supernovae) as faint as 23rd magnitude. The data analysis will be completed within a few days of the observation, allowing follow-up observations to differentiate between supernovae and other variable objects, and between different supernova types. With 100-200 useful galaxies per field and one type Ia supernova every 300-400 galaxy years, this search is expected to discover about one type Ia supernova per night of observation. We will report on the current status of the search.

50.09

Correlations between Diffuse X-ray Background Surface Brightness Fluctuations and the Surface Density of Galaxies.

K. Jahoda (NASA/GSFC), O. Lahav (IoA), R. F. Mushotzky (NASA/GSFC), E. A. Boldt (NASA/GSFC)

We have correlated fluctuations in the high latitude diffuse 2-10 keV X-ray surface brightness (using HEAO-1 A2 data) with fluctuations in the galaxy surface density from diameter limited samples (using the UGC and ESO catalogs). Although the galaxies are nearby ($z < 0.03$) and sample only a small fraction of the volume believed to produce the X-ray background, we present evidence of a statistically significant correlation between the fluctuations. We also present evidence for a correlation between the X-ray data and fluctuations in the surface density of Abell clusters with distance class of 5 or less ($z \leq 0.2$). The correlations are used to estimate the volume X-ray emissivity of the nearby universe; these estimates are compared with X-ray luminosity functions for galaxies and clusters.

WEDNESDAY AFTERNOON

Session 51: Rossi Prize Lecture
Oral Session, 2:00–2:45 pm
Ballroom A/B

51.01

Two Unsolved Problems of High Energy Astrophysics

S. A. Colgate (LANL)

High energy astrophysics means to me problems in astrophysics that depart from thermodynamic equilibrium conditions to a major degree. I believe the extremum of nonequilibrium phenomena is still the $10^{20}eV$ cosmic rays that defy any consensus of an explanation. Similarly I believe that the highly columnated so-called jets from active galactic nuclei and quasars are a similar extreme departure from equilibrium hydrodynamic flows. Almost all the phenomena associated with neutron star magnetospheres are highly nonequilibrium phenomena. We also include the conditions of the early universe under the same rubric if only because it requires the highest energy accelerators to simulate these conditions, but these conditions are in general very close to thermodynamic equilibrium. Here I will consider just the highly columnated extragalactic radio sources and the ultrahigh energy cosmic rays because I believe there is a logical connection.

The acceleration of such ultrahigh energy cosmic rays must take place in the intergalactic medium, because the galactic field is too weak to afford the necessary confinement. On the other hand, acceleration within AGN is defeated by radiation damping. Fermi-shock acceleration is defeated by limits of time, magnetic flux, and the inherent properties of diffusion in both energy and dimension space. The columnated radio sources are also difficult to explain. A gas jet expanding into vacuum in a solid, smooth, perfectly designed nozzle has a limiting angle of divergence of the order of 10% due to turbulent friction with the nozzle wall, i.e. (lift to drag ratio)$^{-\frac{1}{2}}$. To presume that a fluid wall of a thick accretion disk acting as a perfect nozzle, the usual explanation of radio jets, can produce an angle one tenth of this seems absurd. I and my colleagues have proposed that the jet of SS433 and the columnated radio sources are the result of winding magnetic flux lines by an accretion disk around a black hole immersed in a conducting medium. The resulting helical magnetic field expands and extends semi-infinitely in the axial directions at a velocity, $v = c/\sqrt{12}$ in agreement with SS433, determined by the innermost stable orbit of the accretion disk. The force-free helical field is created by current parallel to the field and its dissipation is associated with the visible and radio signatures. This same magnetic dissipation in AGN columnated radio sources then becomes the natural place to accelerate the ultrahigh energy cosmic rays by E parallel to B. The accceleration is then external to the intense radiation field of the AGN, and the electric field and magnetic field in the region of acceleration are highly coordinated thereby circumventing the limitations of a diffusive process. The necessary magnetic flux to reach $10^{20}eV$ is sufficient. Therefore, I believe that what have been previously called jets associated with gas flows are instead helical magnetic force-free structures immersed in a conducting medium. They probably dissipate by hydromagnetic, resistive, and finally, velocity space instabilities associated with the drift of the current carriers of the current parallel to the magnetic field.

Session 52: Invited Talks: HST/COBE
Oral Session, 3:40–5:10 pm
Ballroom A/B

52.01

Early Assessment of Hubble Space Telescope Science Operations.

R. Giacconi (STScI)

52.02

Status of the COBE Satellite

E. S. Cheng, C. L. Bennett, N. W. Boggess, E. Dwek, S. Gulkis, M. G. Hauser, M. Janssen, T. Kelsall, P. M. Lubin, J. C. Mather, S. S. Meyer, S. H. Moseley, Jr., T. L. Murdock, R. A. Shafer, R. F. Silverberg, G. F. Smoot, R. Weiss, D. T. Wilkinson, and E. L. Wright

An overview will be given of the capabilities and mission objectives of the NASA/Goddard Space Flight Center Cosmic Background Explorer (COBE) satellite. Preliminary quicklook results will be presented from all three instruments. All-sky maps from the Diffuse Infrared Background Experiment (DIRBE) provide an unprecedented view of the infrared sky between 1 and 240 microns. Differential Microwave Radiometer (DMR) skymaps are achieving a level of sensitivity exceeding