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ROSAT OBSERVATIONS OF X-RAY–SELECTED ACTIVE GALACTIC NUCLEI

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ABSTRACT

We have observed a sample of six optically faint, X-ray–selected active galactic nuclei with the *ROSAT* Position Sensitive Proportional Counter (PSPC). These objects represent a sample of soft and hard spectrum sources; all were observed previously with the *Einstein* X-Ray Observatory. Included in this sample is E0132.8−4111, whose soft X-ray and ultraviolet flux distributions bear a striking resemblance to that of Mrk 841, but whose relative hard X-ray emission is much less than that of Mrk 841. The spectra are all fitted satisfactorily with single power-law models and their spectral indices (with one exception) agree with those estimated from the *Einstein* IPC observations. Tests of short-term variability are carried out, with all sources showing constant count rates over the period of their *ROSAT* observations. Some sources do, however, show significant changes in count rate when compared to previous *Einstein* data taken a decade earlier.

Subject headings: galaxies: active — galaxies: nuclei — X-rays: galaxies

1. INTRODUCTION

The original intent of this work was to study the X-ray properties of the active galactic nuclei (AGNs) discovered as part of the Ultrasoft Survey of the *Einstein* Imaging Proportional Counter (IPC) database (USS, Córdova et al. 1990). These sources represented a sample of AGNs with well-defined components of X-ray emission below 0.5 keV, many possessing little or no detectable emission above 0.5 keV. An analysis of the sample's X-ray properties (as observed with *Einstein*) is presented in Córdova et al. (1992) and its optical properties are presented in Puchnarewicz et al. (1992).

Understanding the soft components of AGNs is an important step toward defining the emission mechanism responsible for the prodigious energy output in the UV-to-soft X-ray region. The soft excess may be the high-energy tail of the "big blue bump," which is believed to be thermal emission from the inner region of an accretion disk surrounding a central black hole. This hypothesis is by no means universally accepted, however; other models for the soft excess include reprocessing of a nonthermal continuum by either dense clouds or ionized absorbers near the central continuum source (e.g., Guilbert & Rees 1988; Halpern 1984).

The Position Sensitive Proportional Counter (PSPC) on the *ROSAT* satellite has provided the first opportunity to acquire high-quality spectral data in the soft X-ray region (0.1–2.4 keV), allowing improved measurements of the spectrum and flux of sources. With its enhanced soft-X-ray response over previous X-ray detectors, the PSPC is the ideal instrument for studying soft components in AGNs. With this purpose in mind, we have observed a number of USS AGNs with the *ROSAT* PSPC.

Only after the publications of Córdova et al. (1992) and Puchnarewicz et al. (1992), and the observations of our *ROSAT* targets, was it discovered that problems existed with the reprocessed *Einstein* IPC data with the effect that the original USS sample now contains a mixture of spectral types (see § 4). Nevertheless, the results presented here constitute what is perhaps the first publication of *ROSAT* pointed observations of a sample of *X-ray–selected* AGNs (in contrast to publications such as Kolman et al. 1993 which dealt with *ROSAT* All-Sky Survey observations of one X-ray–selected AGN, and Turner, George, & Mushotzky 1993 which dealt with optically selected AGNs), and thus is a valuable contribution to our knowledge of the spectra of AGNs in general. A better understanding of the spectra of X-ray–selected AGNs is also important for modeling the X-ray background, which is believed to be composed (in part or entirely) of discrete sources (AGNs).

Table 1 lists the AGNs for which we have obtained PSPC observations. Also listed are the positions, redshifts, visual magnitudes, observation start dates, exposure times, and the PSPC count rates (over the 0.1–2.4 keV range). The results of *ROSAT* observations of a seventh USS source, E1346.2+2637, are presented by Puchnarewicz, Mason, & Córdova (1993).

2. SPECTRAL FITTING

The data were analyzed using either the Post Reduction Off-Line Software (PROS) or the Starlink ASTERIX software. The spectra were extracted from a circular region of 3′ radius (centered on the source), using a surrounding annulus (or nearby region) for background subtraction. Channels 1–11 were discarded due to their uncertain response and channels above 200 were discarded due to the uncertain effective area of the detector at these higher energies.

