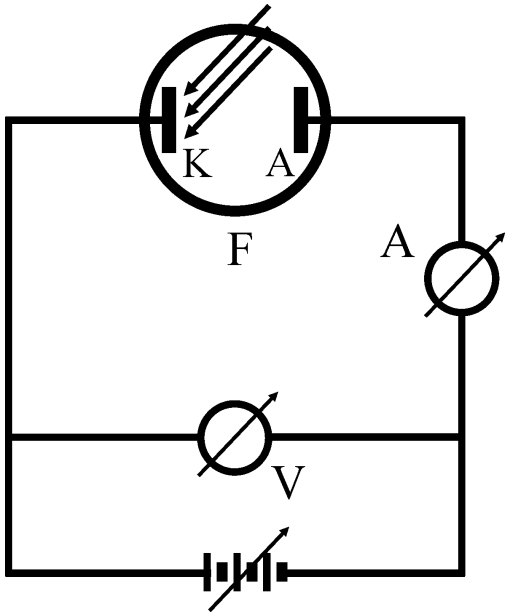
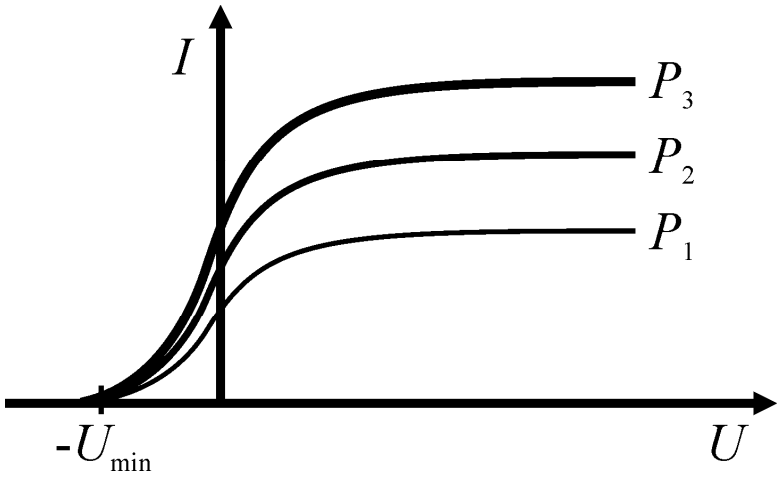
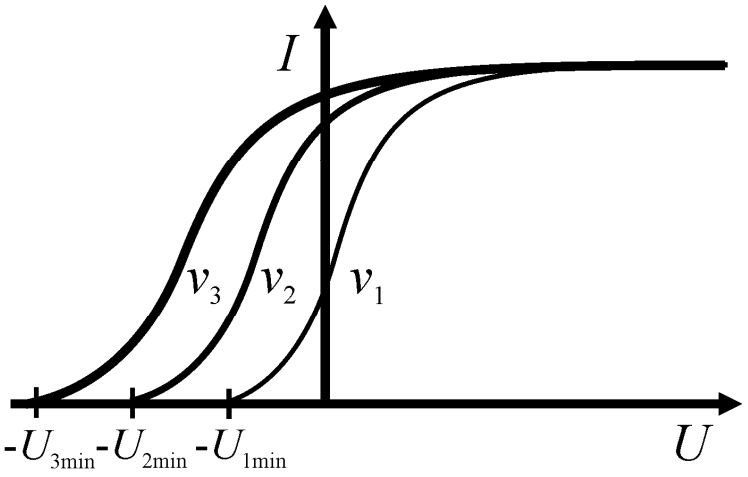
Фотоефекат

