FINAL TECHNICAL REPORT

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A Study of the Discrepant QSO X-ray Luminosity Function from the HEAO-2 Data Archive

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I. SUMMARY

We describe an in-progress Einstein Observatory Guest Investigation aimed at characterizing the X-ray luminosity of very faint QSOs. Using optical rather than X-ray selection techniques, we have newly discovered more than 100 faint, previously uncataloged QSOs which lie in areas imaged in X-rays at very high sensitivity by the Einstein Observatory. Analysis of the X-ray fluxes or upper limits on these objects will result in the largest sample of observations of faint QSOs of any program undertaken by Einstein. These data are relevant both to the physics of QSO X-ray emission, as well as the contribution of QSOs to the diffuse X-ray background radiation. If the ratio of x-ray to optical luminosity of QSOs varies with optical luminosity, as several workers have recently suggested, only studies of very faint objects such as we discuss can realistically lead to a proper analytic formulation of this variation. If QSOs are responsible for most of the X-ray background radiation, again as many workers suggest, then the majority of contribution comes from objects with magnitudes fainter than 19, which are extensively represented in our study, but largely absent from previous work. Preliminary analysis of results on hand indicate that we are effectively probing a largely unexplored region of the QSO X-ray luminosity function.

II. PROBLEM DESCRIPTION

One of the most exciting findings of the Einstein Observatory is that a very large number of quasi-stellar objects (hereafter, QSOs) are powerful X-ray sources (Tananbaum et al. 1979, Ku, Helfand, and Lucy 1980, Zamorani et al. 1981). The scientific implications of this finding may be divided into two broad classes: a) impact on the physics of QSO X-ray emission, including inferences on the central "engine" responsible for the output of QSOs at all wavelengths; and b) the contribution of QSOs to the diffuse X-ray background radiation (e.g., Margon 1983). Unfortunately the application of the Einstein data to each of these problems has not been as straightforward as one might have hoped, because the existing X-ray data indicate that the X-ray luminosity of QSOs ranges over many orders of magnitude, depends strongly on radio and optical luminosity, and may even evolve with redshift.

Observational approaches to the problem thus far have been twofold. First, there have been quite extensive Einstein observations of previously known QSOs, i.e., objects catalogued prior to the launch of Einstein, and discovered by their radio or optical properties. In addition to the broad surveys in this category (Ku et al. 1980, Zamorani et al. 1981), there have been more specific surveys of selected groups of previously known objects. For example, Tananbaum et al. (1983) report observations of a large sample of radio-selected 3CR QSOs, and Marshall et al. (1983b), of color-selected Bracessi QSOs. It is clear that the X-ray properties of QSOs derived from these important surveys must inevitably reflect the selection biases of the parent population. Furthermore, the demise of Einstein obviously implies that this type of program cannot be continued and expanded in an attempt to overcome these biases.

A second approach to deriving the X-ray properties of QSOs has been an effort pursued by a number of different groups to optically identify X-ray sources found serendipitously on Einstein images obtained for a variety of different purposes, often unrelated to QSOs. The Principal Investigator and colleagues have been active in this area (Margon, Chanan, and Downes, 1981a, 1981b, 1982, Chanan, Margon, and Downes 1981, Margon, Downes, and Spinrad 1983), as well as groups from CFA/Arizona (Grindlay et al. 1980, Maccacaro et al. 1982, Stocke et al. 1983), MIT (Kriss and Canizares 1982) and UCB (Reichert et al. 1982). These efforts have shown that roughly half of the serendipitous sources to flux levels as faint as 0.01 IPC cts/sec can ultimately be identified with previously uncatalogued QSOs. The serendipitous source identification programs provide an X-ray selected list of QSOs that offers several advantages in the study of the problems discussed above. This list obviously lacks the selection biases of the previous surveys, e.g., strong radio flux, prominent ultraviolet excess, or strong emission lines. However, at the risk of stating the obvious, it is clear that X-ray selection can find only those QSOs which are in fact strong X-ray sources.

Most workers using either of the above two approaches to the study of QSO X-ray emission have chosen to characterize the observed X-ray emissivity of each source with the parameter α_{ox}, the slope of a line connecting the x-ray and optical fluxes, or, equivalently, a logarithmic ratio of x-ray to optical luminosity (see Tananbaum et al. 1979). If one can in fact learn the value of this parameter, its dispersion, and any functional dependencies on other physical parameters, then a great deal can be learned about QSOs. The contribution of QSOs to the background radiation, for example, is directly related to α_{ox}, if one feels confident that the optical surface density of QSOs is well known.

It is beyond the scope of this report to review in detail the various inferences on α_{ox} that have been claimed thus far in the literature, but it should suffice to briefly summarize some of the more widely discussed points. Ku et al. (1980) and Zamorani et al. (1981) hypothesized that α_{ox} has a strong functional dependence on either QSO optical luminosity or on redshift, z. This work was extended by Avni and Tananbaum (1982) and Tananbaum et al. (1983), who concluded that the primary functional dependence is on optical luminosity. Reichert et al. (1982) also considered this dependence, but their conclusions have been termed invalid by Avni and Tananbaum (1982) due to failure to correct for X-ray nondetections; the resolution of this controversy is unimportant to our work. Using an X-ray selected QSO sample, Margon et al. (1981a, 1982) were the first to point out that these objects have a lower mean optical luminosity (or equivalently, mean z) than an optically or radio selected list of the same optical limiting magnitude. These authors note that one explanation of this phenomenon is that some mechanism "quenches" the X-ray emission from "typical" (i.e., high z, high optical luminosity) QSOs, causing them not to be strong X-ray sources. Zamorani (1982) claims that the α_{ox} dependence discussed above qualifies as one such mechanism.

What seems clear from the above summary is that the distribution of α_{ox} for QSOs is a complex one. A variety of interpretations have already been suggested to explain this distribution. Tucker (1983) and Shull (1983) attach physical significance to the proposed dependence of α_{ox} on optical luminosity, and use it to fix otherwise free parameters in a variety of QSO models. On the other hand, Chanan (1983) demonstrates there may be no physical significance to the dependencies at all, but that they may rather result from a combination of an intrinsically broad α_{ox} distribution coupled with the finite observational thresholds. Further, he shows that the precise nature of the empirical relationship depends critically on whether one chooses to regard the X-ray or optical luminosity as the independent variable, a highly suspicious circumstance if in fact the empirical correlation is indicative of a discrete physical property of QSOs.

Further complicating the issue are results unrelated to Einstein QSO work, which, in certain interpretations, conflict with a straightforward analysis of the α_{ox} problem. If an "effective" value of this parameter (i.e., a value averaged and weighted over all diverse members of the QSO population) is 1.45 (Zamorani et al. 1981), then not only is the overwhelming majority of the diffuse X-ray background radiation due to discrete sources in the QSO family, but the steeply rising optical log N/log S curve for QSOs must flatten just at the current limit of accurate observations, about 20th mag, to avoid creating too much X-ray background. Marshall et al. (1980) have shown that the spectrum of the background radiation in the 2-10 keV regime is beautifully compatible with a hot thermal plasma, and Worrall and Marshall (1983) have emphasized that if this is merely a coincidence and this spectrum instead represents the superposition of a large number of active galactic nuclei, the "typical" QSO has a spectrum very different from that of any observed to date. Furthermore, Hawkins (1983) has recently presented evidence that the log N/log S curve is still sharply rising at 22nd magnitude!

The impact of this current uncertainty in the precise interpretation of the α_{ox} distribution is profound. For example, Margon et al. (1982) have shown that, independent of the values of q_o and H_o, if α_{ox} does in fact evolve such that it increases by only 15% between the current epoch and a point 1 mag brighter than where the log N/log S curve actually flattens (presumably 19-20 mag), then estimates of the QSO contribution to the diffuse background radiation will be halved. The major source of this uncertainty is simply that in point source superposition models for the background, the majority of the contribution must come from very faint, distant objects; specifically, about 75% of the radiation is due to QSOs with $J \gtrsim 20$ (Margon et al. 1982). Because foreground, optically superluminous, and/or radio bright QSOs dominate the current X-ray observations, but simultaneously give strong evidence of complex α_{ox} dependence, it is clear that definitive conclusions on the X-ray properties of "typical" QSOs (defined here as those objects capable of contributing substantially to the background radiation) are indeed difficult. For example, there has never been a positive X-ray detection of a nonsuperluminous ($M_v > -27$), radio quiet QSO at $z \geq 1$, even in the very sensitive observations of Marshall et al. 1983b). This uncertainty has also been stressed by Kembhavi and Fabian (1982).