The spectra were fitted with power-law, blackbody, and blackbody-plus-power-law models using the XSPEC spectral fitting software and the latest version of the PSPC spectral response function (released 1993 January). In all cases, the spectra were best-fitted with either a single power-law model or a blackbody-plus-power-law model. When the latter provided the lowest χ^2_ν, the single power law provided an equally good fit (on the basis of the *F*-statistic); therefore we have chosen to use the simpler, single power-law model. In order to test for evidence of intrinsic absorption in each source, the N_H value was allowed to vary freely. There was no statistically significant difference in the fits with free N_H versus N_H fixed at the Galactic value, and no sources showed evidence of intrinsic absorption. Table 2 gives the best-fit parameters of the single power-law fits (with free N_H). Listed in the table are the best-fit and Galactic values of N_H (cm^{-2}), the power-law photon index

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TABLE 1

SOURCE DATA

Source	Position R.A.(J2000)	Position Decl.(J2000)	z	v_{mag}	Date	Exposure (s)	Rate (counts s^{-1})	±
E0132.8−4111.........	01ʰ34ᵐ57ˢ.2	−40°56′10″.0	0.27	17.5	1992 Jul 7	9178	0.036	0.004
E0844.1+3743.........	08 47 15.5	+37 32 12.0	0.45	17.3	1991 Apr 11	5389	0.071[a]	0.005
					1992 Apr 23	12391	0.059	0.002
E0845.1+3751.........	08 48 16.8	+37 39 57.9	0.31	18.0	1991 Apr 11	5180	0.027	0.005
					1992 Apr 23	12391	0.036	0.002
E1227.0+1403.........	12 29 34.3	+13 46 40.5	0.10	17.3	1991 Dec 25	7282	0.029	0.005
E1401.7+0951.........	14 04 10.9	+09 37 53.7	0.44	16.6	1992 Jan 17	7583	0.101	0.005
E2034.5−2253.........	20 37 27.5	−22 42 31.0	0.26	17.8	1992 Apr 30	12291	0.042	0.002

[a] See discussion of the E0844.1+3743 count rate in § 2.1.2.

Γ (defined as $f_\nu = \nu^{-(\Gamma-1)}$), the degrees of freedom (dof) for the fit, the reduced χ^2 value, the flux at the detector (F_{TOT}, ergs cm^{-2} s^{-1}) and luminosity (L_X, ergs s^{-1}, calculated assuming $H_0 = 50$ km s^{-1} Mpc^{-1} and $q_0 = 0$) over the 0.1–2.4 keV energy range of the PSPC. Also given in Table 2 is the ratio of the soft counts (0.12–0.41 keV) to the hard counts (0.41–2.0 keV).

The value of N_H for E2034.5−2253 is from the Stark et al. (1992) survey. The remaining N_H values were computed using 100 μm *IRAS* maps with a resolution of 1′ (Puchnarewicz 1992). The errors quoted in Table 2 are at the 90% confidence level (for two interesting parameters; Lampton, Margon, & Bowyer 1976). The results of the spectral fitting will be discussed separately for each source below.

2.1. *Spectral Fitting Results*

2.1.1. *E0132.8−4111*

Figure 1*a* shows the PSPC spectrum of E0132.8−4111 with the best-fit power-law model overlaid. The data are binned in the standard PROS 34-bin format, a semilogarithmic format derived to closely match the energy resolution of the detector (see PROS software manual). E0132.8−4111 is the only source in our sample for which spectral fitting of its *Einstein* IPC spectrum has also been done. The spectrum (over 0.15–3.5 keV) was fitted with a two-component model composed of a 13 eV blackbody and a power law with the photon index held fixed at 1.7 (Córdova et al. 1992). A two-component fit to the PSPC data did not significantly improve the fit of a single power law.

The PSPC data show that E0132.8−4111 emits ~60% of its flux below 0.5 keV, with a soft/hard count ratio of 3.31 and a power-law index of 3.92, well above the average value of 2.35 found for *ROSAT* All-Sky Survey of AGNs (Brinkmann 1991), demonstrating the extreme softness of this source. The *ROSAT* observation of E0132.8−4111 also confirms (over the PSPC bandpass) the dramatic lack of hard X-ray emission implied by the *Einstein* data. The lack of a hard component, coupled with strong optical Fe II emission (Puchnarewicz 1992), is problematic for models of Fe II production which require excitation by hard ($E > 2$ keV) X-rays (e.g., Lepp & McCray 1983). Models such as the jet model of Joly (1991), which require little or no ionizing flux to produce strong Fe II, may be more successful in explaining this and other sources in our sample which show strong Fe II without strong hard X-ray emission.

