Abstract Submitted
for the SES14 Meeting of
The American Physical Society

Specular Reflection as the Universal Formulation for N-dimensional Diffraction Gratings, N=1- 3 MING YIN, Benedict College Physics/Engineering, Columbia, SC 29204, LEI WANG, MICHAEL WESCOTT, TIMIR DATTA, Physics & Astronomy, USC, Columbia, SC 29208 — Textbooks in Optics introduce the subject by the familiar 1-d grating formula, a[$\alpha - \alpha_{\rm i}\}= {\rm n_x}\lambda$, here 'a' is the grating constant and λ is wavelength. Ever since the development of precession ruling engines by Rowland, 1- dimensional optical diffraction gratings have become ubiquitous, and workhorse in optical devices. Optical cross gratings (2-d) with lines ruled in both x & y directions are treated *mutatis mutandis* by a pair of 1-d grating formula. In 1912, Max von Laue, Nobel Physics for 1914, proposed his three fundamental equations for 3-d, x-ray grating as: a[$\alpha - \alpha_{\rm i}\}= {\rm n_x}\lambda$; b[$\beta - \beta_{\rm i}\}= {\rm n_y}\lambda$ and c[$\gamma - \gamma_{\rm i}\}= {\rm n_z}\lambda$, here α, β & γ ($\alpha_{\rm i}$, $\beta_{\rm i}$ & $\gamma_{\rm i}$) are the direction cosines of the outgoing (incoming) x-ray beam. Furthermore for simplicity an orthorhombic crystal structure with lattice constants a, b & c, oriented along each Cartesian axis respectively, were assumed. However, Laue's grating theory was soon superseded by Lawrence Bragg's namesake formula 2dSin(θ) = nλ. Peter Ewald's reciprocal lattice construction demonstrated that when certain conditions, 3-d diffraction process reduces to Bragg's reflection law. We show that reflection is a generic or universal treatment for one, two or three-dimensional gratings.

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Date submitted: 26 Sep 2014 Electronic form version 1.4