It seems obvious that further progress on this problem will require X-ray data on QSOs that have one or both of the following properties: a) optically fainter QSOs are observed; b) the sample has fewer, or at least different, selection biases from the previous work. Property a), fainter target objects, is especially important for the reasons alluded to above. If α_{ox} indeed depends on optical luminosity (or even on redshift), extensive data on the faintest objects are needed to accurately define the analytic form of the dependence. Furthermore, it is these faintest QSOs which are the only quasars which make a significant contribution to the diffuse X-ray background radiation.

Very important progress has been made on the issue of X-ray observations of optically fainter QSOs through the work of Marshall (1983) and Marshall et al. (1983a, 1983b). These authors obtained long Einstein exposures of fields which contain the ultraviolet-excess selected QSOs of Braccesi, Formiggini, and Gandolfi (1970) and the fainter sample of Formiggini et al. (1980), sometimes called the AB (or "Braccesi") and BF (or "Braccesi faint") samples. About half of the AB/BF QSOs were positively detected in X-rays; the faintest

X-ray detected object had B=18.96. This is optically fainter than the large majority of previously-known QSOs observed by Einstein, although not as faint as the faintest optically-identified serendipitous QSOs. These authors infer a value for α_{ox} very similar to that value found by previous CfA workers, certainly an important step in understanding the x-ray luminosity of faint QSOs.

The Marshall technique required successful completion of a very difficult and extended series of both X-ray and optical observations. However, this approach has several undesirable features which are not the fault of those authors, but rather intrinsic to the sample under study. We discuss here each of these problems in turn, to illustrate the complementary nature of the technique we report on here.

1) Color selection bias. The AB/BF sample is color-selected, and the extent of the bias that this introduces is still somewhat uncertain. However it is clear that certain known X-ray emitting active galactic nuclei (Chanan et al. 1981, Reichert et al. 1982, Stocke et al. 1983) fail the AB/BF selection criteria, escape the survey, and therefore may bias the results.

2) Redshift selection bias. A related but highly specific bias of the AB/BF objects is that the survey selects only QSOs with $z < 2.2$; at greater redshifts, Lyman α moves into the U band and destroys the ultraviolet excess. Note that this point is distinct from 1) above, in that the non-UV objects cited as missing from the AB/BF work do have redshifts lower than this threshold, and thus should have been included.

Veron (1983) has recently summarized available evidence concerning the completeness of the Bracessi surveys, due to the combination of both of the above effects. He estimates that it is possible that the Bracessi sample is as much as 100% incomplete, i.e., half of all QSOs to the BF stated limiting magnitude may have been missed. This estimate is, of course, itself highly uncertain.

3) Controversy over angular extent. There has been an active controversy in the recent literature over the exact physical nature of objects in the BF sample, because of conflicting reports on the angular extent of these faint objects. Bonoli et al. (1980) report a significant fraction of the BF objects to be extended, and suggest that they may therefore not be genuine QSOs. Veron and Veron (1982) contradict this report on the basis of observational material which should be of higher quality. Finally, Kron et al. (1983) present yet further material that seems to confirm the extensions at least in a statistical sense.

4) Lack of X-ray completeness. The X-ray observations of the BF fields reported by Marshall et al. (1983b) revealed numerous serendipitous X-ray sources in addition to detection of about half of the previously catalogued the AB/BF QSOs. The major fraction of these newly detected sources remain optically unidentified. Clearly if even a few are QSOs, they will influence the ultimate mean value of α_{ox}. The crucial importance of a completely-identified sample of X-ray sources has been repeatedly stressed by Maccacaro et al. (1983).

5) Length of the X-ray sample. Marshall et al. (1983b) define a "complete" sample of QSOs, or, perhaps more precisely, a sample of identical biases and incompletenesses as the AB/FB sample. This sample of Marshall et al contains a total of 10 objects, of which about half are positively detected

in X-rays. Thus, as with much past work on this subject, the Marshall *et al*. sample is inevitably plagued by the statistics of very small numbers.

In summary, the work of Marshall *et al*. has been an extremely valuable first step towards extending the available X-ray observations of faint QSOs, but it is clear that a substantially longer sample of data, ideally of a complementary rather than identical technique, is badly needed. We describe below progress to date on a program that will provide such data from the existing *Einstein* archives.

III. THE CURRENT APPROACH

Under an *Einstein* Guest Investigator program funded by NASA Contract NAG8-433, we have been conducting a program aimed at addressing some of the problems discussed above by a technique we believe to be complementary to any other in use. A brief discussion of this work has also been given by Anderson and Margon (1983a, b). We have been examining the $\sim$1% of all *Einstein* IPC fields at high galactic latitude that have the longest integration times ($\gtrsim$15,000 sec) of all those obtained during the mission. The fields are chosen *only* through these two criteria (integration time and galactic latitude), without regard to the targets of the original observations, which were[*] a large variety of galactic and extragalatic objects, not limited to QSOs. These IPC images each cover about one square degree of sky, and so these most sensitive of all existing X-ray flux measurements also apply to a very large number of as yet undiscovered QSOs in each field. Although there is perhaps controversy concerning QSO number counts at very faint magnitudes ($J > 21$), there is no question that to J=20.5, each of these fields contains 20-25 previously uncatalogued QSOs (of course completely independent of whether or not they are also detectable X-ray sources). Our approach is to invert the normal order of *Einstein* QSO observations, and now optically disover these new QSOs, for which the best possible X-ray measurements are already available to us. The grisms, prisms, and grens in use at the 4 m class telescopes of KPNO, CFHT, and CTIO are beautifully matched to this task, as a variety of workers (e.g., Hoag, Burbidge, and Smith 1977, Hoag and Smith 1977, Crampton and Parmar 1983) have shown that it is easy to reach J=20 in modest exposure times ($\sim$1 hr), and these devices all have angular fields of view quite comparable to each IPC image. Thus one plate can cover the entire IPC area, at least inside the "ribs." As described below, we have been granted a number of nights at each of these faciltities for this program.

We stress that this is *not* a program for the optical identification of serendipitous X-ray sources. As we will illustrate, even at these most sensitive X-ray and optical flux levels, many of the QSOs that we are discovering optically on our grism plates are not detected as sources on our X-ray images, and therefore would not be found in a serendipitous

[*] At the request of Harvey Tananbaum, we have voluntarily agreed to forgo examination of a handful of long integration IPC fields that had as their goal the analysis of X-ray emission from faint QSOs, e.g., the "Deep Survey" (Giacconi *et al*. 1979) and the fields discussed by Marshall *et al*. (1983*b*). This is of little consequence to our program, because the sensitivity of IPC exposures in practice scales more slowly than the square root of the integration time; thus a field of 20,000 sec exposure and one of 50,000 sec are often of substantially the same limiting X-ray sensitivity.

identification program. However, sophisticated analytic tools already exist (e.g., Avni et al. 1980, Marshall et al. 1983a) to convert these X-ray upper limits into estimators of α_{ox}.

A virtue of our approach is that a relatively modest survey will uncover a very large number of new QSOs. We show below that in our final survey, this list will exceed 100 objects, each of which lies in one of the most sensitive Einstein fields, and thus has available a useful α_{ox} estimator. Of course, the problem of faint QSOs has been previously addressed, not only by the Marshall et al. (1983b) work, but also by a small handful of QSOs discovered in the totality of all the Deep Survey fields (Giacconi et al. 1979), and one or two as yet unpublished exposures of deep, previously-existing grism fields (Kriss and Canizares 1981). The largely-completed project we describe here will provide one order of magnitude more QSOs than the sum of all these previous programs together.