2.1.2. *E0844.1+3743*

This source was observed twice by *ROSAT*. It was the target of observation on 1991 April 11 and fell within the field of view of a much longer observation on 1992 April 23. The spectral fitting results for both sets of data were the same within the statistical errors, showing no evidence for spectral variability between the two *ROSAT* observations (see Table 2). For spectral fitting, the data from 1991 were binned in the PROS 34-bin format, and the data from 1992, reduced with the Starlink ASTERIX software, were binned to give a minimum of 10 counts per bin.

E0844.1+3743 is a much stronger source than E0132.8−4111, possessing a significant hard X-ray component, with no evidence for a separate soft X-ray excess. Figure 1*b* shows the spectrum of E0844.1+3743 with the best-fit power-law spectrum overlaid. Both fits for the power-law index of this source, 2.11 and 1.84, are somewhat flatter than the *ROSAT* All-Sky Survey average value for AGNs of 2.35, though the 90% confidence limits on Γ from the shorter 1991 observation do include the survey value. Despite the

TABLE 2

SPECTRAL FITTINGS

Source	Date	N_H (gal)[a]	N_H[a]	Γ	dof	χ^2_ν	F_{TOT}[b]	L_X[c]	Soft/Hard
E0132.8−4111.........	1992 Jul 7	1.91(+0.20; −0.20)	3.80(+4.32; −2.48)	3.92(+1.75; −1.11)	25	1.12	2.69	1.08	3.31
E0844.1+3743.........	1991 Apr 11	2.94(+0.20; −0.20)	2.94(+2.17; −1.68)	2.11(+0.64; −0.58)	25	0.74	7.49	9.76	0.67
	1992 Apr 23		2.62(+1.31; −1.12)	1.84(+0.42; −0.40)	55	1.13	7.20	9.39	0.42
E0845.1+3751.........	1991 Apr 11	2.98(+0.20; −0.20)	5.12(+7.08; −4.42)	3.45(+1.63; −1.46)	25	0.87	2.87	1.58	0.83
	1992 Apr 23		4.08(+2.08; −1.69)	3.00(+0.80; −0.68)	31	1.51	3.22	1.77	0.98
E1227.0+1403.........	1991 Dec 25	2.91(+0.20; −0.20)	3.06(+4.07; −2.78)	2.19(+1.03; −0.96)	25	0.94	4.23	0.20	0.56
E1401.7+0951.........	1992 Jan 17	1.84(+0.20; −0.20)	1.16(+1.13; −0.83)	1.84(+0.46; −0.41)	25	0.87	8.24	10.2	0.85
E2034−2253...........	1992 Apr 30	3.80(+1.00; −1.00)	3.09(+1.90; −1.59)	1.83(+0.54; −0.52)	39	0.83	4.92	1.82	0.29

