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PROBING THE GALACTIC HALO WITH *ROSAT*

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ABSTRACT

We discuss the current status of *ROSAT* shadowing observations designed to search for emission from million degree gas in the halo of the Milky Way galaxy. Preliminary results indicate that million degree halo gas is observed in the 1/4 keV band in some directions, most notably toward the Draco cloud at $(\ell, b) = (92°, +38°)$, but that the halo emission is patchy and highly anisotropic. Our current understanding of this halo emission is based on a small handful of observations which have been analyzed to date. Many more observations are currently being analyzed or are scheduled for observation within the next year, and we expect our understanding of this component of the galactic halo to improve dramatically in the near future.

INTRODUCTION

The discovery of the soft X-ray diffuse background (SXRB) in 1968 was accompanied by the discovery that the 1/4 keV X-ray intensity is anticorrelated with N_H /1/. Attention was immediately focussed on the theoretically attractive possibility that soft X-rays from a hot intergalactic medium (IGM) with closure density were being absorbed by cold gas in the galactic disk /1,2,3/. When the first shadowing experiment failed to detect absorption by the Small Magellanic Cloud /4/, the hot galactic halo predicted by Spitzer /5/ replaced the IGM as the suspected source of soft X-rays producing the observed anticorrelation /6,7/.

Direct evidence for hot gas in the halo, at temperatures up to several hundred thousand Kelvin, has

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come from observations of absorption lines of highly ionized gas toward halo stars and extragalactic objects /8/. Because of the difficulty of detecting million degree gas with this technique, past efforts to find evidence of million degree halo gas and to understand the high latitude SXRB centered on unsuccessful attempts to observe shadows of high latitude neutral clouds with non-imaging soft X-ray experiments /4,9,10,11/ and on global fits to the SXRB intensity.

A complete review of efforts to find global fits to the all-sky maps of the soft X-ray background would be too lengthy to present here, and we refer interested readers to a recent review for details /12/. Briefly, simple two component slab absorption models, consisting of two emitting regions separated by an absorbing region, fit the large-scale trends of the data quite well if the effective absorption cross section is allowed to be well below its theoretical value /7,13/. This is particularly true for the northern galactic hemisphere, where the anticorrelation of the SXRB and N_H is especially striking. However, no explanation for the low effective absorption cross-section has been found that is consistent with observations of the interstellar medium at high latitudes /11,14,15,16/. This problem and other evidence, including the results of previous shadowing experiments, led to the adoption of the displacement model /17,18,19/ in which most of the 1/4 keV X-rays originate in a hot cavity surrounding the Sun (the Local Bubble /20/). In the displacement model the X-ray/N_H anticorrelation is due to displacement of neutral gas by the hot gas in the Local Bubble, and the shape of the cavity can be mapped out using the soft X-ray intensity /18/.

More sophisticated global models incorporating mixed emission and absorption components have been cited as providing evidence for a galactic halo. The Jakobsen and Kahn model /21,22/ assumes that spherical clouds are embedded in a hot gas, as suggested by the McKee and Ostriker model of the interstellar medium /23/, and allows the emitting and absorbing gas to have different exponential scale heights. As originally formulated, this model does not fit the data well /13/. With the addition of a local, unabsorbed component from the Local Bubble, the model fits the average dependence of the UW C band rate on N_H fairly well and can approximately fit the B band data, although the dependence on N_H is too steep at low N_H /13/. This fit requires an emitting scale height two orders of magnitude larger than the absorbing scale height. Hirth and collaborators have produced a similar embedded absorber model for the SXRB /24/ in which they derive the soft X-ray emissivity profile with galactic altitude and claim to find evidence for a hot halo. Unfortunately, Hirth *et al.* made several serious errors in their analysis that invalidate their conclusions /25/. Neither of these models reproduces the average trend of the data or accounts for the considerable longitude structure of the SXRB as well as the two component slab absorption model, which still provides the best phenomenological description of the data. We do not believe that any of these global models proves the existence of million degree gas in the galactic halo.

The lack of unambiguous evidence for a million degree galactic halo changed dramatically in 1991 with the discovery of shadowing by the Draco cloud /26,27/. These observations demonstrated the power of the *ROSAT* Position Sensitive Proportional Counter (PSPC) for the detection of diffuse X-rays in general and for shadowing experiments in particular. At this writing, the PSPC has obtained pointed observations of at least 15 fields for several different groups searching for soft X-ray shadows, with at least as many more scheduled for observation within the next year. Many of these fields are at high galactic latitudes and are designed specifically to search for evidence of soft X-ray emission from a hot galactic halo. We discuss the first results of these research programs. We emphasize that this work is in a state of rapid flux as new results are obtained and analyzed, and this paper therefore represents only a snapshot of the current state of the field.