An additional attraction of this approach when contrasted with much of the previous work is that we are highly sensitive to "X-ray quiet" QSOs, if indeed such objects exist, or, less extremely, by objects with a very low ratio of f_x/f_{opt}. By hypothesis such objects cannot be detected as the optical counterparts of serendipitous X-ray sources (by selection, those are X-ray bright objects), and surveys of lists of previously known QSOs are also biased against this class. The 3CR QSOs, for example, would of course all be expected to be strong X-ray emitters (Tananbaum et al. 1983) because of the well-known correlation between radio and X-ray luminosity (Ku et al. 1980, Zamorani et al. 1981). Only an X-ray unbiased survey, such as that we describe here, where QSOs within an existing X-ray image are all selected optically to a given limiting magnitude, could begin to probe the properties of such a class.

It is well known that grism/prism plates preferentially select QSOs with $z \gtrsim 2$, where the strong Lyman α emission line falls on the J or F emulsion. This is a bias to be kept in mind, but not a fatal problem for us ("selection effect" is not synonymous with "error"!). Even if our final object list were severely biased towards $z \gtrsim 2$, this would be complementary to the work of Marshall et al. (1983b), which has an immovable threshold at $z < 2.2$. In fact, Hoag and Smith (1977) and Crampton and Parmar (1983) have demonstrated (and our own experience, to be described below, confirms) that with due care, objects with $z < 2$ are found in grism/prism surveys. To enhance our sensitivity to such objects, and also to sharply reduce the number of objects found with only a single emission line (thus leaving potential ambiguity regarding choice of redshift), we have adopted a somewhat different approach from previous observers. Wherever time permits, we obtain both an F plate exposed with a blue-blazed grism, and also a silver nitrate hypersensitized IV-N plate, taken with a red-blazed grism. The result is spectral coverage from the atmospheric cutoff at the UV (about 330 nm) all the way deep into the near infrared (at least 850 nm).

The crude photometry needed for each QSO to enable calculation of α_{ox} is obtained through image diameter measurements tied to the Palomar Observatory Sky Survey prints. Because most QSOs are variable at both optical and X-ray wavelengths, there is little to be gained from more accurate photometry if it is not contemporaneous with the X-ray observations, which is of course now impossible.

IV. RESULTS

A brief progress report on this work has been given by Anderson and Margon (1983a, b), and we update this report here. In our initial proposal to the Einstein Guest Investigator program, we envisaged a one year study, that would analyze data obtained chiefly from two observing runs at one 4 m class telescope, or about 6-8 nights in total of optical data. In the actuality, the peer review committees at Kitt Peak, Cerro Tololo, and Canada-France-Hawaii telescopes responded far more favorably to our approach than we had cautiously anticipated, and time was granted on all three of these 4 m class telescopes, as well as on a variety of smaller instruments for supporting work. In total we have been granted 32 nights of observing time for this project, or roughly 400% the volume of optical data originally anticipated. All of these observing runs have now been completed (the final run was in January 1984), and we were also lucky enough to encounter a very large fraction of clear nights. We thus now have on hand a very considerable volume of high quality optical data. As the performance period and funding of the original Guest Investigator contract are shortly to be exhausted, it is clear that the completion and publication of the analysis will require one extra year of time and funding. Such a proposal was submitted to NASA in September 1983.

We have obtained plate material for approximately 50 different field centers, and details of these data appear in the Appendix. The optical data are now largely reduced, and X-ray analysis of many of the fields is well-advanced. The optical analysis procedes as follows. Each plate is scanned several times with a binocular microscope and a overlay grid (used to systematize the search). In agreement with previous workers, we find about 3 QSOs per plate to a limiting continuum magnitude of B=21 (note this is not the number of QSOs per square degree, but rather an intermediate, empirical result which includes various detection efficiencies). For roughly one-half of these candidates, we detect and can unambiguously identify more than one emission line at a consistent redshift, confirming irrevocably that these objects are QSOs. Slit spectra have recently been obtained of a few of these candidates with the MMT and the UCSD/Minnesota Mt. Lemmon 1.5 m reflector, as additional confirmation of the nature of the grism-selected objects. All but one are QSOs, i.e., to date, we have had only one "non-confirmation." In our survey we have also rediscovered (in a double-blind test) three objects which are also X-ray selected QSOs in the surveys of Chanan, Margon, and Downes (1981) and Stocke et al. (1983). All of the above factors suggest that our search technique is reasonably sound and complete.*

Our analysis of the X-ray data is still in a rather preliminary stage; certain of the fields have their optical data completely analyzed, but have not yet been subject to X-ray analysis. This analysis is quite straightforward; using only standard CfA algorithms to take the known optical position of each QSO, designate a region from which background is extracted, and compute either an X-ray flux or flux upper limit for each QSO position. Because we measure the optical positions of each QSO to an accuracy of a few arcseconds, refinements in IPC X-ray source positions which result from the

* It is important to note that absolute completeness is unimportant to our analysis, in that the number of QSOs per square degree in no way enters our calculation. Any estimate of the total contribution of QSOs to the background radiation can use other determinations of this figure, as all other X-ray background studies have done.

IPC reprocessing are helpful but not crucial to this program. As our optical data provide the redshift for each object, it is convenient to use existing CfA X-ray programs to calculate the "X-ray K correction," providing X-ray fluxes in a uniform bandpass for direct comparison with results of other Einstein investigators.

We have had the opportunity thus far to complete the X-ray analysis for about 30 QSOs. Although this gives us a sample of very small size compared with that which we know will be available at the completion of this work, it does provide a very important indication of the degree of matching between the X-ray and optical sensitivities of our survey, i.e., it is important to ensure that both our X-ray and optical data are sufficiently sensitive that we are probing an interesting region of the α_{ox} distribution. Perhaps the most interesting result of our work so far is that most of our grism-selected QSOs are not detected in our X-ray images, and that the inferred limits on α_{ox} are stringent enough to be interesting. Table 1 summarizes our current data for those few newly discovered QSOs for which we have also completed the X-ray analysis. Note the large range of redshifts appearing in the Table, indicating that we are indeed finding low as well as high z objects. The limits on α_{ox} were estimated in the manner described by Tananbaum et al. (1979). Despite the long X-ray exposures, only about 20% of the objects have statistically significant X-ray detections. Most of the 30 lower limits on α_{ox} in Table 1 are greater (i.e., the f_x/f_{opt} values are smaller) than the canonical "effective" value of α_{ox}=1.3 quoted for X-ray selected QSOs (Margon, Chanan, and Downes 1982), as well as that value inferred indirectly by Zamorani et al. (1981) and Marshall et al. (1983b) to apply to the weighted ensemble of all QSOs.

Tempered by the statistics of the small amount of X-ray data thus far analyzed, the data of Table 1 clearly indicate that our technique is capable of probing the low X-ray luminosity end of the QSO X-ray luminosity function. These preliminary results of course do not and cannot make it clear whether the relatively low f_x/f_{opt} values we have found thus far actually represent a previously unsampled population of "X-ray quiet" QSOs, or merely instead reflect new information on the very complex dependences of α_{ox} on z, optical luminosity, and radio luminosity discussed above. However, the straightforward completion of the X-ray analysis for the data already on hand will provide more than 100 such new, sensitive α_{ox} estimators, and therefore either confirm the former concept, or strongly constrain the latter. Either outcome will shed new light on the physics of QSO emission mechanisms, as well as the contribution of QSOs to the diffuse X-ray background radiation.