[a] 10^{20} cm^{-2}.
[b] 10^{-13} ergs cm^{-2} s^{-1}.
[c] 10^{44} ergs s^{-1}

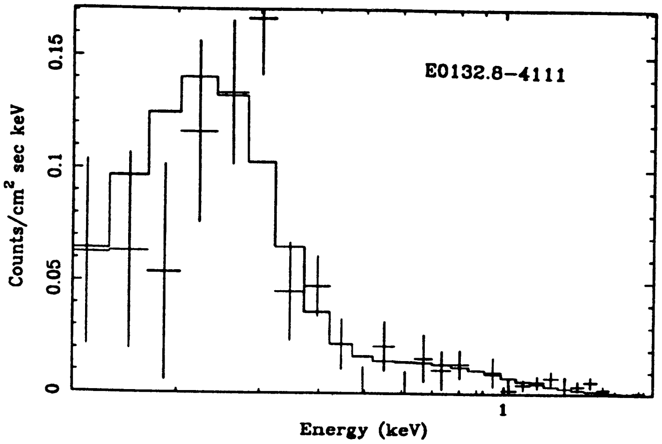

FIG. 1*a*

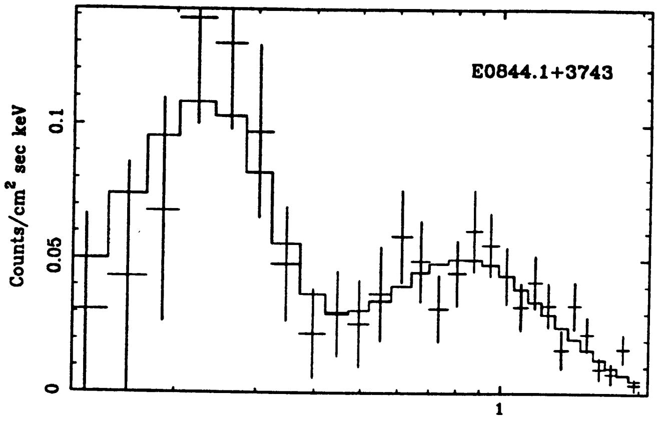

FIG. 1*b*

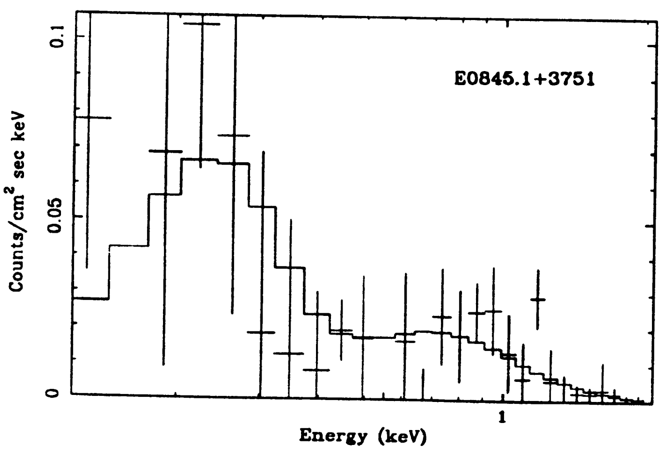

FIG. 1*c*

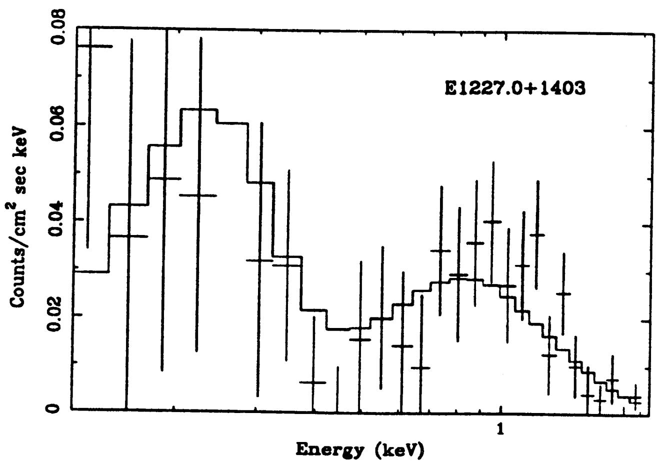

FIG. 1*d*

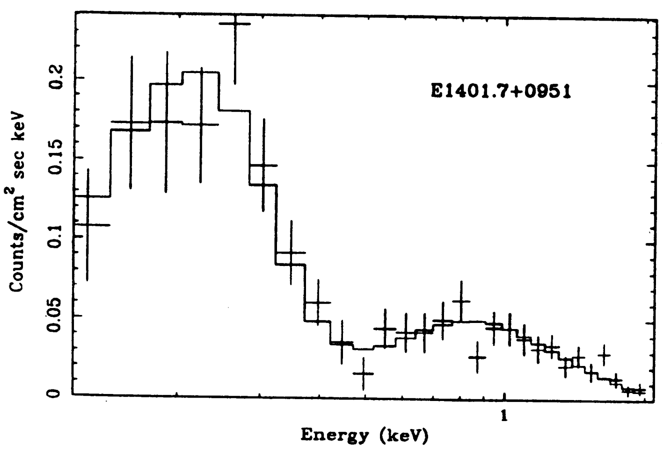

FIG. 1*e*

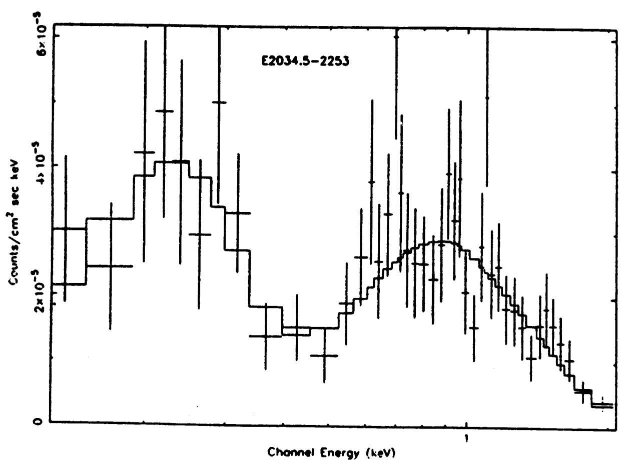

FIG. 1*f*

FIG. 1.—The *ROSAT* PSPC spectrum of each AGN with its best-fit power-law model overlaid

lack of any soft X-ray excess, the optical continuum of this source is seen to rise steeply toward the blue (Puchnarewicz 1992).