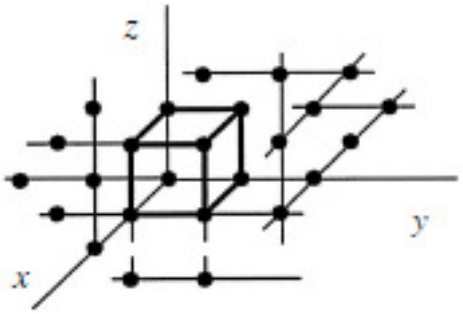


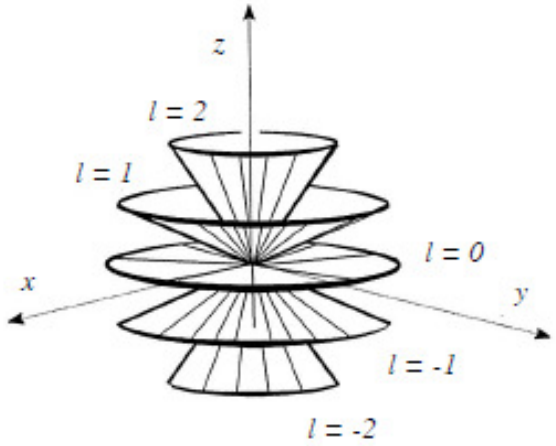
$$h\nu = A_i + eU$$

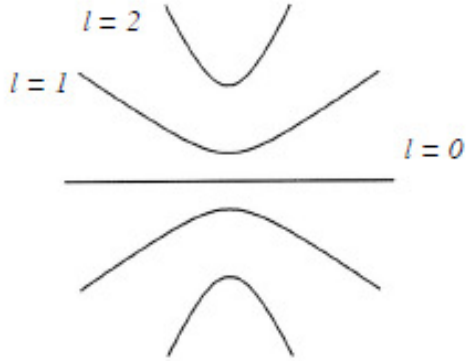


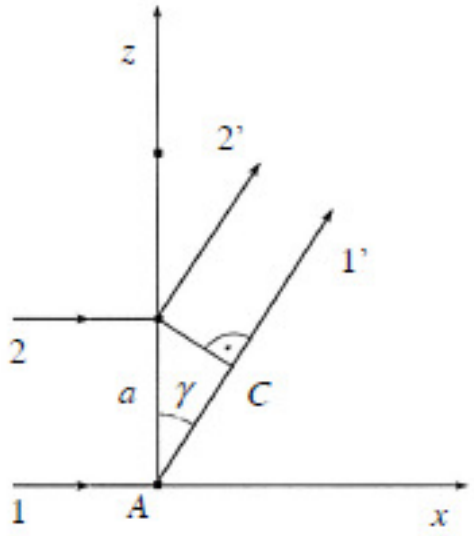


Дифракција x-зрачења, Лауеов метод

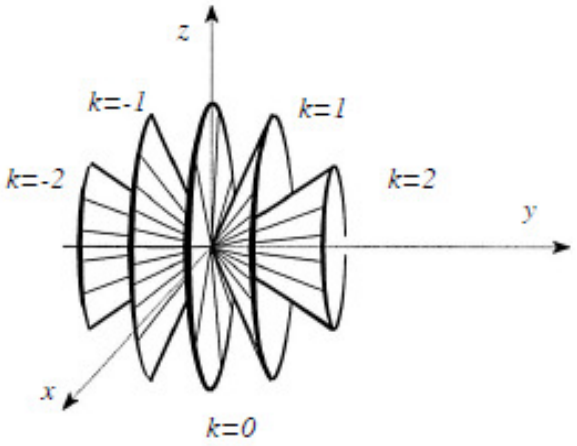


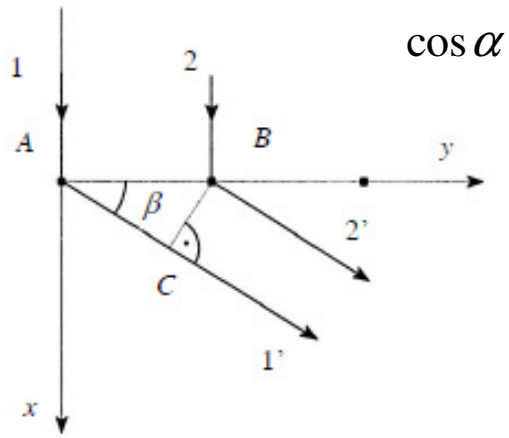






$$\delta = \overline{AC} = a\cos\gamma = l\lambda$$



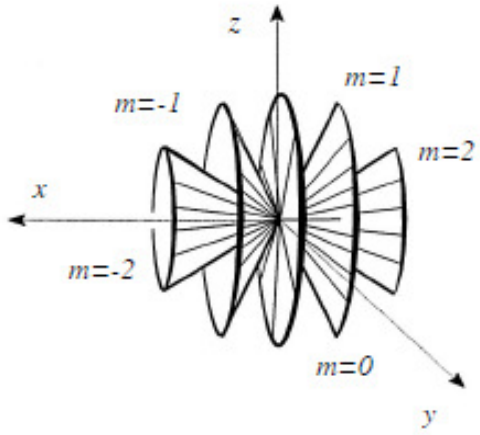


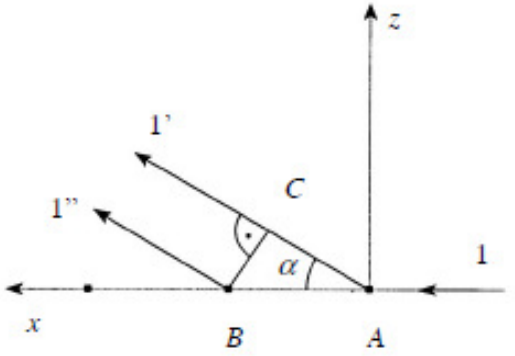
$$\cos\alpha = 1 - \frac{m\lambda}{a}; \quad \cos\beta = \frac{k\lambda}{a}; \quad \cos\gamma = \frac{l\lambda}{a}$$