Table 1. QSOs with Complete Optical and X-ray Analyses

Object	z	B	log(Lopt)	log(L2kev)	α_{OX}
1	0.38	17.2	30.50	<26.07	>1.70
2	0.4	18.8	30.01	26.55	1.29
3	0.6	19.3	30.15	<26.42	>1.42
4(*)	0.8	18.5	30.82	27.19	1.39
5(*)	0.8	18.5	30.85	27.08	1.45
6	0.9	19.8	30.43	<26.97	>1.33
7	0.9	20.4	30.25	<26.93	>1.27
8	0.9	19.9	30.43	<26.90	>1.36
9(*)	1.0	20.1	30.46	27.27	1.22
10	1.42	20.1	30.84	<27.36	>1.34
11	1.43	19.0	31.31	<27.43	>1.49
12	1.49	19.8	31.04	<27.53	>1.32
13	1.8	19.9	31.17	26.68	1.72
14	1.8	19.9	31.17	<27.71	>1.33
15	1.9	19.1	31.61	<27.77	>1.47
16	1.9	19.6	31.39	<28.00	>1.30
17	1.9	20.1	31.22	<27.76	>1.33
18	1.9	18.2	31.95	<27.72	>1.62
19	1.92	20.4	31.12	<27.79	>1.28
20	2.0	19.9	31.36	<27.87	>1.37
21	2.0	19.3	31.62	<27.89	>1.36
22	2.09	19.8	31.45	<27.84	>1.38
23	2.1	19.9	31.41	<27.82	>1.38
24	2.1	19.9	31.45	<27.79	>1.41
25	2.2	18.0	32.22	<28.07	>1.59
26	2.2	20.1	31.34	<27.85	>1.34
27	2.2	19.6	31.55	<28.41	>1.21
28	2.3	19.6	31.58	27.91	1.41
29	2.3	19.6	31.58	27.94	1.40
30	2.3	20.1	31.42	<28.00	>1.31
31	2.3	20.1	31.44	<28.02	>1.31
32	2.3	20.1	31.40	<27.89	>1.35
33	2.4	20.4	31.45	<27.92	>1.36
34	2.5	19.0	32.09	28.40	1.42
35	2.7	18.8	32.24	<28.12	>1.58
36	2.9	19.6	32.03	<28.19	>1.47
37	3.2	20.1	31.94	<28.28	>1.41

NOTES: (1) Lopt and L2kev are in erg/cm^2/sec/Hz (monochromatic luminosities)

(2) α_{OX} = (log(Lopt/L2kev))/2.605; computed as in Zamorani _et al._ (1981).

(3) Limits on log(L2kev) and α_{OX} are 3-sigma limits: 8 of 37 of our optically selected QSOs are detected in X-rays at > 3-sigma.

(4) QSOs with an asterisk in the 'Object' column are previously identified serendipitous X-ray sources which were "re-discovered" in our grism/grens survey: objects 4 and 9 identified in Stocke _et_ al. (1983); object 5 identified in Chanan et al. (1981).

V. PUBLICATIONS

The following publications have been supported by this grant:

Anderson, S. F., and Margon, B., An Optical Search for "X-ray Quiet" Quasars, in "Quasars and Gravitational Lenses", Proc. 24th Liege International Astrophysical Colloquium (June 1983), pp. 68-71, 1983.

Anderson, S. F., and Margon, B., "An Optical Selection Technique to Probe the Faint End of the QSO X-Ray Luminosity Function", B.A.A.S., 15, 977, 1983.

In addition, several other publications are currently in final stages of preparation, and will be cited in the next grant report.

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VII. APPENDIX: OPTICAL DATA ON HAND

X-RAY FIELD: 0014+157
R.A./DEC.(1950): 00 14 00.0 / +15 45 00.0
GALACTIC LONG./LAT.(II): 110.8/-46.0
IPC OR HRI SEQ. NO.: IPC 7597
TARGET: Kron-Koo cluster of galaxies
OBSERVER: 382=Boynton,Schommer,Koo,Kron
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 24.8
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 5.9
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY
25658	CTIO/Sch	9/13/82	IIIaJ	UV prism	90min	2.5"/2
	(plate center at 00 14, +15 54)					
3610	CFHT	9/6/83	IIIaF	Blue grens	60min	1"/1
	(also see CFHT plate no. 3615)					

X-RAY FIELD: 0014+163
R.A./DEC.(1950): 00 14 20.0 / +16 20 00.0
GALACTIC LONG./LAT.(II): 111.1/-45.5
IPC OR HRI SEQ. NO.: IPC 10431
TARGET: Galaxy cluster at z<1
OBSERVER: 692=Windhorst,Kron,Koo
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 18.9
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 5.7
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY
25658	CTIO/Sch	9/13/82	IIIaJ	UV prism	90min	2.5"/2
	(plate center at 00 14, +15 54)					
3615	CFHT	9/7/83	IIIaF	Blue grens	60min	/1-
	(also see CFHT plate no. 3610)					

X-RAY FIELD: 0015+155
R.A./DEC.(1950): 00 15 20.0 / +15 35 00.0
GALACTIC LONG./LAT.(II): 111.2/-46.2
IPC OR HRI SEQ. NO.: IPC 10432
TARGET: Galaxy cluster at z<1
OBSERVER: 692=Windhorst,Kron,Koo
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 17.0
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 5.8
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/QUALITY
25658	CTIO/Sch	9/13/82	IIIaJ	UV prism	90min	2.5"/2
	(plate center at 00 14, +15 54)					
3610	CFHT	9/6/83	IIIaF	Blue grens	60min	1"/1
	(also see CFHT plate no. 3615)					

X-RAY FIELD: 0015+161
R.A./DEC.(1950): 00 15 58.0 / +16 10 00.0
GALACTIC LONG./LAT.(II): 111/-46
IPC OR HRI SEQ. NO.: HRI 7755
TARGET: Rich cluster of galaxies
OBSERVER: HRI
DATE WHEN FIELD BECOMES PUBLIC: now
TIME IN PROCESSED IMAGE (KSEC): 59.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/QUALITY
25658	CTIO/Sch	9/13/82	IIIaJ	UV prism	90min	2.5"/2
	(plate center at 00 14, +15 54)					
3615	CFHT	9/7/83	IIIaF	Blue grens	60min	/1-
	(also see CFHT plate no. 3610)					

X-RAY FIELD: 0044-210
R.A./DEC.(1950): 00 44 39.0 / -21 02 00.0
GALACTIC LONG./LAT.(II): 113.9/-83.6
IPC OR HRI SEQ. NO.: IPC 5766
TARGET: NGC 247
OBSERVER: 1=Columbia
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 14.3
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.9
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/QUALITY/PA
6113	CTIO/4m	7/12/83	IIIaF	Blue grism	40min	2-2.5"/2-/E
6122	CTIO/4m	7/13/83	IIIaF	Blue grism	40min	1"/3+/E
	(poor focus)					
6134	CTIO/4m	7/14/83	IIIaF	Blue grism	35min	1"/1-/E

X-RAY FIELD: 0112-017
R.A./DEC.(1950): 01 12 44.4 / -01 42 54.0
GALACTIC LONG./LAT.(II): 136.5/-63.7
IPC OR HRI SEQ. NO.: IPC 5394
TARGET: PKS 0112-017 (QSO)
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 7/84
TIME IN PROCESSED IMAGE (KSEC): 14.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.7

COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
25659	CTIO/Sch	9/13/82	IIIaJ	UV prism	60min	2"
6114	CTIO/4m (poor focus)	7/12/83	IIIaF	Blue grism	40min	2"/3/N
6123	CTIO/4m	7/13/83	IIIaF	Blue grism	40min	1.5"/1-/N

X-RAY FIELD: 0204+150
R.A./DEC.(1950): 02 04 10.0 / +15 02 37.0
GALACTIC LONG./LAT.(II): 148.5/-43.8
IPC OR HRI SEQ. NO.: IPC 7614
TARGET: TT Ari
OBSERVER: 363=Cordova
DATE WHEN FIELD BECOMES PUBLIC: 11/84
TIME IN PROCESSED IMAGE (KSEC): 23.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.1
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3784	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	0.5-1"/1-/S
3796	KPNO/4m	1/16/83	IV-N	Red grism+ Wratten 29	60min	1"/2-/E
3616	CFHT	9/7/83	IIIaF	Blue grens	60min	/1-/