HIGH LATITUDE SHADOWS AS PROBES OF THE HOT GALACTIC HALO

We are pursuing a program of *ROSAT* pointed observations of interstellar clouds with the intent of mapping out the Local Bubble and directly measuring the contributions to the SXRB from hot gas within the galactic disk and halo. Several other groups are pursuing similar observing programs. Here we will concentrate on high latitude observations (which we arbitrarily define as $|b| > 30°$), where the background X-ray emission may tell us something about the galactic halo. However, we must be careful to distinguish true shadows from chance anticorrelations or displacement effects, as expected in the displacement model. To be certain that an apparent shadow is really caused by absorption of a more distant source of soft X-rays, an X-ray miminum in the general vicinity of a maximum in a tracer of neutral gas (e.g. HI, CO, or dust) is insufficient. In the ideal case, we would like to demonstrate the following characteristics:

1. An extremely detailed anticorrelation with a neutral gas tracer.
2. Specific evidence of absorption, such as observation of the expected E^{-3} energy dependence and agreement with the theoretical cross-section in spectral fits or in fits of I_x vs N_H.
3. Evidence against displacement of cold gas at the edge of the Local Bubble as an explanation for the anticorrelation. Such evidence could include a cloud distance well beyond the edge of the Local Bubble or a morphology to the anticorrelation that would require an extremely convoluted bubble edge if attributed to displacement.

This ideal situation may not be achievable in many cases due to short exposure times or weak shadows, but we believe that these points should be considered for every potential shadow.

The *ROSAT* PSPC is described in /28/. Its characteristics of large collecting area, fast optics, wide field of view, good energy resolution, and extremely low charged particle background rates make it well suited to the detection of diffuse soft X-ray emission. The dramatic improvement over the only imaging X-ray instrument previously used for diffuse background analysis, the *Einstein* IPC, is illustrated by the fact that the broad band particle background can contribute as much as 32% of the total count rate in the IPC /29/, while the comparable number for *ROSAT* images is less than 1% /30/. The *ROSAT* PSPC is subject to other types of background contamination, however, including scattered solar X-rays and a poorly understood variable 1/4 keV component referred to as long term enhancements (LTEs) /19,31/. Although we have made every effort to remove contributions due to these sources of contamination from our data, the LTEs are particularly difficult to eliminate, and there is always the possibility that our 1/4 keV foreground intensities are overestimated due to this contamination. In most cases, therefore, our foreground intensities must be taken as upper limits; however, this contamination is distributed rather uniformly across the detector and cannot produce an apparent shadow, but can only reduce the contrast of a shadow if one is seen. Furthermore, any foreground contamination will not affect our estimates of the background intensity that may be due to the halo. With those caveats, we will discuss the existing high latitude shadowing observations beginning with the most spectacular: the Draco cloud.

The Draco Cloud

The Draco cloud has a very distinctive spatial morphology and spectral signature at 21 cm /32/ that makes it easy to identify and to separate from foreground and background gas. A 100μm image of the entire Draco cloud (from the IRAS Sky Survey Atlas (ISSA)) is shown in Figure 1. The cloud is located at $(\ell, b) \approx (92^\circ, 38^\circ)$ and has an extent on the sky of about $4^\circ \times 5^\circ$. Plumes and filaments that appear to stream back from knots along its south-eastern edge give it a cometary appearance. It has been extensively studied over the past decade in 21 cm, CO, IR, and optical wavelengths /32–40/, and is associated with faint optical nebulosity (LBN 406, 412, 415 /41/) and with several high latitude molecular clouds (MBM 41–44 /42/). The Draco cloud is classified as an intermediate velocity cloud, with a typical velocity of about –25 km/s, except along its south-eastern edge, where the velocity is more like –20 km/s. The 21 cm line is very narrow, with a typical width of ~ 2 km/s /32/. The cometary morphology and velocity gradients suggest that it is being decelerated by interaction with gas in the galactic disk /38/.

