Abstract Submitted
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3-dimensional indexation of the icosahedral diffraction pattern using the techniques of electron microscopy ANTONY BOURDILLON, UHRL — The following facts about icosahedra need wider attention. 1) The golden section τ is as fundamental to the icosahedral structure (length /edge) as π is to the sphere (circumference /diameter). 2) The diffraction series are in restricted Fibonacci order because the ratio of adjacent terms f_n/f_{n-1} does not vary, but is the constant τ. The series is therefore geometric. 3) Because of the tetragonal subgroup in the icosahedral point group symmetry, many axes in the icosahedral structure have identical orientation to axes in the face centered cubic matrix of Al_6Mn [1] (e.g. [100] and [111]). On these bases, a three dimensional stereographic projection will be presented. 4) A quasi-Bragg law is derived that correctly represents the diffraction series in powers of τ [2]. Furthermore, by employing the normal conventions of electron microscopy, all diffraction patterns are completely indexed in three dimensions. These are the topic of this presentation. Significant consequences will be presented elsewhere: 1) The diffraction pattern intensities near all main axes are correctly simulated, and all atoms are located on a specimen image. 2) The quasi-Bragg law has a special metric. Atomic locations are consistently calculated for the first time. 3) Whereas the Bragg law transforms a crystal lattice in real space into a reciprocal lattice in diffraction space, the quasi-Bragg law transforms a geometric diffraction pattern into a hierarchic structure. 4) Hyperspatial indexation [3] is superceded. [1] Shechtman, D.; Blech, I.; Gratias, D.; Cahn, J.W., Metallic phase with long-range orientational order and no translational symmetry, Phys. Rev. Lett., **1984**, 53, 1951-3. [2] Bourdillon, A. J., Nearly free electron band structures in a logarithmically periodic solid, Sol. State Comm. **2009**, 149, 1221-1225. [3] Duneau, M., and Katz, A., *Phys Rev Lett* **54**, 2688-2691

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