X-RAY FIELD: 0303+151
R.A./DEC.(1950): 03 03 25.9 / +15 08 47.0
GALACTIC LONG./LAT.(II): 164.6/-36.4
IPC OR HRI SEQ. NO.: IPC 3952
TARGET: Cluster evolution
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 12/84
TIME IN PROCESSED IMAGE (KSEC): 20.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 5.6
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
7337	KPNO/Sch	1/11/83	IIaO	UG-2	90min	1"/1/
3785	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1"/2+/S
3878	KPNO/4m	1/29/84	IIIaF	Blue grism	35min	2"//S

X-RAY FIELD: 0307+169
R.A./DEC.(1950): 03 07 11.0 / +16 54 28.9
GALACTIC LONG./LAT.(II): 164.1/-34.5
IPC OR HRI SEQ. NO.: IPC 7790

TARGET: Distant cluster of galaxies
OBSERVER: 313=Tyson, Jarvis, Perrenod
DATE WHEN FIELD BECOMES PUBLIC: 12/84
TIME IN PROCESSED IMAGE (KSEC): 14.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.3
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3611	CFHT	9/6/83	IIIaF	Blue grens	60min	1"/1/

X-RAY FIELD: 0430+052
R.A./DEC.(1950): 04 30 30.0 / +05 15 00.0
GALACTIC LONG./LAT.(II): 190.4/-27.4
IPC OR HRI SEQ. NO.: IPC 351, also HRI nos. 4908,6389.
TARGET: 3C 120 (Seyfert galaxy)
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 1/84
TIME IN PROCESSED IMAGE (KSEC): 41.8,15.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.1
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
7340	KPNO/Sch	1/12/83	IIaO	UG-2	120min	3"/2/
3786	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1"/1-/S
3797	KPNO/4m	1/16/83	IV-N	Red grism+ Wratten 29	60min	0.5"/2+/S
3891	KPNO/4m	1/30/84	IIIaF	Blue grism	33.5min	1.5-2.5"//S
3892	KPNO/4m	1/30/84	IIIaF	Blue grism	33.5min	2"//S

X-RAY FIELD: 0438-165
R.A./DEC.(1950): 04 38 49.5 / -16 32 30.9
GALACTIC LONG./LAT.(II): 215/-35
IPC OR HRI SEQ. NO.: IPC 3558 and 3557, most of 4 HRI fields 3575-3578
also on one plate
TARGET: Eri deep survey
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: IPC - 2/84, HRI - now
TIME IN PROCESSED IMAGE (KSEC): IPC - 34.0 and 29.4, HRI - mean of 45.9
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3879	KPNO/4m	1/29/84	IIIaF	Blue grism	35min	2"//S
3905	KPNO/4m	2/1/84	IIIaF	Blue grism	?min	2-4"//S
3906	KPNO/4m	2/1/84	IIIaF	Red grism	40min	2"//S

X-RAY FIELD: 0503-119
R.A./DEC.(1950): 05 03 06.6 / -11 56 24.0
GALACTIC LONG./LAT.(II): 211.9/-28.8
IPC OR HRI SEQ. NO.: IPC 10225
TARGET: NGC 1784
OBSERVER: 5=calibration
DATE WHEN FIELD BECOMES PUBLIC: 3/85
TIME IN PROCESSED IMAGE (KSEC): 18.0
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 8.1
COMMENTS ON X-RAY IMAGE: Note that this is a calibration field
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3787	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1"/1/S
3798	KPNO/4m	1/16/83	IV-N	Red grism+ Wratten 29	60min	1"/2+/S
3907	KPNO/4m	2/1/84	IIIaF	Red grism	40min	0.5-1"//S

X-RAY FIELD: 0545-096
R.A./DEC.(1950): 05 45 23.0 / -09 41 12.0
GALACTIC LONG./LAT.(II): 214.5/-18.5
IPC OR HRI SEQ. NO.: IPC 5048
TARGET: Kappa Ori
OBSERVER: 267=Cassinelli,Dupree
DATE WHEN FIELD BECOMES PUBLIC: 8/84
TIME IN PROCESSED IMAGE (KSEC): 14.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.9
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
7343	KPNO/Sch (bright star on plate)	1/13/83	IIaO	UG-2	90min	2"/1/
3881	KPNO/4m	1/29/84	IIIaF	Blue grism	35min	1.5"//S

X-RAY FIELD: 0735+178
R.A./DEC.(1950): 07 35 14.0 / +17 49 08.9
GALACTIC LONG./LAT.(II): 201.8/+18.1
IPC OR HRI SEQ. NO.: IPC 5695
TARGET: Variability in 0735+178 (BL Lac?)
OBSERVER: 1=Columbia
DATE WHEN FIELD BECOMES PUBLIC: 8/84
TIME IN PROCESSED IMAGE (KSEC): 34.6
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 8.0
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
7338	KPNO/Sch (plate center at 07 42, +18.7)	1/11/83	IIaO	UG-2	120min	1"/1/

3788	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1-2"/2+/E
3799	KPNO/4m	1/16/83	IV-N	Red grism+ Wratten 29	75min	1"/2/S
3882	KPNO/4m	1/29/84	IIIaF	Blue grism	40min	<1"//S
3908	KPNO/4m	2/1/84	IIIaF	Red grism	40min	1"//S

X-RAY FIELD: 0834+651
R.A./DEC.(1950): 08 34 46.6 / +65 11 46.8
GALACTIC LONG./LAT.(II): 150.6/+35.7
IPC OR HRI SEQ. NO.: IPC 6964
TARGET: Pi 2 UMa, stellar variability
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: 1/85
TIME IN PROCESSED IMAGE (KSEC): 14.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.9
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3789	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	2"/2-/N
3800	KPNO/4m (hypering failure)	1/16/83	IV-N	Red grism+ Wratten 29	75min	1.5"/3+/N
3883	KPNO/4m	1/29/84	IIIaF	Blue grism	40min	1-1.5"//E
3910	KPNO/4m	2/1/84	IIIaF	Red grism	40min	2"/N/

X-RAY FIELD: 0835+580
R.A./DEC.(1950): 08 35 04.9 / +58 04 51.9
GALACTIC LONG./LAT.(II): 159.3/+36.9
IPC OR HRI SEQ. NO.: IPC 503
TARGET: 3CR 205
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: 5/84
TIME IN PROCESSED IMAGE (KSEC): 14.6
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 8.1
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3790	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1"/2+/N
3817	KPNO/4m	4/18/83	IV-N	Red grism+ Wratten 29	75min	2"/2-/W
3899	KPNO/4m	1/31/84	IIIaF	Blue grism	40min	3"//N
3909	KPNO/4m	2/1/84	IIIaF	Red grism	40min	1.5"//N

X-RAY FIELD: 0838+133
R.A./DEC.(1950): 08 38 01.7 / 13 23 05.0
GALACTIC LONG./LAT.(II): 215/+30
IPC OR HRI SEQ. NO.: IPC 486
TARGET: 3CR 207 (QSO)
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 5/84
TIME IN PROCESSED IMAGE (KSEC): 14.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.1
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3893	KPNO/4m	1/30/84	IIIaF	Blue grism	40min	1"//S

X-RAY FIELD: 0849+285
R.A./DEC.(1950): 08 49 37.0 / +28 31 00.0
GALACTIC LONG./LAT.(II): 196.8/+37.7
IPC OR HRI SEQ. NO.: IPC 5504, also HRI nos. 8329,8330
TARGET: HD075732
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 5/84
TIME IN PROCESSED IMAGE (KSEC): 22.7
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.5
COMMENTS ON X-RAY IMAGE: Medium survey field
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
7341	KPNO/Sch (trailed)	1/12/83	IIaO	UG-2	120min	2"/2/
3778	KPNO/4m	1/13/83	IIIaF	Blue grism	30min	1"/1-/E
3884	KPNO/4m	1/29/84	IIIaF	Blue grism	40min	1"//S

X-RAY FIELD: 0851+202
R.A./DEC.(1950): 08 51 48.0 / +20 14 00.0
GALACTIC LONG./LAT.(II): 206.9/+35.7
IPC OR HRI SEQ. NO.: IPC 1994
TARGET: OJ287 (BL Lac)
OBSERVER: 1=Columbia
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 18.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.8
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3791	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	0.5"/2+/S

