Spettroscopia neutronica

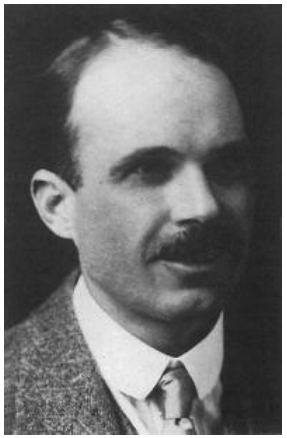
Ci sono 2 modi per determinare le energie dei neutroni:

•Determinarne la velocità tramite la misura del *tempo di volo* su distanze note (ToF) [richiede fasci pulsati]

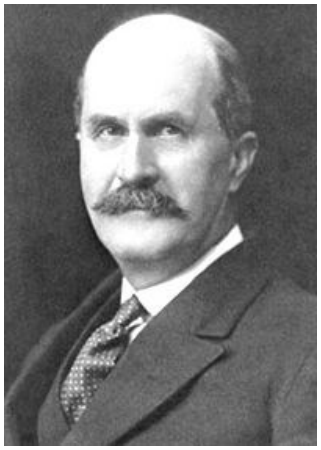
•Determinarne la lunghezza d'onda attraverso la *diffrazione da cristalli*

Mr. W. L. Bragg & father

the pioneers of diffractometry & of neutron beam monochromatization



W. L. Bragg



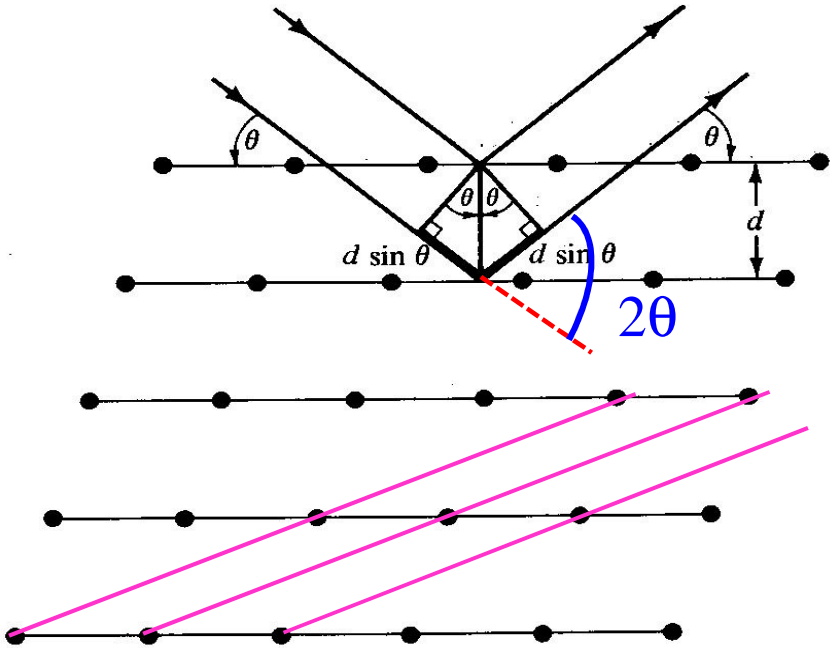
W. H. Bragg

(W.L.) Bragg's law ruling the reflection of X rays or neutrons by crystals is at the basis of diffractometry and energy selection.

Bragg's law: $n\lambda = 2\,d\,\sin\theta$

single crystal diffraction with

Monochromatic beams



λ is fixed → a given *d*-spacing can give reflection only if λ < 2*d* (Bragg's cutoff).

If λ is appropriate, a given *d*-spacing defines the set of crystal orientations that ensure the right θ for constructive interference and observation of a reflection

If the orientation is appropriate to observe reflection from a set of lattice planes, reflection takes places in a precise direction (incident beam, reflected beam and the normal to the planes must lie on the same plane)

By rotating the crystal it is possible to reach the condition for Bragg reflection from other sets of lattice planes (other *d*-spacings)

Bragg's law: $n\lambda = 2\,d\sin\theta$

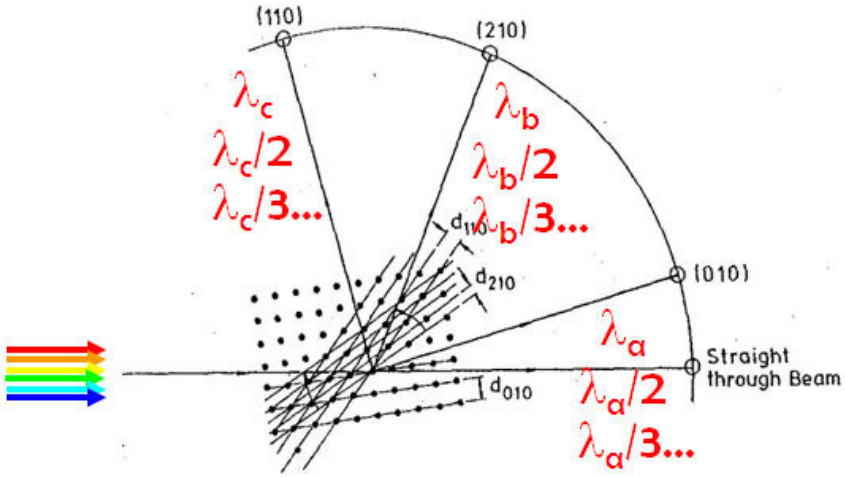
single crystal diffraction with

Polychromatic beams

Many λ's → various sets of lattice planes can have the appropriate orientation for Bragg's reflection.

A given *d*-spacing selects the particular wavelength that obeys Bragg's law.

Reflections due to different *d*-spacings correspond to different scattering angles



A certain *d*-spacing selects not only (its own) λ, but also λ/2, λ/3, …. giving reflection at the same scattering angle.