The distance to the Draco cloud is uncertain by at least a factor of two. A lower limit of 800 pc was derived using interstellar extinction /32,35/ and reddening /36/, but the results are very uncertain

/43/. A more reliable lower limit of 300 pc was set by a search for Na I D line absorption in high resolution spectra of eight stars in the direction of the Draco cloud, which found no evidence for absorption at the Draco velocity in any of these stars /40/. Since the distance to the edge of the Local Bubble is estimated to be about 150–200 pc in this direction, based on the B band intensity /18/, the Draco cloud is unambiguously *outside* of the Local Bubble.

Soft X-ray shadows of the Draco cloud were discovered in *ROSAT* PSPC data collected in survey mode on 12–15 July 1990 /26/ and in a pointed observation from 23–24 July 1990 /27/. Both sets of data were collected during the verification and calibration phase of the mission. The former observation was centered at $(\alpha, \delta)_{2000} = (16^{\mathrm{h}}\ 48^{\mathrm{m}}, 64^\circ\ 5')$, while the latter was centered about four degrees south at $(16^{\mathrm{h}}\ 48^{\mathrm{m}}, 59^\circ\ 54')$ on a knot with molecular cores (MBM 41) and sharp, well-defined boundaries. (These locations are indicated on Figure 1 by circles, together with a third field centered just northwest of MBM41 that we have included with our first field in the analysis discussed below. The locations of other scheduled *ROSAT* PSPC pointed observations are shown by crosses.) Both observations found deep shadows (50% – 63% deep), indicating a substantial emission measure beyond the cloud. At a galactic latitude of 38°, its distance places the Draco cloud at least 185 pc above the galactic plane. It is therefore plausible to assume that the background X-ray emitting gas lies in the galactic halo.

Figure 2 shows a 1/4 keV image centered at $(\ell, b) = (89.^\circ5, 38.^\circ3)$, overlaid with the 100μm image. This image is a mosaic of four different PSPC observations pointed in two different directions. Two of the observations were unfiltered. The other two had a boron filter covering the central portion of the field of view, but the outer part of the field of view provides an unfiltered annulus of inner radius 35′ which we included in the mosaics. The three peaks in the 100μm contours that form the eyes and nose of a "moose head" are the molecular cores associated with MBM 41 /35,42/.

The data were time-filtered to remove times with excessive count rates. We have found that this technique is effective in cleaning the data, particularly when the observation is composed of many short intervals spread out over a long period of time. Our two observations of Draco were separated in time by over a year; the lack of any seam at the boundary between the images argues that the data are free from scattered solar X-rays or long term enhancements. From the count rates measured in the overlapping portion of the two fields we estimate that any residual contamination or systematic error in the flat-fielding and mosaicing procedure is $< 10\%$.

Following time-filtering, exposure maps were generated for eight energy bands. These exposure maps are a significant improvement over the single exposure map available last year for the preliminary analysis of our first Draco field. In the 1/4 keV band the new exposure maps include instrumental effects ("ghost images") that are important in the softest pulse-height channels. One effect of this improvement is that the fluctuations in the diffuse background that we reported last year are substantially reduced. We now measure fluctuations in our flat-fielded 1/4 keV images, above those expected purely from counting statistics, of only 5% of the off-cloud intensity. This is probably at the limit of the systematic uncertainties in the instrument maps used for flat-fields.

Point sources (identified by the standard processing output and visual inspection) were removed by zeroing the counts and exposure maps within a circle with radius determined by the point spread function at that location. Mosaics were made of the resulting counts maps and exposure maps, which were then divided to form a count rate image of the region. The peak exposure in the combined exposure map is 21125 s. Finally, the point sources and ribs were filled in as needed with the average rate in the surrounding region and the image was smoothed with a $5'$ (FWHM) Gaussian to produce the image shown in Figure 2, which is based on 80240 counts.

The anticorrelation between the 1/4 keV intensity and the 100μm contours is striking, and is in itself convincing evidence that the soft X-rays are being absorbed by the gas in the Draco cloud. This satisfies our first requirement for classification as an absorption feature. The distance estimate satisfies our third point. Fits of soft X-ray intensity vs. 100μm brightness satisfy the second point by showing the relationship expected for photoelectric absorption.

We have compared the 1/4 keV X-ray image with 100μm maps using a simple two component slab absorption model /27/:

$$I = I_L + I_D \exp[-\sigma_{100} I_{100}], \tag{1}$$

where I is the observed X-ray intensity, I_L and I_D are the intensities of the local and distant X-ray components, and I_{100} is the 100μm surface brightness. We fitted this model to the 1/4 keV X-ray data with the results shown in Table 1. We showed that the best-fit cross-sections for these fits are very close to the expected value, providing evidence that the mechanism involved is actually absorption. We are in the process of repeating this analysis for a three component model that is more representative of the 21 cm and optical data for this direction.

