Inverse relations between 0.25 keV counts and local interstellar dust

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A preliminary comparison of color excesses and HEAO-1, A2 0.25 keV counts have been performed on two angular levels in order to search for indications of local photoelectric absorption.

a. Color excesses and background counts are smoothed to a common 1.5 1.5 sq.deg. beam. Although distance information on the color excesses are available it is not used in this first attempt. The lines of sight to which the excesses pertain have however a length comparable to the expected viewing distance at these energies in the local medium. Figure 1 displays the resulting average counts/pixel versus average excess/pixel for the five areas investigated. A general decrease of the counts with excess is apparent. The wide scatter in the individual regions is probably due to excess variations on scales smaller than the collimated beam. The minimum counts on the diagram come from a region where an almost coherent sheet of dust is present within a distance ~200 pc. The constancy of the minimum counts in this particular direction indicates that the soft X-ray emission probably originate exclusively in front of the matter observed to be present. Note that the SGP counts show a shallow inverse dependence on excess. The latitude distribution of the five areas assures that the general inverse relation of the 0.25 keV counts on color excesses is not a latitude effect.

b. What may appear more exciting is the existence of an inverse relation between 0.25 keV counts and color execesses on angular scales 0.001 sr, corresponding to the projected size of individual diffuse clouds. For this purpose SA 162, (l,b)=(21,-59) data are presented . The counts and color excesses are now compared on a 0.5×0.5 sq.deg scale.Given a measured number of counts/pixel the excesses do show quite a range of values. The absorbing material varies however on scales ~30'. All excesses pertain to the nearest few hundred pc. Most of the excess variation is due to the small scale angular variation and nct to any radial variation. The main problem is to decide which measure of the amount of absorbing matter to compare to the counts. In order to have a representation of absorbing matter present as typical as posibel, and selected in an untiased way, the comparison is restricted to the

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pixels where the excess has been measured along at least two different lines of sight. Figure 2 is a display of the upper and lower excess limits versus counts/pixel for the subsample where such a detailed comparison was possible. The 0.25 keV counts/pixel do decrease with both the lower and upper excess limit. Part of this variation is undoubtedly due to photoelectric absorption but depends also on the fraction of the beam coevered by absorbing material. The lower envelope may be due to the largest clouds and accordingly be the best representation of the dependence of counts on excess. To have an idea of the relative distribution of local and remote contributions to the counts an exponential is fitted to the average excess for a given count:

$$N(\text{counts}) = 5\exp(-\sigma(0.25\ \text{keV}) \times N(H)/E(b-y) \times \langle E(b-y)\rangle) + 11$$

This expression indicates that 2/3 of the background originates in front of the absorption but that the remote contribution has about the same importance in the directions where there is little obscuration.

It remains to be investigated whether the HEAO-1,A2 soft X-ray data are sufficiently accurate to support a variation of only 10 - 20 %. The discussion also tacitly assumed a constant ratio between gas and dust in the diffuse medium.

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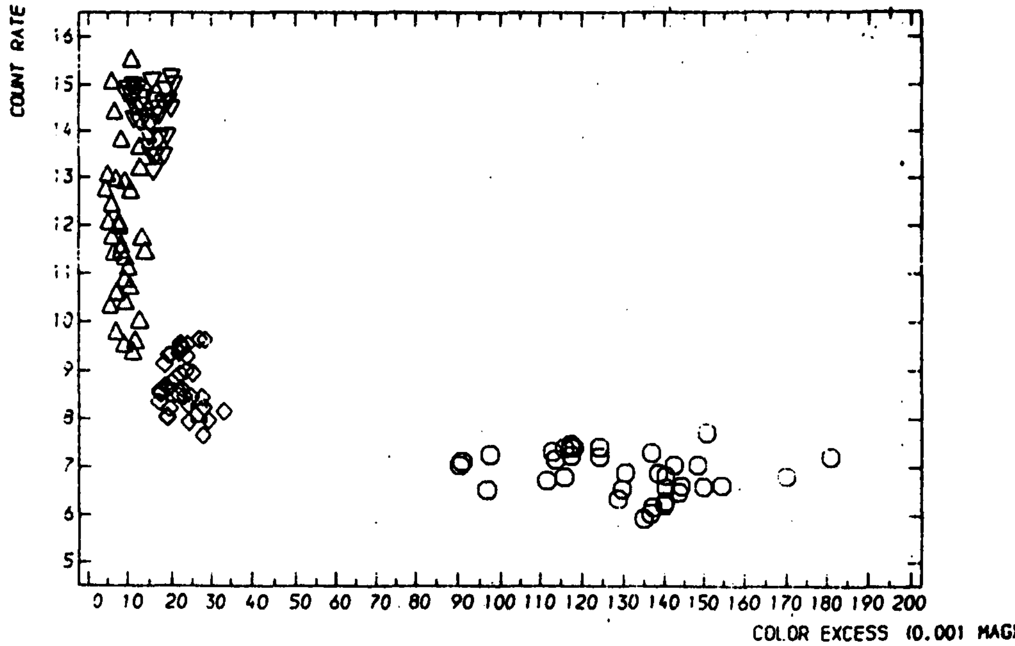

Fig. 1. 0.25 keV counts versus color excess for five Selected Areas: ◻ SA 128, ◇ 141, △ 144, ○ 156, ▽ 162. Averaged over 4 sq.deg beams.

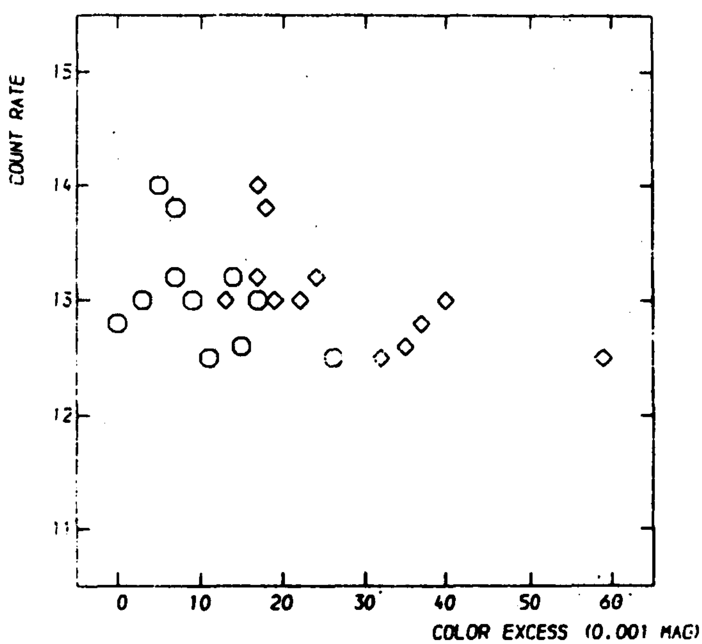

Fig.2. 0.5 0.5 sq.deg counts versus upper and lower excess limit. Only pixels with more than two extinctions observations.

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