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Micro-photometry by scattered light.

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The quantitative evaluation of photographically recorded X-ray interference patterns based on micro-photometry of the processed film suffers from the non-linear relation between the light transmitted of which the density is an inverse function, and the X-ray dose received by the film. As a result, the quantitative evaluation of diffraction spots is a rather formidable problem. About 30 years ago Brentano, Baxter and Cotton pointed out that, within a reasonable range, a linear relation should exist between the light scattered by the grains and the X-ray dose; their experiments showed, however, that the fraction of scattered light was truly linear only for low densities below perhaps 0·2 and then tailed off. This linear range was too small to make the method practicable. The authors quite rightly attributed this failure to the fact that light, in order to be scattered, must also penetrate the film and therefore suffer attenuation by absorption. No further thought seems so far to have been given to getting over this difficulty (Buerger, 1960).

It occurred to us that changing the silver grains into transparent crystals of high refractive index would enhance the scattering and reduce the absorption. Reactions of this kind are parts of well known intensification or reduction techniques; of the ones we tried bleaching the film in a solution of 6g mercuric chloride and 6g potassium bromide in 250 ml water was best. When this bleaching procedure was combined with the measurement of the intensity of light scattered backwards, instead of the light scattered forwards, the meter reading was found to be linear with density (as determined before bleaching) up to densities of about 1·1.

There is far less light scattered backwards (at about 120°) than forwards (at about 20°) but no difficulty arises from this if a photomultiplier is used. It was found necessary, however, to place the film in immersion oil or Canada balsam between a clear and a blackened glass plate in order to prevent primary and forward scattered light from being reflected backwards at film-glass-air interfaces.

The light received by the photomultiplier is then a measure of the X-ray dose that has fallen onto the illuminated area; obviously, allowance must be made for scattering by the blank film. The modification of Brentano's method here proposed offers therefore the prospect of a simple and reliable method of measuring integrated intensities such as are recorded by a rotating crystal, Weissenberg and similar photographs.

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Lattice constants of the ternary ordered alloys $AgAuCd_2$, $AgAuZn_2$, and $CuAuZn_2$*.

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Ternary ordered structures have been observed around the stoichiometric compositions for the alloys $AgAuCd_2$, $AgAuZn_2$, and $CuAuZn_2$. The last alloy was first independently reported by Schubert, Burkhardt, Esslinger, Günzel, Meissner, Schütt, Wegst & Wilkens (1956), and more recently by Duggin & Rachinger (1964), who studied a nonstoichiometric alloy, 31·2% Cu, 23·5% Au, 45·3% Zn. Rothwarf & Muldawer (1962) observed ternary ordering of gold–silver over a wide range of composition near $AgAuCd_2$. In all three alloys, the noble metal order gradually disappears as the temperature is raised (Muldawer, 1966).

Visual intensity observations of the powder patterns and lattice constant measurements indicate that the three ternary phases have the Heusler alloy structure ($L2_1$), space group $Fm3m$, with the noble metals ordered in positions 4(*a*) and 4(*b*) and Zn or Cd occupying positions 8(*c*), 16 atoms per unit cell. These ternary alloys differ from most of the other Heusler alloys in that the compound ABC_2 is made up of binary compounds AC and BC. The only other compound satisfying this requirement known to this author is Ni_2TiAl (Taylor, 1961).

Lattice constants of these alloys were determined from precision measurement of powder pattern lines. The values reported in Table 1 are the average of several determinations, each of which was obtained using a Nelson–Riley extrapolation. It is believed that these results are good to one part in 10^4. Included in the table is the value reported by Duggin & Rachinger for their alloy.

Table 1. *Lattice constants of alloys*
Compositions are in at. %.
The last alloy is that of Duggin & Rachinger.

Alloy	Composition			Lattice constant
$AgAuCd_2$	24·82,	25·11,	50·07	6·6462 Å
$AgAuZn_2$	26·02,	25·21,	48·77	6·2943
$CuAuZn_2$	24·72,	25·22,	50·06	6·1273
$CuAuZn_2$(DR)	31·2,	23·5,	45·3	6·098

* A preliminary report of these alloy structures was presented at a meeting of the American Crystallographic Association, June 1962.