TABLE 1 Fit results (from /27/)

Region	I_L	I_D	σ_{100}	χ^2_ν	ν
North	$450 \pm 30^*$	$800 \pm 100^*$	1.08 ± 0.23	1.15	193
South	$440 \pm 80^*$	$1130 \pm 100^*$	1.03 ± 0.26	1.08	189

*Units of 10^{-6} counts s^{-1} arcmin^{-2}

check this!

The halo intensity inferred from these fits, if adjusted for absorption along the off-cloud lines of sight and corrected for the latitude of this observation, corresponds to a total million degree halo luminosity of about 10^{41} ergs/s if we assume that the emissivity is uniform within a galactic radius of 15 kpc and that the halo is the same above and below the galactic disk. We show below that these assumptions are not warranted by other shadowing observations, and this is therefore an overestimate of the luminosity of million degree gas in the Milky Way halo.

Two of our Draco observations were obtained with the Boron filter over the central portion of the field of view. This filter provides a distinctly different low energy bandpass (BF band) than provided by the proportional counter itself, and this additional energy information can, in principle, provide useful diagnostics of temperature and absorption. In Figure 3 we present a preliminary mosaic of the inner 18.5' of our two Boron filter observations of the Draco cloud, with 100μm contours overlaid. There is clearly a shadow along the north-eastern boundary of MBM 41, with a depth of $\sim$ 36%. The fact that the BF band shadow is shallower than the higher energy C band shadow is consistent with our interpretation of this line of sight, since we expect the distant emission component to be absorbed by the low velocity gas across the entire field. This observation is confirmed by a C1/C2 band ratio map, in which we have divided the unfiltered 1/4 keV band (C band) into two sub-bands with slightly different energy responses. Both the C1/C2 map and a B/C2 ratio map show that the Draco shadow is softer than the surrounding emission. Quantitative analysis will require additional data reduction and modeling of the expected transmission of this gas to the X-rays in this bandpass, but we expect to be able to use these data to help constrain our models of this line of sight.

We show the 3/4 keV band data for this direction in Figure 4. This image is based on only 6194 photons, so it is much noisier than the 1/4 keV image. The optical depth to these X-rays is small except in the center of the molecular cores. There is little evidence for a 3/4 keV shadow, in contrast to clouds such as MBM 12 (below). The apparent shadowing seen in this figure is due to a low energy "photon leak" in this band, which has a slight response to 1/4 keV X-rays. Although this response is small, the incident flux is much higher in the 1/4 keV band than at 3/4 keV, so the 1/4 keV features appear weakly in this map. The lack of shadowing at the centers of the molecular cores of MBM 41 argues that there is little true 3/4 keV shadowing seen here. Further analysis is required to place a firm limit on halo emission in this energy band.

MBM 40

We include this cloud as an example of why an observed 1/4 keV minimum aligned with a high latitude cloud cannot be automatically taken as evidence of halo emission. MBM 40 is a fairly typical high latitude molecular cloud /42/ located at $(\ell, b) = (37.^\circ6, 44.^\circ7)$, with a roughly circular projection on the sky, a diameter of about one degree, and a peak antenna temperature (CO) of 4.4 K. It lies directly on the HI shell of Loop I, just outside the North Polar Spur. A plausible explanation for its superposition on this HI shell is that it represents a molecular clump within the shell. If so, we can estimate its distance from a knowledge of the geometry of Loop I. For a distance to Loop I of 130 ± 75 pc /44/, we obtain a distance to the shell of 70 ± 40 pc. MBM 40 has an optically determined distance (from interstellar absorption lines) within the range $90 < d < 150$ pc /45/, consistent with this interpretation.

Due to an error in the *ROSAT* timeline, our PSPC observation of MBM 40 obtained only 30% of the desired time at the position of the cloud. Figure 5 shows our 3000 s observation combined with the outer annulus of a 7000 s filtered observation. The exposure towards the cloud is 75% of the time we obtained in our first observation of Draco, and there is clearly no striking shadow similar to Draco visible in our MBM 40 data. Our preliminary estimate of the apparent shadowing depth is $\sim 20\%$. (This estimate will be revised when a set of instrument maps appropriate for the pointed phase of *ROSAT* observations becomes available, and is likely to decrease somewhat at that time.)

