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Final Report on NASA ATP Award NAG 5-7128, May 2002

"Precision Measurement of Large Scale Structure"

PI: A. J. S. Hamilton

Work Completed

The purpose of this grant was to develop and to start to apply new precision methods for measuring the power spectrum and redshift distortions from the anticipated new generation of large redshift surveys.

A highlight of work completed during the award period was the application of the new methods developed by the PI to measure the real space power spectrum and redshift distortions of the IRAS PSCz survey, published in January 2000. New features of the measurement include: (1) measurement of power over an unprecedentedly broad range of scales, 4.5 decades in wavenumber, from 0.01 to $300\,h\,\mathrm{Mpc}^{-1}$; (2) at linear scales, not one but three power spectra are measured, the galaxy-galaxy, galaxy-velocity, and velocity-velocity power spectra; (3) at linear scales each of the three power spectra is decorrelated within itself, and disentangled from the other two power spectra (the situation is analogous to disentangling scalar and tensor modes in the Cosmic Microwave Background); (4) at nonlinear scales the measurement extracts not only the real space power spectrum, but also the full line-of-sight pairwise velocity distribution in redshift space.

Several authors, including collaborations with the PI, have used the PSCz measurements at linear scales to place constraints on cosmological parameters.

Near the end of the grant period, in June 2001, the 2 degree Field survey team published their first edition of 100k galaxies, and Max Tegmark (U. Penn) and the PI have quickly applied the new methods to measure the linear power spectrum and redshift distortions of galaxies in the 2dF survey.

Mike Culhane obtained his PhD in July 2000. His thesis, "Measurements of the Power Spectrum and Redshift Distortions of the Las Campanas Redshift Survey", consists of 4 papers which the PI trusts that Mike will submit for publication in the near future. Culhane's thesis applied an innovative procedure, devised by him, for carrying out a near-optimal analysis of the linear power spectrum of, and linear redshift distortions in, this "difficult" (because of the complicated selection function) survey.

Publications supported by this grant

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