Final Performance Report for NAG5-12278

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Final Report for FUSE GI Program C128:
How Does Abundance Affect the Strength of UV Emission in Elliptical Galaxies?

This program used the Far Ultraviolet Spectroscopic Explorer (FUSE) to observe elliptical galaxies with the intention of measuring the chemical abundances in their hot stellar populations. It was designed to complement an earlier FUSE program that observed elliptical galaxies with strong UV emission. The current program originally planned observations of two ellipticals with weak UV emission (M32 and M49). Once FUSE encountered pointing control problems in certain regions of the sky (particularly Virgo, which is very unfortunate for the study of ellipticals in general), M49 was replaced with the bulge of M31, which has a similar UV-to-optical flux ratio as the center of M49.

As the closest elliptical galaxy and the one with the weakest UV-to-optical flux ratio, M32 was an obvious choice of target, but M49 was the ideal complementary target, because it has a very low reddening (unlike M32). With the inability of FUSE to point at Virgo, nearly all of the best elliptical galaxies (bright galaxies with low foreground extinction) were also lost, and this severely hampered three FUSE programs of the PI, all focused on the hot stellar populations of ellipticals. M31 was the best replacement for M49, but like M32, it suffers from significant foreground reddening. Strong Galactic ISM lines heavily contaminate the FUSE spectra of M31 and M32. These ISM lines are coincident with the photospheric lines from the stellar populations (whereas M49, with little foreground ISM and significant redshift, would not have suffered from this problem). We have reduced the faint (and thus difficult) data for M31 and M32, producing final co-added spectra representing all of the exposures, but we have not yet finished our analysis, due to the complication of the contaminating ISM.

The silver lining here is the set of CIII lines at 1175 Angstroms, which are not significantly contaminated by the ISM. A comparison of the M31 spectrum with other galaxies observed by FUSE showed a surprising result: the hot stars in M31 seem to have a similar carbon abundance to those stars in galaxies with much brighter UV emission. The fraction of these hot stars in a population should be a strong function of chemical abundances, so this finding warrants further exploration, and we are proceeding with our analysis.

Because the UV emission in these galaxies comes from a population of extreme horizontal branch stars, the PI (Brown) presented this result at a June 2003 conference on such stars. The talk is included in the refereed proceedings:
Brown, T.M. 2004, "The UV Upturn: From M32 to Distant Clusters," Astrophysics & Space Science, 291, 215.