This apparent shadow cannot be caused by absorption of galactic halo X-rays. The Loop I shell has a column density in the direction of MBM 40 of 3.8×10^{20} cm^{-2} above the local background level. This represents 4.8 optical depths for 1/4 keV X-rays, and the soft X-ray transmission of the HI shell is less than 1%. The apparent shadow must be produced by some other effect.

A chance coincidence cannot be ruled out, but seems unlikely. The other obvious possibilities are displacement or absorption by a cloud within the Local Bubble. With a peak 100μm brightness of 10.6 MJy/sr, MBM 40 is over 10 optical depths for 1/4 keV X-rays, and we cannot distinguish between these possibilities on the basis of our X-ray observations. Displacement would require that the cloud occupy ~ 20% of this line of sight within the Local Bubble, or 10's of parsecs, while the angular diameter of the cloud is consistent with a size of only 1–2 pc. We think that the more plausible scenario is that the cloud is contained inside the Local Bubble; in this case the HI shell of Loop I must be farther from us than MBM 40, and we have probably underestimated its distance.

MBM 40 appears to have a shallow 3/4 keV shadow with about 20% depth. However, the correlation between 3/4 keV count rate and 100μm surface brightness is weak. Further analysis will be required to interpret these results and must take into account foreground emission and the contribution from the cosmic X-ray background (extragalactic sources fainter than our source detection limit).

low E leak?

G192–67

In Figure 6 we show a preliminary 1/4 keV image for G192–67. This high latitude cloud is one of a class of cometary clouds that includes the Draco cloud /38/. Odenwald has placed G192-67 into a different morphological category of cometary clouds than the Draco cloud, based on a lack of optical nebulosity /46/. For our purposes, this object is most interesting as one of the highest latitude distinct 100μm clouds identified, which therefore provides an excellent probe of halo gas in this direction. Unfortunately, the distance to this cloud is not yet known. The 1/4 keV image has an apparent shadow of ~ 25% depth, but it is offset from the position of the cloud by about 20 arcminutes. This position discrepancy is difficult to understand if the X-ray minimum results from absorption by the cloud, and we tentatively conclude that this feature is produced by some other mechanism (possibly coincidence). If interpreted as absorption of halo emission, the halo intensity in this direction is roughly 20% of the halo intensity toward the Draco cloud.

There is no evidence for a shadow in our preliminary 3/4 keV image, in spite of the fact that this cloud has a higher optical depth than MBM 40. The peak optical depth is about 1/2 for 3/4 keV

X-rays, and we would expect to see evidence of shadowing by at least the cosmic X-ray background. Further interpretation of this result must await a more complete analysis.

Ursa Major (the Lockman Hole)

ROSAT survey observations of a large region in Ursa Major, including the region known as the Lockman Hole with the lowest N_H in the sky /15/, show a complex relationship between N_H and 1/4 keV intensity /47/. The simplest statement one can make about this region of the sky is that a general anticorrelation is observed between N_H and 1/4 keV intensity in this region, and that some N_H clouds (at unknown distances) appear to shadow $\sim 50\%$ of the soft X-rays seen towards neighboring regions. However, this is not true everywhere in the field, and the interpretation of these data is not yet clear. If these apparent shadows are measuring halo gas, then the unabsorbed halo intensity in this direction is roughly 1/3 the halo intensity toward Draco.

MBM 12, MBM 36

Preliminary analysis of pointed observations of the high latitude molecular clouds MBM 12 and MBM 36 /19/ indicates that neither cloud shows a 1/4 keV shadow, but both have 3/4 keV shadows. In fact, MBM 12, the closest known high latitude molecular cloud at 65 pc /48,49/, shows a particularly deep shadow of 70% in the 3/4 keV band. Since the 3/4 keV intensity in this direction is lower than the intensity over most of the sky, the observed intensity toward MBM 12 is only 20% of the typical value. This appears to be in striking contrast to the lack of 3/4 keV shadows toward the clouds discussed above. When similar data are available for more clouds we can begin to understand the source of the 3/4 keV background, which is currently the most poorly understood component of the SXRB.

The lack of 1/4 keV shadowing by these clouds is not surprising, since both have background column densities of roughly 10^{21} cm^{-2}, many optical depths at this energy. These clouds therefore do not provide information about the hot halo unless it is contributing to the 3/4 keV band. The lack of 1/4 keV shadows towards these clouds implies that they are located outside of the Local Bubble.