X-RAY FIELD: 0903+169
R.A./DEC.(1950): 09 03 44.2 / +16 58 16.0
GALACTIC LONG./LAT.(II): 211.9/+37.2

IPC OR HRI SEQ. NO.: IPC 481, also HRI 8320
TARGET: 3CR 215 (QSO)
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: 5/84
TIME IN PROCESSED IMAGE (KSEC): 14.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 8.1
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3779	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1.5"/2/S
3894	KPNO/4m	1/30/84	IIIaF	Blue grism	40min	1"//S

X-RAY FIELD: 0934-047
R.A./DEC.(1950): 09 34 24.5 / -04 47 12
GALACTIC LONG./LAT.(II): 238/+32
IPC OR HRI SEQ. NO.: IPC 6097
TARGET: Nearby cluster
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: 9/84
TIME IN PROCESSED IMAGE (KSEC): 16.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.8
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3885	KPNO/4m	1/29/84	IIIaF	Blue grism	40min	1.5"//S
3911	KPNO/4m	2/1/84	IIIaF	Red grism	40min	0.5-1"//S

X-RAY FIELD: 0938+119
R.A./DEC.(1950): 09 38 31.8 / +11 59 13.0
GALACTIC LONG./LAT.(II): 222.4/+42.9
IPC OR HRI SEQ. NO.: IPC 530
TARGET: QSO 0938+119
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: 2/84
TIME IN PROCESSED IMAGE (KSEC): 15.3
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.2
COMMENTS ON X-RAY IMAGE: Medium survey field
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3779	KPNO/4m	1/13/83	IIIaF	Blue grism	30min	1"/1-/S
3806	KPNO/4m	4/16/83	IV-N	Red grism+ Wratten 29	60min	1.5"/2-/S
3886	KPNO/4m	1/29/84	IIIaF	Blue grism	45min	1"//S
3912	KPNO/4m	2/1/84	IIIaF	Red grism	40min	1"//S

X-RAY FIELD: 1016+201

R.A./DEC.(1950): 10 16 55.5 / +20 07 17.9
GALACTIC LONG./LAT.(II): 216.5/+54.6
IPC OR HRI SEQ. NO.: IPC 913
TARGET: AD Leo
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 2/84
TIME IN PROCESSED IMAGE (KSEC): 15.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.5
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
7339	KPNO/Sch	1/11/83	IIaO	UG-2	120min	2"/2/
3780	KPNO/4m	1/13/83	IIIaF	Blue grism	40min	1"/2/S
3801	KPNO/4m (hypering failure)	1/16/83	IV-N	Red grism+ Wratten 29	75min	<1"/3-/S
3887	KPNO/4m	1/29/84	IIIaF	Blue grism	45min	1.5"//S

X-RAY FIELD: 1114+183
R.A./DEC.(1950): 11 14 16.1 / +18 19 35.0
GALACTIC LONG./LAT.(II): 230.5/+66.4
IPC OR HRI SEQ. NO.: IPC 3927
TARGET: NGC 3607 group
OBSERVER: 148=Biermann,Kronberg,Madore
DATE WHEN FIELD BECOMES PUBLIC: 6/84
TIME IN PROCESSED IMAGE (KSEC): 19.5
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.9
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3793	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1"/2/S
3807	KPNO/4m (hypering failure)	1/16/83	IV-N	Red grism+ Wratten 29	60min	1"/3/S
3811	KPNO/4m	4/17/83	IV-N	Red grism+	80min	2.5"/2/S
3895	KPNO/4m	1/30/84	IIIaF	Blue grism	40min	1"//S
3900	KPNO/4m	1/31/84	IIIaF	Blue grism	40min	3-4"//S

X-RAY FIELD: 1208+396
R.A./DEC.(1950): 12 08 00.0 / +39 40 00.0
GALACTIC LONG./LAT.(II): 155.1/+75.1
IPC OR HRI SEQ. NO.: IPC 353, also HRI nos. 340,6395
TARGET: NGC 4151 (Sefert galaxy)
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: IPC - 3/84, HRI - now
TIME IN PROCESSED IMAGE (KSEC): 21.2

MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.8
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
7342	KPNO/Sch	1/12/83	IIaO	UG-2	120min	1"/1/
3781	KPNO/4m (cloudy)	1/13/83	IIIaF	Blue grism	30min	1/2-/E
3795	KPNO/4m (cloudy)	1/15/83	IV-N	Red grism+ Wratten 29	45min	2"/2-/N
3896	KPNO/4m	1/30/84	IIIaF	Blue grism	40min	1"//E
3913	KPNO/4m	2/1/84	IIIaF	Red grism	40min	1"//E

X-RAY FIELD: 1226+023
R.A./DEC.(1950): 12 26 33.2 / +02 19 43.0
GALACTIC LONG./LAT.(II): 292/+64
IPC OR HRI SEQ. NO.: HRI 569
TARGET: 3CR 273 (QSO)
OBSERVER: HRI
DATE WHEN FIELD BECOMES PUBLIC: now
TIME IN PROCESSED IMAGE (KSEC): 96.0
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3897	KPNO/4m (terminated early because of bad seeeing)	1/30/84	IIIaF	Blue grism	23.5min	2-4"//S
3902	KPNO/4m	1/31/84	IIIaF	Blue grism	40min	1.5-2"//S
3914	KPNO/4m	2/1/84	IIIaF	Red grism	40min	1"//S

X-RAY FIELD: 1230+117
R.A./DEC.(1950): 12 30 00.0 / +11 47 27.6
GALACTIC LONG./LAT.(II): 286.3/+73.6
IPC OR HRI SEQ. NO.: IPC 279
TARGET: NGC 4406 (Virgo)
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: now (11/83)
TIME IN PROCESSED IMAGE (KSEC): 25.8, 23.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 9.5
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3782	KPNO/4m	1/13/83	IIIaF	Blue grsim	30min	1.5"/2/S
3819	KPNO/4m	4/19/83	IV-N	Red grism+ Wratten 29	75min	1.5"/2/S

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/QUALITY/PA
3901	KPNO/4m	1/31/84	IIIaF	Blue grism	40min	2-2.5"//S

X-RAY FIELD: 1234+262
R.A./DEC.(1950): 12 34 24.0 / +26 16 00.0
GALACTIC LONG./LAT.(II): 231.4/+86.6
IPC OR HRI SEQ. NO.: IPC 9974
TARGET: NGC 4565
OBSERVER: 569=Bahcall,Ostriker
DATE WHEN FIELD BECOMES PUBLIC: 3/85
TIME IN PROCESSED IMAGE (KSEC): 22.7
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.9
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/QUALITY/PA
3783	KPNO/4m (double exposed approx. 5 sec)	1/13/83	IIIaF	Blue grism	30min	1.5"/2/S
3802	KPNO/4m (hypering failure)	1/16/83	IV-N	Red grism+ Wratten 29	75min	0.5"/3/S
3808	KPNO/4m	4/16/83	IV-N	Red grism+ Wratten 29	75min	<1"/2/E
3888	KPNO/4m	1/29/84	IIIaF	Blue grism	45min	1.5"//S

X-RAY FIELD: 1315+180
R.A./DEC.(1950): 13 15 47.0 / +18 02 01.9
GALACTIC LONG./LAT.(II): 337.8/+78.8
IPC OR HRI SEQ. NO.: IPC 5546
TARGET: HD115617
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 3/85
TIME IN PROCESSED IMAGE (KSEC): 21.4,18.3
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 8.9
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/QUALITY/PA
3794	KPNO/4m	1/14/83	IIIaF	Blue grism	40min	1"/2+/S
3818	KPNO/4m (windy)	4/16/83	IV-N	Red grism+ Wratten 29	56min	2"/2-/S
3820	KPNO/4m	4/19/83	IV-N	Red grism+	75min	2"/2/S

X-RAY FIELD: 1334+039
R.A./DEC.(1950): 13 34 13.0 / +03 57 00.0
GALACTIC LONG./LAT.(II): 329.7/+64.2
IPC OR HRI SEQ. NO.: IPC 5547
TARGET: Wolf 489

OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: 7/84
TIME IN PROCESSED IMAGE (KSEC): 13.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.6
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6124	CTIO/4m	7/14/83	IIIaF	Blue grism	35min	1.5"/2/N
3889	KPNO/4m	1/29/84	IIIaF	Blue grism	35min	1"//S

X-RAY FIELD: 1409+524
R.A./DEC.(1950): 14 09 30.0 / +52 25 59.0
GALACTIC LONG./LAT.(II): 108/+54
IPC OR HRI SEQ. NO.: HRI 4290
TARGET: 3C 295 (QSO?)
OBSERVER: HRI
DATE WHEN FIELD BECOMES PUBLIC: now
TIME IN PROCESSED IMAGE (KSEC): 103.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3898	KPNO/4m	1/30/84	IIIaF	Blue grism	40min	1-2"//E
3903	KPNO/4m (haze)	1/31/84	IIIaF	Blue grism	40min	1-2"//E

X-RAY FIELD: 1410+730
R.A./DEC.(1950): 14 10 00.0 / +73 00 00.0
GALACTIC LONG./LAT.(II): 113/+45
IPC OR HRI SEQ. NO.: IPC 27, most of 4 HRI fields 4278-4281 also on one plate
TARGET: UMi deep survey
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: IPC - 4/84, HRI - now
TIME IN PROCESSED IMAGE (KSEC): IPC - 31.6, HRI - mean of 45.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES:

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3890	KPNO/4m	1/29/84	IIIaF	Blue grism	27min?	<1.5/2+/N
3915	KPNO/4m	2/1/84	IIIaF	Red grism	40min	1-2"/2/N

X-RAY FIELD: 1415+253
R.A./DEC.(1950): 14 15 42.0 / +25 22 00.0
GALACTIC LONG./LAT.(II): 32.0/+70.5
IPC OR HRI SEQ. NO.: IPC 356
TARGET: NGC 5548 (Seyfert galaxy)
OBSERVER: O=CFA

DATE WHEN FIELD BECOMES PUBLIC: 3/84
TIME IN PROCESSED IMAGE (KSEC): 25.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.3
COMMENTS ON X-RAY IMAGE: Medium survey field
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3809	KPNO/4m	4/16/83	IV-N	Red grism+ Wratten 29	75min	0.5"/1-/S
3813	KPNO/4m	4/17/83	IIIaF	Blue grism	40min	1"/1/S
3916	KPNO/4m	2/1/84	IIIaF	Red grism	40min?	1.5//?

X-RAY FIELD: 1502+022
R.A./DEC.(1950): 15 02 55.0 / +02 17 37.0
GALACTIC LONG./LAT.(II): 0.7/+49.3
IPC OR HRI SEQ. NO.: IPC 10456
TARGET: NGC 5838 Zwicky cluster
OBSERVER: 3=MIT ro Goddard ?
DATE WHEN FIELD BECOMES PUBLIC: 3/85
TIME IN PROCESSED IMAGE (KSEC): 17.6
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 8.3
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6105	CTIO/4m (windy; poor focus)	7/14/83	IIIaF	Blue grism	40min	2"/2/N

X-RAY FIELD: 1509-090
R.A./DEC.(1950): 15 09 46.0 / -09 02 17.0
GALACTIC LONG./LAT.(II): 350/+40
IPC OR HRI SEQ. NO.: HRI 10287
TARGET: Carbon star
OBSERVER: HRI
DATE WHEN FIELD BECOMES PUBLIC: now
TIME IN PROCESSED IMAGE (KSEC): 14.5
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6105	CTIO/4m (poor focus)	7/12/83	IIIaF	Blue grism	35min	2"/2/N
6115	CTIO/4m	7/13/83	IIIaF	Blue grism	40min	1"/1/N

X-RAY FIELD: 1517+204
R.A./DEC.(1950): 15 17 51.0 / +20 26 52.9
GALACTIC LONG./LAT.(II):
IPC OR HRI SEQ. NO.: IPC 10407
TARGET: 3C 218, distant cluster of galaxies
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: 4/85

TIME IN PROCESSED IMAGE (KSEC): 40.0
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.8
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3904	KPNO/4m	1/31/84	IIIaF	Blue grism	40min	1"//S
	(plate center at 00 14, +15 54)					
3610	CFHT	9/6/83	IIIaF	Blue grens	60min	1"/1
	(also see CFHT plate no. 3615)					

X-RAY FIELD: 1601+182
R.A./DEC.(1950): 16 01 00.0 / +18 17 00.0
GALACTIC LONG./LAT.(II): 31.9/+45.1
IPC OR HRI SEQ. NO.: IPC 3713
TARGET: QSO 1601.0+1817
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: now(
TIME IN PROCESSED IMAGE (KSEC): 18.8
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.2
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3810	KPNO/4m	4/16/83	IV-N	Red grism+ Wratten 29	90min	1"/2+/S
3814	KPNO/4m	4/17/83	IIIaF	Blue grism	40min	<1"/1-/S
	(this field has also been examined by Hoag, Burbidge, Burbidge, et al.)					
3837	KPNO/4m	7/18/83	IV-N	Red grism+ Wratten 29	60min	1.5"/2-/S
	(clouds and moon - sky background overexposed but plate still useable)					

X-RAY FIELD: 1614+055
R.A./DEC.(1950): 16 14 03.1 / +05 30 46.8
GALACTIC LONG./LAT.(II): 31.9/+45.1
IPC OR HRI SEQ. NO.: IPC 3716
TARGET: QSO 1614+150 was intended target but Einstein was mis-pointed to above coordinates
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC: 8/84
TIME IN PROCESSED IMAGE (KSEC): 21.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 9.1
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6106	CTIO/4m	7/12/83	IIIaF	Blue grism	40min	2"/2/N
6116	CTIO/4m	7/13/83	IIIaF	Blue grism	40min	1.5"/1-/N

X-RAY FIELD: 1638+826
R.A./DEC.(1950): 16 38 00.0 / +82 39 00.0
GALACTIC LONG./LAT.(II): 115.8/+31.2
IPC OR HRI SEQ. NO.: IPC 1910
TARGET: NGC 6251 (radio galaxy)
OBSERVER: 1=Columbia
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 21.6
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.3
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3821	KPNO/4m	4/19/83	IV-N	Red grism+ Wratten 29	75min	2"/2/E
3823	KPNO/4m	4/19/83	IIIaF	Blue grism	35min	1"/2/E

X-RAY FIELD: 1642-032
R.A./DEC.(1950): 16 42 25.0 / -03 12 31.0
GALACTIC LONG./LAT.(II): 14/+27
IPC OR HRI SEQ. NO.: HRI 10442: also HRI 8029 and IPC nos. 2494 and 10443
TARGET: Radio pulsar
OBSERVER: HRI
DATE WHEN FIELD BECOMES PUBLIC: now
TIME IN PROCESSED IMAGE (KSEC): 19.6
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6126	CTIO/4m (poor focus)	7/14/83	IIIaF	Blue grism	40min	1.5"/2-/N

X-RAY FIELD: 1648+050
R.A./DEC.(1950): 16 48 41.9 / +05 05 00.0
GALACTIC LONG./LAT.(II): 23.1/+28.9
IPC OR HRI SEQ. NO.: IPC 10533
TARGET: Her A
OBSERVER: 2=MIT or Goddard?
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 45.5
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 8.7
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3824	KPNO/4m	4/19/83	IIIaF	Blue grism	35min	2.5"/2-/S

X-RAY FIELD: 1704+607
R.A./DEC.(1950): 17 04 00.0 / +60 47 59.8
GALACTIC LONG./LAT.(II): 90.1/+36.4
IPC OR HRI SEQ. NO.: IPC 5688, also HRI 4207
TARGET: 3C 351

OBSERVER: 1=Columbia
DATE WHEN FIELD BECOMES PUBLIC: HRI - now
TIME IN PROCESSED IMAGE (KSEC): 38.4
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.6
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3838	KPNO/4m	7/18/83	IV-N	Red grism+ Wratten 29	75min	>2"/2+/N