The PSPC count rate for the 1991 observation (as shown in Table 1) is higher than that from 1992, possibly due to the presence of a tail-like feature in the 1991 observation. Figure 2 shows contour plots of E0844.1+3743 from the 1991 data (*upper*) in which an extension, or "tail" feature is present, extending ~1′.5 to the southwest. This feature is not present in the contour plot of the longer, 1992, observation (*lower*), although in this observation, E0844.1+3743 fell ~15′ off axis, outside the region where the detector's point response function is well behaved. This may have lead to a smearing out of such a feature in the 1992 observation. Excluding this region from the 1991 data gives a count rate of 0.066 ± 0.005 counts s^{-1}, consistent with that of the 1992 data. We do not believe that the tail feature in the 1991 observation is due to instrumental smearing, based on the fact that none of the other individual sources in the field shows such an effect, and a composite image created by combining nine other sources in the field (to increase the signal-to-noise ratio) appears azimuthally symmetric. Furthermore, this extension in E0844.1+3743 appears only at energies above 0.5 keV; an instrumental smearing effect would be energy-independent. At present, it has not been conclusively determined whether this feature is an actual extension of the source or is a separate source which flared up during the observation (an optical counterpart of such a source has not been detected photographically; Hutchings et al. 1984; J. B. Hutchings, private communication 1992).

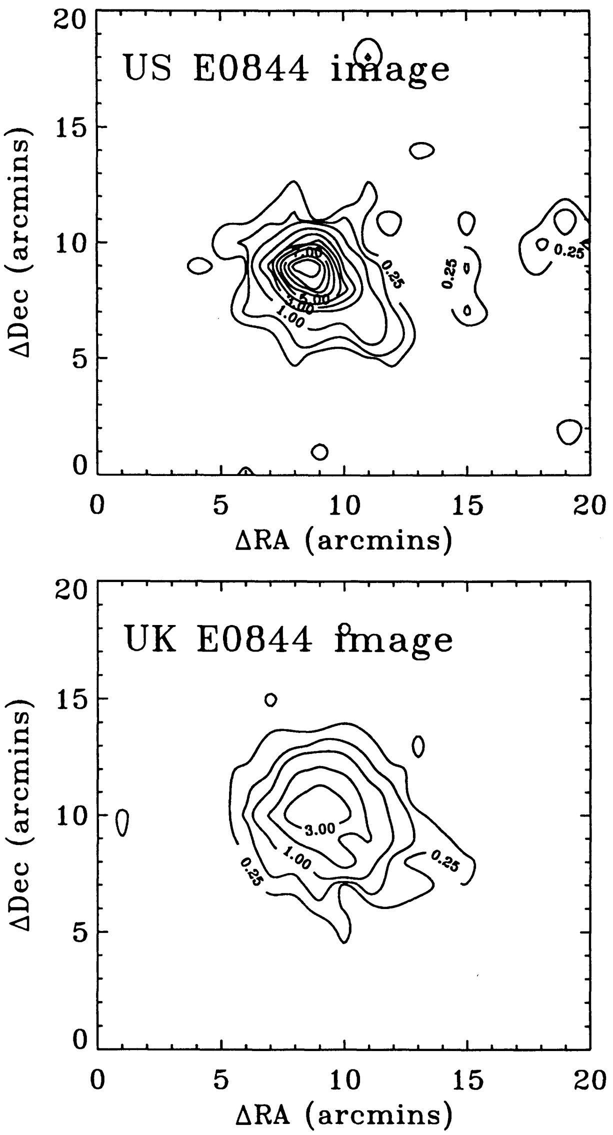

FIG. 2.—Count rate contour plots of E0844.1+3743 from the 1991 targeted observation (*top*) and the 1992 observation in which the source was 15′ of axis (*bottom*). The axes show the angular scale of the plots.

