

11.06

The Annie Jump Cannon Video Project at the Harvard-Smithsonian Center for Astrophysics.

C. Lupfer, B.L. Welther, A. Griswold (CfA)

The heart of this poster paper is the screening of the new 25-minute educational video, "Annie and the Stars of Many Colors." It explores the life and work of Annie Jump Cannon through the eyes of sixth-grade students. A production of the Science Media Group at the CfA, the video was created to interest and inspire girls and minorities, in particular, to continue their study of history and physical science in high school.

Recent studies show that science teachers are successfully using videotapes in the classroom to supplement traditional methods of teaching. Other reports show that capable girls and minority students tend to drop science in high school. Our goal, then, was to create a video to stimulate the curiosity and natural interest in science of these younger students.

With the help of the Public Affairs Office at the CfA, we arranged to visit local schools to talk to sixth-grade science teachers and their students about the video project. Boys and girls were both eager to participate in it. By lottery, we chose a dozen youngsters of multi-cultural backgrounds to attend a three-day workshop, during which we videotaped them discovering facts about Cannon's childhood and career.

Barbara Welther, historian and principal investigator, took the group to the Harvard University Archives to look at some Cannon memorabilia. To learn about spectra, each student assembled a spectroscope from a kit and observed solar lines. CfA astronomers then led the group in various activities to explore the types of stellar spectra that Cannon classified and published in The Henry Draper Catalogue 75 years ago.

"Annie and the Stars of Many Colors" shows young people actively engaged in the process of discovery and offers teachers a novel tool to stimulate discussion of topics in science, history, women's studies, and careers. It is intended for use in schools, libraries, museums, planetariums, as well as for personal interest. For more information and/or a copy of the videotape, contact the authors at the CfA, Cambridge, MA.

Abstract submitted for the 182st meeting of the AAS, Berkeley, CA

Date submitted: April 21, 1993 Electronic form version 1.3

Session 12: High Energy Observations of AGNs**Oral Session, 10:30 am–12:00 pm****Zellerbach Auditorium**

12.01

ABSORPTION IN ROSAT SPECTRA OF HIGH REDSHIFT QUASARS

Martin Elvis, Fabrizio Fiore, Belinda Wilkes, Jonathan McDowell (CfA), Jill Bechtold (Steward)

We present evidence that X-ray absorption is common in high redshift (radio-loud) quasars. We have studied six high redshift ($z \sim 3$) quasars with the ROSAT PSPC of which four are in directions of low Galactic N_H . Three out of these four show excess absorption, while only three in about fifty $z \lesssim 0.4$ quasars do, indicating that such absorption must be common at high redshifts ($z > 0.4$).

PKS0438–436 and PKS2126–158 show evidence for absorption above the local Galactic value at high confidence. For absorbers at the quasar redshift $N_H = (0.86^{+0.49}_{-0.28}) \times 10^{22}$ atoms cm^{-2} for PKS0438–436, and $N_H = (1.45^{+1.20}_{-0.64}) \times 10^{22}$ atoms cm^{-2} for PKS2126–158, (solar abundances).

This absorption reverses the trend for the most luminous AGN to have the least X-ray absorption, so a new mechanism is likely to be responsible. Intervening absorption due to damped Lyman- α systems is a plausible cause. We also suggest that intracluster

material, e.g. a cooling flow, around the quasar which could also account for the GigaHertz Peaked spectrum of 2 of the 3 showing absorption.

No excess absorption is seen toward Q0420–388, although it has damped Lyman- α absorption at $z=3.08$. The N_H limit implies a low ionization fraction, $N(\text{HI})/N(\text{H}) \gtrsim 4 \times 10^{-3}$ (3σ , solar abundances).

In the emitted frame these PSPC spectra cover the band ~ 0.5 – 10 keV, which has been well observed for low redshift quasars and AGN. Comparison of high and low redshift spectra in this emitted band show no change of mean spectral index greater than $\Delta\alpha_E > 0.3$ (99% confidence) with either redshift or luminosity, for radio-loud quasars.

12.02

ROSAT Observations of an AGN with an Extremely Steep X-ray Spectrum

D. A. Schwartz, P. Zhao (SAO), R. A. Remillard (MIT)

The Scanning Modulation Collimator (MC) experiment on the first High Energy Astronomical Observatory (HEAO-1) has produced two candidate identifications for the bright hard X-ray source 1H0122-281. ROSAT observations of this field suggest Ton S210, at $z = 0.114$, as the HEAO-1 identification. However, the second candidate, RXJ0119.6-2821, at $z = 0.351$, has an extremely steep spectrum, with a fit to the energy index of $\alpha = 3.0$. Another newly discovered AGN at $z = 0.434$ gives the more conventional spectrum of $\alpha = 1.2$, while Ton S210 shows $\alpha = 1.7$. The two more distant quasars are fit to intrinsic absorption about 40% more than the nominal galactic value of $1.6 \times 10^{20} n_H \text{ cm}^{-2}$. This research was supported in part by NASA grant NAG5-1884.

12.03

Extended and Compact X-Ray Emission in Powerful Radio Galaxies

C.R. Lawrence (Caltech), D.M. Worrall (CfA), T.J. Pearson, A.C.S. Readhead (Caltech)

We report ROSAT X-ray observations of two powerful radio galaxies. 3C 280 provides evidence for a mixture of point-like and extended emission, with the latter produced by hot plasma of insufficient pressure to confine the radio lobes and insufficient density for a cooling flow to have begun. 3C 220.3 gives only an X-ray upper limit, but one consistent with our interpretation of the X-ray emission from powerful radio-loud AGN in terms of obscured and unobscured components.

12.04

ROSAT images of the double quasar 0957+561

G. Chartas, E. Falco, W. Forman, C. Jones, R. Schild, I. Shapiro (Harvard-Smithsonian Center for Astrophysics)

Observations of 0957+561 with the *Einstein* HRI (High Resolution Imager) in November 1979 and the ROSAT HRI in May 1991 indicate a decrease, over this time interval of about 0.5 in the x-ray flux of the northern image A which significantly differs from the change seen over the same period from monitoring of the optical continuum emission of the quasar, implying:

- 1) That image A is microlensed, or
- 2) That the variability of the quasar in the x-ray and optical spectral bands is significantly different over the time of the measurements, or