HALOS OF EDGE-ON SPIRAL GALAXIES

The work described above is aimed at the difficult problem of trying to ascertain the structure of our own galactic halo from the inside. An alternative approach for understanding halos of spiral galaxies and their connections to the interstellar medium is to observe the X-ray halos of other galaxies. The characteristics of a hot halo can most easily be determined through observations of edge-on spirals, where the integration path through the halo is maximized and confusion with disk emission is minimized. *Einstein* IPC observations of edge-on galaxies placed upper limits of 1×10^{39} ergs/s and 2×10^{38} ergs/s on diffuse halo emission from NGC 3628 and NGC 4244, respectively /50/. The task is not easy in practice, even with *ROSAT*, because of possible confusion with disk emission. However, halo emission has apparently been detected in NGC 891 /51/ and possibly in NGC 4631 /52/. By contrast, NGC 4244 has no detectable halo emission at a level well below the limit set with the IPC /53/. Other galaxies will undoubtedly be added to this list over the next year or two and should significantly increase our understanding of galactic halos and their interactions with the interstellar medium.

DISCUSSION

There are now *ROSAT* pointed observations or survey results in hand for over a dozen fields, including 8–10 at high latitudes that can be used to derive information on the galactic halo. Half a dozen of these have had at least preliminary data reduction and analysis performed, and most appear to shadow the SXRB in the 1/4 keV band and/or the 3/4 keV band. As shown by the cases of MBM 40 and G192-67, however, further analysis is required to determine whether the 1/4 keV results really represent shadows of halo emission. The 3/4 keV results are less ambiguous because of the lower absorption cross-section in this band, but they need further work to identify the fraction of the observed shadows that can be attributed to weak extragalactic sources and to determine the nature of the galactic component (derived from observations at low latitudes where the extragalactic and halo components will be heavily absorbed) before we can make definitive conclusions about halo gas at several million degrees. Both components have conflicting results towards different clouds, and the reason is not understood yet. There is clearly much work yet to be done to understand these data completely.

Progress during the first year of *ROSAT* pointed observations was hampered by both the slow processing of *ROSAT* data and by the lack of calibration data and software tools needed to analyze diffuse emission. Both of these problems are now largely solved; the *ROSAT* processing pipeline has eliminated its backlog and is producing a rapid turnaround, and software tools are now in place for reducing and analyzing these data. The backlog now is in the hands of the scientists who have been deluged with new data over the past several months, but the experienced gained over the past year with the first shadowing fields will enable us to eliminate the data analysis backlog as well. Many additional clouds are on the *ROSAT* timeline for the current six month observing season or are on the target list for possible observations during the next observing season. Of particular interest for halo studies are several very high latitude clouds similar to G192-67. We can therefore expect more rapid progress over the remainder of the useful lifetime of the *ROSAT* PSPC.

We emphasize the importance of optical work to determine the distances to these shadowing targets. While the X-ray observations can tell us where the X-ray emission originates with respect to these clouds, followup optical work is essential to obtain accurate distances to these objects in order to interpret the X-ray results. Some of this work is in progress, but much more is needed. This work is expected to be most challenging for the high latitude clouds essential for halo studies, since the background stellar density is low for these objects.

Finally, we note that the shadowing observations we have already obtained are inconsistent with all existing global models of the SXRB: displacement, absorption, etc. As usual, reality is proving to be more complex than the simple global models that have been produced to date. Shadowing observations with *ROSAT* are revealing a complex relationship between soft X-ray emission from the Local Bubble and galactic halo and absorption by interstellar clouds. It seems less likely with each new observation that a simple global model of the SXRB can be constructed that can account for all of the data. Meanwhile, as we continue to probe as many lines of sight as possible with the PSPC, we are directly measuring foreground and background contributions in these directions, rather than inferring them indirectly on the basis of global models. We believe that the success of *ROSAT* shadowing observations should be exploited fully to obtain data on as many lines of sight as possible before further attempts to create global models for the SXRB are pursued.

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Fig. 1. IRAS 100μm image of the Draco cloud.

Fig. 2. 1/4 keV mosaic of the southern corner of the Draco cloud (MBM 41).

Fig. 3. Boron filter mosaic of MBM 41.

Fig. 4. 3/4 keV mosaic of MBM 41.

Fig. 5. 1/4 keV image of MBM 40.

Fig. 6. 1/4 keV image of G192–67.