2.1.3. *E0845.1+3751*

E0845.1+3751 was also observed twice with *ROSAT*; once as the observation target on 1992 April 23, and once within the field of view of the 1991 observation of E0844.1+3743. Again, the spectral fitting results were statistically the same for the two PSPC observations (see Table 2). Figure 1*c* shows the spectrum of E0845.1+3751 with the best-fit power-law model overlaid. The 1991 data were reduced using PROS and were binned in the PROS 34-bin format. The data from the 1992 observation were reduced using the Starlink software and were binned to give a minimum of 10 counts per bin. This source is softer than E0844.1+3743, with values of the photon index of 3.45 and 3.00 for the 1991 and 1992 observations, respectively (in agreement with the value estimated from its *Einstein* colors, 3.5 ± 1), both steeper than the All-Sky Survey value of 2.35 (though the survey value is included in the 90% confidence limits of both observations).

2.1.4. *E1227.0+1403*

The data for E1227.0+1403, which is a relatively weak source, were extracted using PROS and the spectrum binned in the 34-bin format. This source possesses a rather flat spectrum, best-fit with a power-law photon index of 2.19 (see Table 2). The spectrum of E1227.0+1403 is presented in Figure 1*d*, with the best-fit power-law model overlaid. It was observed twice with the *Einstein* IPC and the color ratios from those observations imply photon indices of 2.3 ± 0.5 and 3 ± 1, both in agreement (within the errors) with the PSPC measurement.

2.1.5. *E1401.7+0951*

With a PSPC count rate of 0.101 counts s^{-1}, this is the strongest source in our sample. Figure 1*e* shows the spectrum (binned in the standard PROS format) with the best-fit power-law model overlaid. It has a very flat power-law spectrum, $\Gamma = 1.84$, which is consistent with that estimated from the *Einstein* color ratios (1.7 ± 0.7). The explanation for the presence of this flat-spectrum source in our steep-spectrum *Einstein* USS will be discussed in § 4.

2.1.6. *E2034.5−2253*

Figure 1*f* shows the spectrum of E2034.5−2253 with the best-fit power-law model overlaid. The data were reduced using the Starlink software and binned to give a minimum of 10 counts per bin. This source, like E0844.1+3743 and E1401.7+0951, shows no evidence for a soft excess component in the PSPC data, although the *Einstein* data do indicate the presence of a soft excess. It should be pointed out, however, that on the PSPC image E2034.5−2253 appears to have a faint companion approximately 30″ to the east which would not have been resolved by the IPC. No attempt was made to subtract the small number of counts (~30 out of 516 total counts) of this companion from the spectrum of

E2034.5−2253. Therefore, the soft source observed by *Einstein* was either this weak companion (which has since decreased greatly in flux), or E2034.5−2253 (which would have to have undergone substantial spectral variability between the *Einstein* and *ROSAT* observations).

3. VARIABILITY

3.1. *Short Timescale Variability*

The division of PSPC exposures into separate, shorter observation intervals (OBIs), allows us to search for variations in count rate over the extent of the PSPC observation (typically several days or less). To test for variability, background-subtracted count rates were determined for each OBI, then a χ^2 analysis was carried out to test for deviations from a constant count rate (taken as the mean value of the individual OBI count rates). None of the sources shows significant deviations from a constant; thus we find no evidence of variability on the timescales of the PSPC observations.

3.2. *Long Timescale Variability*

As these sources were also observed by *Einstein*, we have tested for flux variability between the *Einstein* and *ROSAT* PSPC observations (typically a separation of 12–13 yr). It is difficult to compare in a straightforward manner the PSPC count rates with those from the *Einstein* IPC due to the differences in effective area and response of the two detectors. We have made this comparison by folding the best-fit PSPC model for each source through the IPC response function, thus predicting the number of counts that *Einstein would* have seen. Table 3 gives the actual observed IPC count rates for each source along with the count rates predicted from the PSPC spectra. The error estimates on the predicted counts are based on the 90% confidence limits on Γ and N_H (in Table 2).

Significant flux variability is seen for E1227.0+1403 and E1401.7+0951. Both of these objects have relatively flat spectra and neither shows evidence for a soft X-ray excess, suggesting that it is the hard X-ray component which is varying in these sources. E0844.1+3743 and E2034.5−2253, although also possessing flat spectra, show no significant variability. Of the soft sources, flux variability is seen for E0845.1+3751, but none is seen for E0132.8−4111. Long-term variability of the soft X-ray component has been observed in other AGN such as Mrk 841 and Mrk 335 (George et al. 1993; Turner & Pounds 1988).

