X-ray Scattering on Interstellar Dust

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X-rays are scattered on interstellar dust grains. X-ray sources are, therefore, surrounded by haloes of faint, diffuse emission. We have studied about 200 X-ray sources using ROSAT - PSPC data of both all-sky survey and pointed observations. Approximately 50 sources show substantial amount of scattering. From the X-ray spectrum obtained by the same measurement, the interstellar absorption can be determined which offers the unique opportunity to observe both contributions to interstellar extinction (scattering and absorption) simultaneously. A surprisingly good correlation exists between both quantities indicating that interstellar dust and gas must be cospatial to a large extend throughout the Galaxy. For X-ray sources having optical counterparts, the visual extinction also correlates well with the X-ray scattering. These correlations (or, in some cases, the missing correlation) lead to interesting consequences: the comparison of X-ray scattering with visual extinction can be used, for instance, in order to verify the optical identification of X-rays sources using the X-ray data itself. Furthermore, this analyis allows to distinguish between interstellar and local or intrinsic absorption: in the case of Cas A, this provides an interesting explanation why the explosion of Cas A has (almost) not be seen 300 years ago. Possibly, Cas A was embedded in a dense cloud the dust of which has been destroyed subseqently by the shock wave of the supernova explosion.

A quantitaive analysis of the scattering and absorption cross sections yields an indication that interstellar dust grains are 'fluffy' or porous (with voids up to 70%) rather than 'solid little rocks'. High resolution spectro-imaging of scattering haloes could provide a help in answering the question wether or not dust grains have a silicate core surrounded by a mantle of organic (C, N, O) materials.

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P. Predehl and S. Klose, Astron. Astrophys 306, 283-296 (1996)
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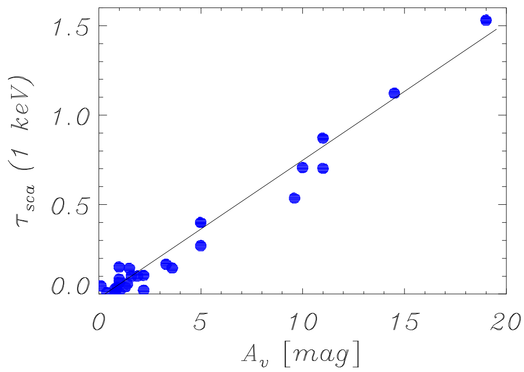

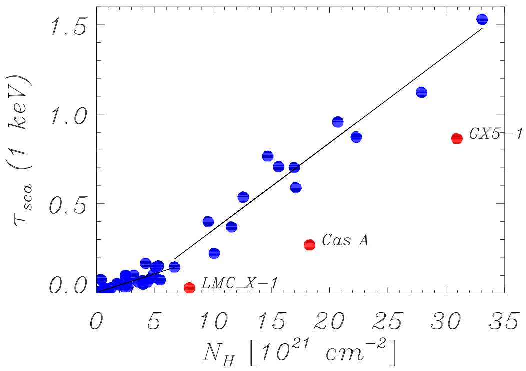

$1 kpc \Leftrightarrow A_V = 1.8 mag \Leftrightarrow \tau_{sca}(1 keV) = 0.16$

$N_H[cm^{-2}] = 1.79 \times 10^{21} \times A_V[mag]$