For $n=0$, $\Omega=1$, $z=0.01$, $1+2\pi q=40,000$, the conventional mass spectrum is almost flat for masses below $10^{19} \text{M}_\odot$ (i.e., no longer peaked around the supercluster or the galactic mass as it was the case for hot massive neutrinos or warm gravitinos). For $n=0$, $\Omega=0.1$, $z=0.5$, $1+2\pi q=2,500$, the knee in the spectrum is raised to $10^{18} \text{M}_\odot$. Furthermore above $10^{14} \text{M}_\odot$ a slight modulation appears: the spectrum is depressed or enhanced depending on the sign of the baryonic density perturbation at recombination.

### Abstracts

**21.09 Gravitational Lensing Effects of Vacuum Strings: Exact Solutions**

J.R. Gott, III (Princeton Univ.)

Exact interior and exterior solutions to Einstein's field equations are obtained for vacuum strings. For a uniform density vacuum string the interior solution (in cross section) is a spherical cap while the exterior solution is part of a cone. A maximum mass per unit length for a string is found: $M_{\text{max}} = 6.73 \times 10^{27} \text{g cm}^{-1}$. Grand unified vacuum strings with $\mu > 10^{24} \text{g cm}^{-1}$, consistent with the observed isotropy of the microwave background and large enough to promote galaxy formation, would produce equal brightness double images of ORO's with separations of up to 8'. Formulas for lensing probabilities, image splittings, time delays, etc., are derived for strings in a reasonable cosmological setting. String searches using ST, the VLA and the COBE satellite are discussed.

**21.10 Point-Mass Deflectors in Gravitational Lensing**

J.F. Dolan (NASA/GSFC)

The observed properties of five systems generally accepted to be gravitational lens systems are compared with the properties predicted for the images of point-mass and distributed-mass deflectors in a gravitational lens system. The majority of the systems have properties more consistent with a point deflecting mass model of the lens. This result may indicate that super-massive black holes, rather than galaxies, may be the effective deflecting mass in most observed gravitational lens systems.

If the deflecting mass in a gravitational lens is a black hole, a simple expression gives the distance to the deflecting mass in terms of the difference in light travel time along the separate image paths.

**21.11 Mapping the Quasar Cutoff Near Redshift 3.5 Using a Spectroscopic Transit Survey**

D. Schneider, M. Schmidt (CIT), J. Gunn (Princeton)

Previous quasar surveys have reported a sharp decline in number of quasars above a redshift of $\approx 3.5$ (Oster 1982, Ap. J., 253, 28; Schneider, Schmidt, and Gunn 1983, PASP, 95, 957). The latter investigation found no quasars with redshifts larger than 2.7 down to a magnitude of $\approx 21.5$ in an area of 0.9 sq degrees. In order to study the profile of the density decreases at brighter magnitudes, a large area of sky must be surveyed. A very efficient method of achieving this is to combine a transmission grating with a CCD used in a transit mode (the CCD is read out at the sidereal rate). This procedure was used in March 1984 with a Texas Instruments 800x800 CCD coupled to the Prime Focus Universal Extragalactic Instrument mounted at the prime focus of the Hale telescope. A strip of sky 5.5' wide from R.A. 08h 09m to 17h 10m centered on declination +47° 09' was observed on two nights, once in the g filter to locate the objects, once with a transmission grating/blocking filter combination. The effective area covered is 7.6 sq degrees, and the integration time for an individual object is 32 seconds. The direct survey has a limiting magnitude of $\approx 23$. The transmission grating produced spectra from 5000 to 7000 A at 120 A resolution down to a limiting magnitude of $\approx 20$. This will allow detection of quasars in the redshift range 2.4-4.7 from the Lyman-alpha and C IV emission lines.

**21.12 Random Walk Statistics Applied to Large Scale Galaxy Maps**

D. H. Wolpert and J. R. Kuhn (Princeton U.)

We report here on attempts to statistically identify large scale structure in the Shane-Kirshner galaxy map. A new method for generating normalization maps for measuring filamentary structure is described and a theorem for optimizing the sensitivity of certain statistics is presented and then applied to a forced random walk statistic. Results using the model normalization maps are described.

This research was supported in part by the National Science Foundation.

**21.13 Construction of a Deep, 1° by 1° Galaxy Catalog**

Edward J. Groth (Princeton)

Construction of a deep, 1° by 1° galaxy catalog from 1m plates is described. Steps in the procedure include digitization, conversion of densities to intensities, normalization to sky surface brightness, removal of bright stars, locating potential objects, and calculating the parameters of objects. Parameter calculation is accomplished by a non-linear fit of a two-dimensional Gaussian to each object located. The fit automatically extends to two or three Gaussians when a close pair or triple of objects is encountered. Fit parameters include the background, coordinates, relative intensity, size, shape and orientation. The classification algorithm is still in development and is based primarily on object sizes. Sample results and preliminary comparisons with other methods of object detection and classification will be presented.

This research was supported in part by NASA through contract NAS5-25084.

**21.14 Redshifts and Magnitudes of a Complete Sample of 1200 Galaxies: Accuracies of Classifications and Redshifts**

E. Spiller and E. D. Loh (Princeton U.)

A comparison of the colors of unidentified objects with colors synthesized from stellar and redshifted galaxy spectra is made to determine the galaxies' redshifts. We use this method using six broadband colors from 375 to 950 nm in eight high galactic latitude fields and evaluate its effectiveness.

We analyze a rich cluster of galaxies with the assumption that counts far from the center fairly represent the