TABLE 3

BROAD-BAND COUNT RATES

	IPC		PREDICTED	
SOURCE	counts s^{-1}	±	counts s^{-1}	±
E0132.8−4111.....	0.010	0.001	0.013	(+0.001; −0.001)
E0844.1+3743.....	0.026	0.006	0.032	(+0.002; −0.002)
			0.031	(+0.002; −0.002)
E0845.1+3751.....	0.021	0.005	0.013	(+0.001; −0.001)
			0.011	(+0.001; −0.002)
E1227.0+1403.....	0.021	0.005	0.018	(+0.001; −0.002)
	0.027	0.002		
E1401.7+0951.....	0.063	0.011	0.038	(+0.002; −0.002)
	0.107	0.009		
E2034.5−2253.....	0.029	0.006	0.021	(+0.002; −0.002)

NOTES.—Count rates in the Predicted column are those predicted for the IPC using an input spectrum determined from the *ROSAT* data. Errors on the Predicted counts are 90% confidence intervals.

4. *Einstein* REV-1 PROCESSING ERROR

As discussed in the *HEAO* Newsletter of 1992 September, an error was discovered in the *Einstein* REV-1 processing software that affected the conversion from Pulse Height Analyzer (PHA) bins to Pulse Invariant (PI) bins. The error resulted in the application of incorrect gain corrections and the consequent assigning of erroneous energy values for the photons. The *HEAO* Newsletter gives a description of the effects of this error on the broad-band hardness ratios. This effect is even more pronounced for our USS analysis due to the narrower energy bands used in the selection criteria for our survey and explains the presence of flat-spectrum sources such as E1401.7+0951 in our ultrasoft sample. This particular source represents the extreme effect of the error, i.e., causing a hard source to appear to have a very soft spectrum. The effect of this error is dependent on the roll angle of the satellite during the original observation, and therefore affected each source differently. Some sources, such as E0132.8−4111 and E2034.5−2253, had their PI bin data only mildly affected.

We are currently reconstructing our sample and find that although many of the members of the original sample (as presented in Córdova et al. 1992 and Puchnarewicz et al. 1992) no longer satisfy our selection criteria, a reanalysis of the IPC database has resulted in a larger sample than the original USS. A more extensive discussion of this topic will be made in a later paper when we present the revised version of the USS.

5. DISCUSSION

The AGNs in this sample possess X-ray spectra covering a broad range of photon indices, from flat spectrum sources such as E1401.7+0951, to those with very steep spectra such as E0132.8−4111. The steep sources such as E0132.8−4111, provide excellent test cases for models of the soft X-ray component (such as thermal accretion disk models, and reprocessing models involving cool clouds and warm absorbers and pair production models). In the past, these models have been used to fit objects such as PG1211+143 and Mrk 335 (Czerny & Elvis 1987; Pounds et al. 1986; Turner et al. 1993b) which, although soft, are not as soft as E0132.8−4111. Furthermore, the claim by Avni & Tananbaum (1986), from a study of optically selected AGNs, that hard X-ray emission is a universal property of AGNs is challenged by our observations of X-ray–selected sources such as E0132.8−4111, which show little or no emission above 0.5 keV. This is in startling contrast to the situation for the ultrasoft Seyfert 1 object Mrk 841, which has a similar UV plus optical spectrum to that of E0132.8−4111, but whose ratio of hard to soft X-ray flux is much higher (Puchnarewicz et al. 1992 and references therein).

In contrast to these soft sources, at least three out of the six AGNs presented here (E0844.1+3743, E1401.7+0951, and E2034.5−2253) show no low-energy excess, with a soft X-ray spectral slope consistent with that seen in AGNs at much higher energies (i.e., $\Gamma = 1.89 \pm 0.06$; Comastri et al. 1992). However, E1401.7+0951 and E0844.1+3743 both have relatively high redshifts (0.44 and 0.45, respectively), and the soft component may simply have been shifted out of the PSPC energy range.