X-RAY FIELD: 1726+502
R.A./DEC.(1950): 17 26 59.9 / +50 12 00.0
GALACTIC LONG./LAT.(II): 77.0/+33.5
IPC OR HRI SEQ. NO.: IPC 2003
TARGET: IZW18 (BL Lac)
OBSERVER: 1=Columbia
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC):
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.2
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3815	KPNO/4m	4/17/83	IIIaF	Blue grism	40min	0.5-1"/1/N
3822	KPNO/4m	4/19/83	IV-N	Red grism+ Wratten 29	75min	1"/2/E
3832	KPNO/4m	7/17/83	IV-N	Red grism+ Wratten 29	65min	2"/2/E

X-RAY FIELD: 1746+205
R.A./DEC.(1950): 17 56 55.8 / +23 43 55.0
GALACTIC LONG./LAT.(II): 49.4/+21.6
IPC OR HRI SEQ. NO.: IPC 10755
TARGET: QSO OT295
OBSERVER: 5=calibration
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 33.9,30.2,30.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE: This field was used for calibration, but this particular IPC image did not have the Al filter in-place. Other images are available with the Al filter.
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3612	CFHT	9/7/83	IIIaF	Blue grens	40min?	/1/

X-RAY FIELD: 1841-633
R.A./DEC.(1950): 18 41 59.9 / -63 21 59.8
GALACTIC LONG./LAT.(II): 332.3/-23.5
IPC OR HRI SEQ. NO.: IPC 6105

TARGET: Galaxy cluster 1842-63
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 16.0
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 9.5
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6108	CTIO/4m	7/12/83	IIIaF	Blue grism	40min	1"/2/S
6118	CTIO/4m (poor focus)	7/13/83	IIIaF	Blue grism	40min	1"/2-/S
6127	Ctio/4m (poor focus)	7/14/83	IIIaF	Blue grism	40min	1.5"/2-/S

X-RAY FIELD: 1845+797
R.A./DEC.(1950): 18 45 52.9 / +79 42 47.8
GALACTIC LONG./LAT.(II): 111.4/+27.1
IPC OR HRI SEQ. NO.: IPC 3833, also HRI 342
TARGET: 3C 390.3 (Seyfert galaxy)
OBSERVER: 1=Columbia
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 16.3,12.8
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.8
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3833	KPNO/4m	7/17/83	IV-N	Red grism+ Wratten 29	75min	2"/2/N

X-RAY FIELD: 1909+049
R.A./DEC.(1950): 19 09 19.9 / +04 54 00.0
GALACTIC LONG./LAT.(II): 38/+2
IPC OR HRI SEQ. NO.: HRI 5323, also HRI 3491 and IPC 4623
TARGET: SS 433
OBSERVER: HRI
DATE WHEN FIELD BECOMES PUBLIC: now
TIME IN PROCESSED IMAGE (KSEC): 5.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3816	KPNO/4m	4/17/83	Tech pan/F	Blue grism	35min	1"/1/E

X-RAY FIELD: 2037-010
R.A./DEC.(1950): 20 37 34.9 / -01 03 23.0
GALACTIC LONG./LAT.(II): 45.3/-24.4
IPC OR HRI SEQ. NO.: IPC 8415
TARGET: AE Aqr

OBSERVER: 433=Chincarini
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 20.0
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.5
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6128	CTIO/4m (windy)	7/14/83	IIIaF	Blue grism	40min	1"/2/E?
3607	CFHT	9/6/83	IIIaF	Blue grens	60min	1"/1/

X-RAY FIELD: 2109-680
R.A./DEC.(1950): 21 09 59.9 / -68 00 00
GALACTIC LONG./LAT.(II): 68/-22
IPC OR HRI SEQ. NO.: most of 4 fields HRI 4151-4154 on one plate, also IPC images
TARGET: Pavo deep survey
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: HRI - now
TIME IN PROCESSED IMAGE (KSEC): HRI - 81 to 95
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6111	CTIO/4m (poor focus)	7/12/83	IIIaF	Blue grism	40min	1"/2-/S
6121	CTIO/4m (poor focus)	7/13/83	IIIaF	Blue grism	40min	1"/3+/S
6131	CTIO/4m (double exposed)	7/14/83	IIIaF	Blue grism	40min	1.5"/2-/W

X-RAY FIELD: 2120+168
R.A./DEC.(1950): 21 20 25.4 / +16 51 45.9
GALACTIC LONG./LAT.(II): 68/-22
IPC OR HRI SEQ. NO.: HRI 10673, also IPC 504
TARGET: 3CR 432
OBSERVER: 0=CFA
DATE WHEN FIELD BECOMES PUBLIC: HRI - now
TIME IN PROCESSED IMAGE (KSEC): HRI - 50.0
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3613	CFHT	9/7/83	IIIaF	Blue grens	60min	/1-/

X-RAY FIELD: 2125-150
R.A./DEC.(1950): 21 25 59.9 / -15 00 00.0
GALACTIC LONG./LAT.(II): 36.9/-41.4

IPC OR HRI SEQ. NO.: IPC 6105
TARGET: QSO 2126-150
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 14.7
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.3
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
25651	CTIO/Sch	9/10/82	IIIaJ	UV prism	90min	3"/3+/
6109	CTIO/4m (poor focus)	7/12/83	IIIaF	Blue grism	40min	1-2"/2-/E
6119	CTIO/4m (poor focus)	7/13/83	IIIaF	Blue grism	40min	1"/2-/E
6129	CTIO/4m	7/14/83	IIIaF	Blue grism	40min	1.5"/2+/E

X-RAY FIELD: 2135-147
R.A./DEC.(1950): 21 35 01.0 / -14 46 27.0
GALACTIC LONG./LAT.(II): 38.4/-43.3
IPC OR HRI SEQ. NO.: IPC 5426
TARGET: QSO PHL 1657
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 14.9
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 7.2
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMUL-SION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6110	CTIO/4m (poor focus)	7/12/83	IIIaF	Blue grism	40min	1.5"/2-/E
6120	CTIO/4m (poor focus)	7/13/83	IIIaF	Blue grism	40min	0.5-1"/2-/E
6130	CTIO/4m	7/14/83	IIIaF	Blue grism	40min	1.5"/2+/E

X-RAY FIELD: 2142+038
R.A./DEC.(1950): 21 42 34.5 / +03 48 19.0
GALACTIC LONG./LAT.(II): 60.3/-35.3
IPC OR HRI SEQ. NO.: IPC 3958, also HRI 9729
TARGET: Cluster at z=0.55
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 14.7
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:

PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
3609	CFHT	9/3/83	IIIaF	Blue grens	60min	1"/1/

X-RAY FIELD: 2155+038
R.A./DEC.(1950): 21 55 19.0 / +03 34 24.0
GALACTIC LONG./LAT.(II): 62.6/-37.9
IPC OR HRI SEQ. NO.: IPC 3959
TARGET: Cluster at z=0.66
OBSERVER: O=CFA
DATE WHEN FIELD BECOMES PUBLIC:
TIME IN PROCESSED IMAGE (KSEC): 16.1
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC): 6.6
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6112	CTIO/4m (poor focus)	7/12/83	IIIaF	Blue grism	40min	1"/2-/N
3608	CFHT	9/6/83	IIIaF	Blue grens	60min	1"/1-/

X-RAY FIELD: 2155-304
R.A./DEC.(1950): 21 55 57.8 / -30 27 54.0
GALACTIC LONG./LAT.(II): 19/-53
IPC OR HRI SEQ. NO.: HRI 3912, also IPC nos. 5201,5202
TARGET: H2156-304 (BL Lac)
OBSERVER: HRI
DATE WHEN FIELD BECOMES PUBLIC: HRI - now
TIME IN PROCESSED IMAGE (KSEC): HRI - 10.2
MINIMUM DETECTABLE SOURCE (COUNTS/1000 SEC):
COMMENTS ON X-RAY IMAGE:
PLATES (COMMENTS):

NO.	OBS/TEL	DATE	EMULSION	FILTER	EXP. TIME	SEEING/ QUALITY/PA
6132	CTIO/4m	7/14/83	IIIaF	Blue grism	40min	1"/1/W