Poster Presentation

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Different teaching way to space group and symmetry operation: polyhedral vs ball

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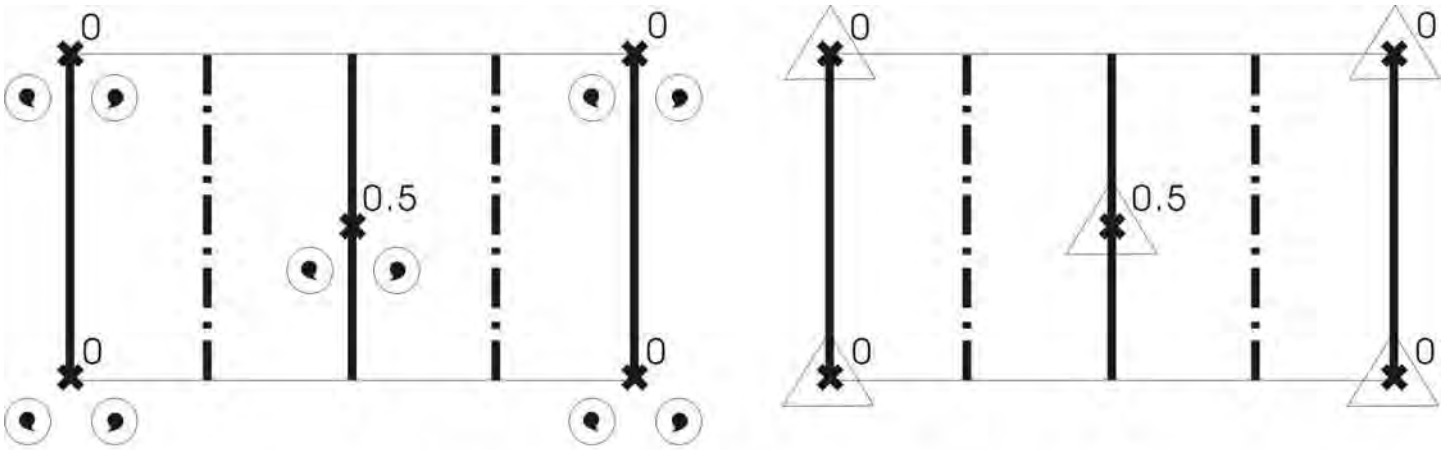
To introduce the regulations of space group combining with a symmetry operation, put an orientation ball at a position shift away from the lattice tops is a good way [1]. However, based on the fundamental knowledge of "lattice", it often occurs that the tops of a lattice "should be" the positions of "atom balls" thought by most beginnings in teaching practice. This "thought" leads them never deduce out those regulations in symmetry operations and often misleads a wrong conclusion. As a beginning one wishes watching movies and pictures instead of mathematical deduction or vector calculation. It easily arises that a lattice has eight tops with atom balls. This "idea" lets the orientation balls shifting away from the lattice tops become difficult to understand. Nevertheless, the balls with a sign of "comma" in the middle are also difficult to understand that they can stand for a certain orientation because ball is circle. "Tops" and "directions" are two troubles in learning crystallographic symmetry and symmetry operations for those beginnings. How to guide them to overcome the two fences is an important step that will lead those beginnings to a never understanding status, on one hand, or let them understand throughout all regulations of space group(s) combining with a symmetry operation on the other. From teaching practice, a polyhedral at lattice tops could overcome both difficulties at position and in orientation. First, a polyhedral is always in orientation, even it is a cubic. This is easily understood. Secondly the centre of a polyhedral could easily meet with the tops of a lattice; it lets students easily understand "a lattice has eight tops occupied – a natural thought by beginnings". This way let them easily understand and deduce all regulations in crystallographic symmetry operations, such as a body-centred lattice combining with a symmetry plane (m) produces n symmetry operation at 1/4t, etc. see figures below.

[1] *T. Hahn, International Tables for Crystallography – brief teaching edition of volume A, Kluwer Academic Publishers, 1996.*



Thin lines: boundaries of a lattice, thick-solid lines: m, dot-discountinous lines: n, X: typic positions of a body-centred lattice.

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