The third object, E2034.5−2253, also has a relatively flat PSPC spectrum, although the IPC colors of this AGN are very soft. This may be due to variability in the nearby X-ray source, unresolved in the IPC image (see § 2.1.6), or it may demonstrate a remarkable change in the X-ray spectral slope of

E2034.5−2253, perhaps exhibiting a "low state" of its soft X-ray component during the *ROSAT* observation. If so, the accompanying lack of flux variability suggests that the underlying hard component's strength has increased. This type of anticorrelated variability of the soft and hard X-ray components has been observed in other AGNs. Anticorrelated component variability in Mrk 841 has been interpreted as evidence of a physical distinction between the soft and hard components, although reprocessing of the hard flux could complicate the issue (George et al. 1993). The X-ray spectrum of 3C 120 has been observed to soften when the low-energy ($E < 2$ keV) intensity increases, with the opposite being true for higher energies (Maraschi et al. 1991). An explanation proposed for 3C 120 is that soft photons are being Comptonized by hot thermal electrons causing the spectrum to "pivot" about an energy intermediate between that of the photons and the mean energy of the electrons ($3kT$). For the softer X-ray spectra of the USS AGNs, this might imply a lower pivot energy than the 2 keV suggested for 3C 120 and could account for such an anticorrelation in E2034.5−2253.

While we could find no evidence for flux or spectral variability in E0132.8−4111, the other soft source in this sample, E0845.0+3751, does exhibit flux (but not spectral) changes between the IPC and PSPC observations. For blackbody accretion disk models, where the soft emission is from the inner region of the accretion disk, this variability may suggest variations in the accretion rate, or turbulent instabilities at the inner disk boundary. Timescales for these instabilities (such as the thermal timescale) can be on the order of years (Abramowicz & Szuszkiewicz 1989). Accretion disk models can also reproduce the short (∼days) timescale variability of the blue bump feature in GQ Comae (Siemiginowska 1989) and the ∼10 hr timescale variability of the soft excess component in Mrk 335 (Turner & Pounds 1988). As with E0845.0+3751, Mrk 335 showed no spectral variability over a period of years (Pounds et al. 1986).

Other models, such as the cool clouds (Guilbert & Rees 1988) and the warm absorber (Halpern 1984) models depend on the reprocessing of a nonthermal continuum and can be used to explain both flux and spectral variability. The cool clouds model, for example, predicts the soft excess component as due to reduced gas opacity below the carbon and oxygen K edges (Ferland & Rees 1988). Changes in this opacity could account for variations in the strength of the soft component. Further investigations of AGNs with higher resolution spectroscopy is required to confirm the existence of such clouds (through detection of these edges) and to fully understand the timescales involved in such opacity variations. The warm absorber model has been successfully used to explain the soft excess (at energies >1 keV) and model the higher energy spectral and flux variability of NGC 4151 (Yaqoob, Warwick & Pounds 1989) as being due to changes in the ionization parameter of the X-ray absorbing gas surrounding the central energy source. Yaqoob et al. were not able to explain a nonvarying "very soft excess" observed in NGC 4151 below 1 keV in the context of the warm absorber model and therefore attributed it to a diffuse component in the narrow-line region. The fact that we see significant variability in the soft component of E0845.0+3751, while that of NGC 4151 was observed to remain constant over many years, suggests that the soft emission in E0845.0+3751 is not due to a component in the narrow-line region, but originates much closer to the central engine.

6. CONCLUSION

Using the *ROSAT* PSPC, we have observed a sample of X-ray–selected AGNs possessing a broad range of X-ray spectra ($\Gamma = 1.84$–3.92). For all of these sources, we have found their X-ray spectra (over the PSPC bandpass) to be fitted satisfactorily with single power-law models.

We have searched for broad-band flux variability, on both medium (∼days) and long (decade) timescales. While there is no evidence for medium timescale variability, flux variability is seen in three out of six sources when comparing *Einstein* IPC and *ROSAT* PSPC observations taken 12–13 yr apart. We recognize that this does leave some degree of uncertainty as to the *minimum* timescale for variability in these sources; however, a lack of more frequent observations of these X-ray–selected sources in the intervening years between their *Einstein* and *ROSAT* observations prevents us from constraining further the timescale for the variability of these AGNs.

A comparison of the PSPC spectral indices with those estimated from IPC color ratios reveals no evidence for changes in X-ray spectral slope for five of the six sources. Spectral variability cannot be ruled out in some cases, however, due to large uncertainties resulting from the poor counting statistics of the *Einstein* data. Evidence for spectral variability is seen in E2034.5−2253 which, with an accompanying lack of flux variability, may suggest anticorrelated variability of the soft and hard X-ray components.

As a continuing project, we will be modeling the multiwavelength energy distributions of the soft AGNs presented here, along with others from our revised USS available from the *ROSAT* archive, with various models for the generation of soft X-ray emission. Results of this work will be presented in a future publication.

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