Standing waves of X-rays and their diverse applications in condensed matter physics

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Wherever there are waves, there is always a possibility of forming standing waves. Different notes generated on the strings of a *sitar* or *guitar* are actually standing waves. X-rays are electromagnetic waves. So standing waves of X-rays can be generated by using diffraction or reflection of X-rays from materials. For this purpose synchrotron X-radiation is the best source. However, this can be done in laboratories using X-rays from sealed tubes or rotating anode X-ray generators. The physics of generation of standing waves of X-rays will be discussed. Thereafter examples of different applications in condensed matter physics will be presented. These include (i) solution to the phase problem in crystallography, (ii) determination of phonon eigenvectors, (iii) atomic structure on surfaces, (iv) melting transition on surfaces, (v) surface segregation in polymer blends, (vi) diffusion across interfaces in multilayers, (vi) X-ray waveguides and their applications in the study of nanofluid and several other examples. The power of this little known technique in India will be revealed.