$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$$

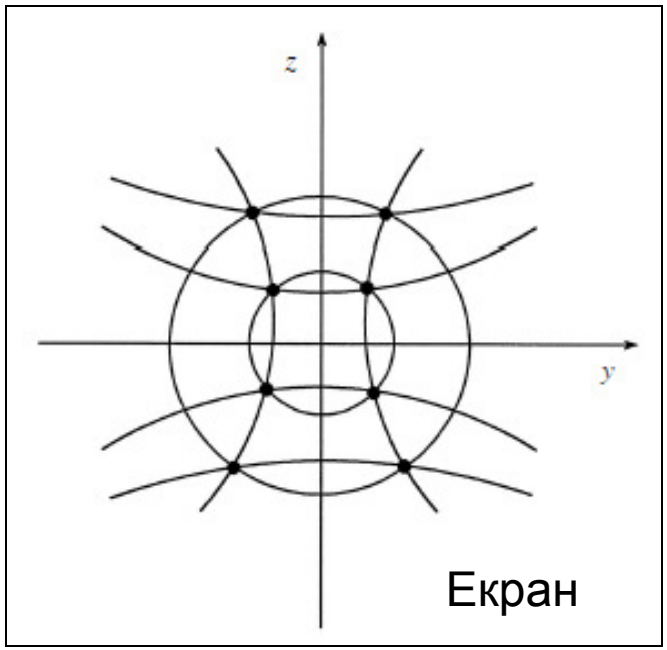
$$\delta = \overline{AC} = a\cos\beta = k\lambda$$

$$\lambda = \frac{2ma}{m^2 + k^2 + l^2}, m > 0$$

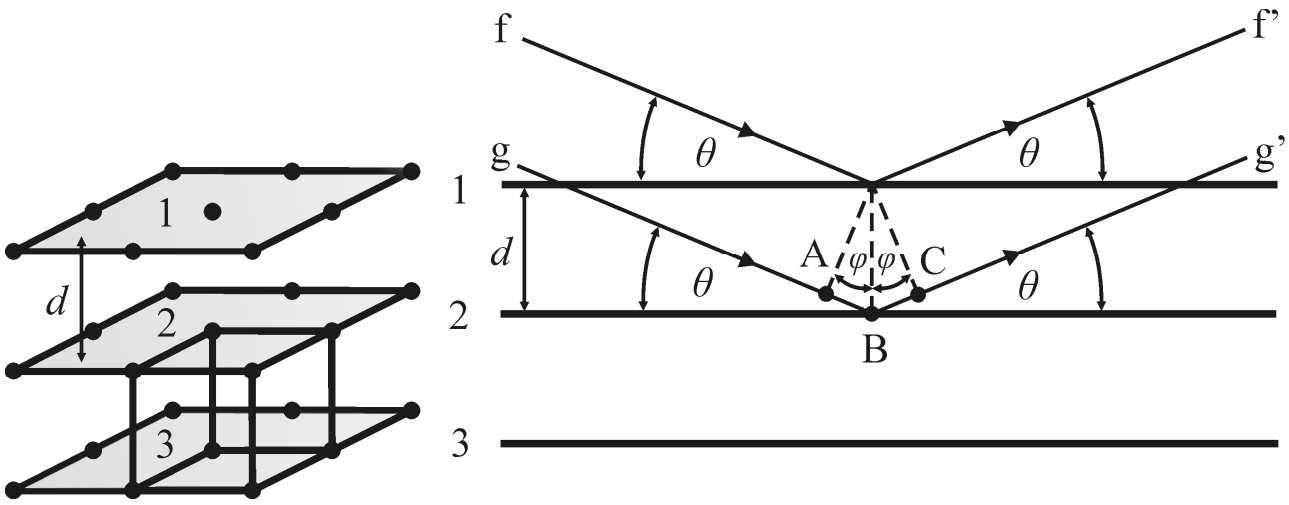




$$\delta = \overline{AB} - \overline{AC} = a - a\cos\alpha = m\lambda$$



Дифракција x-зрачења, Брагов метод

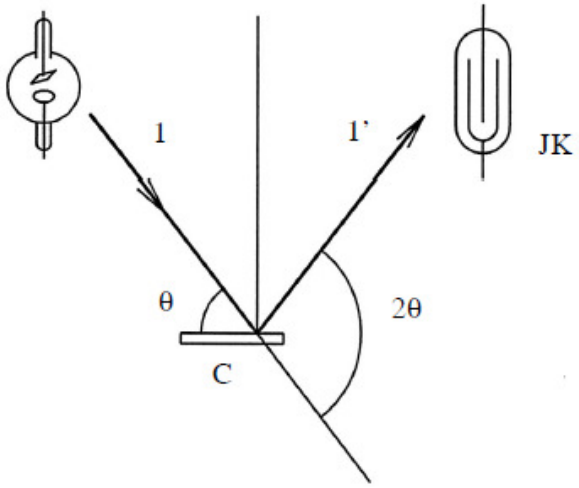


$$\overline{AB} + \overline{BC} = n\lambda$$

$$\varphi = \theta$$

$$\overline{AB} = \overline{BC} = d \sin\theta$$

$$2d \sin\theta = n\lambda$$



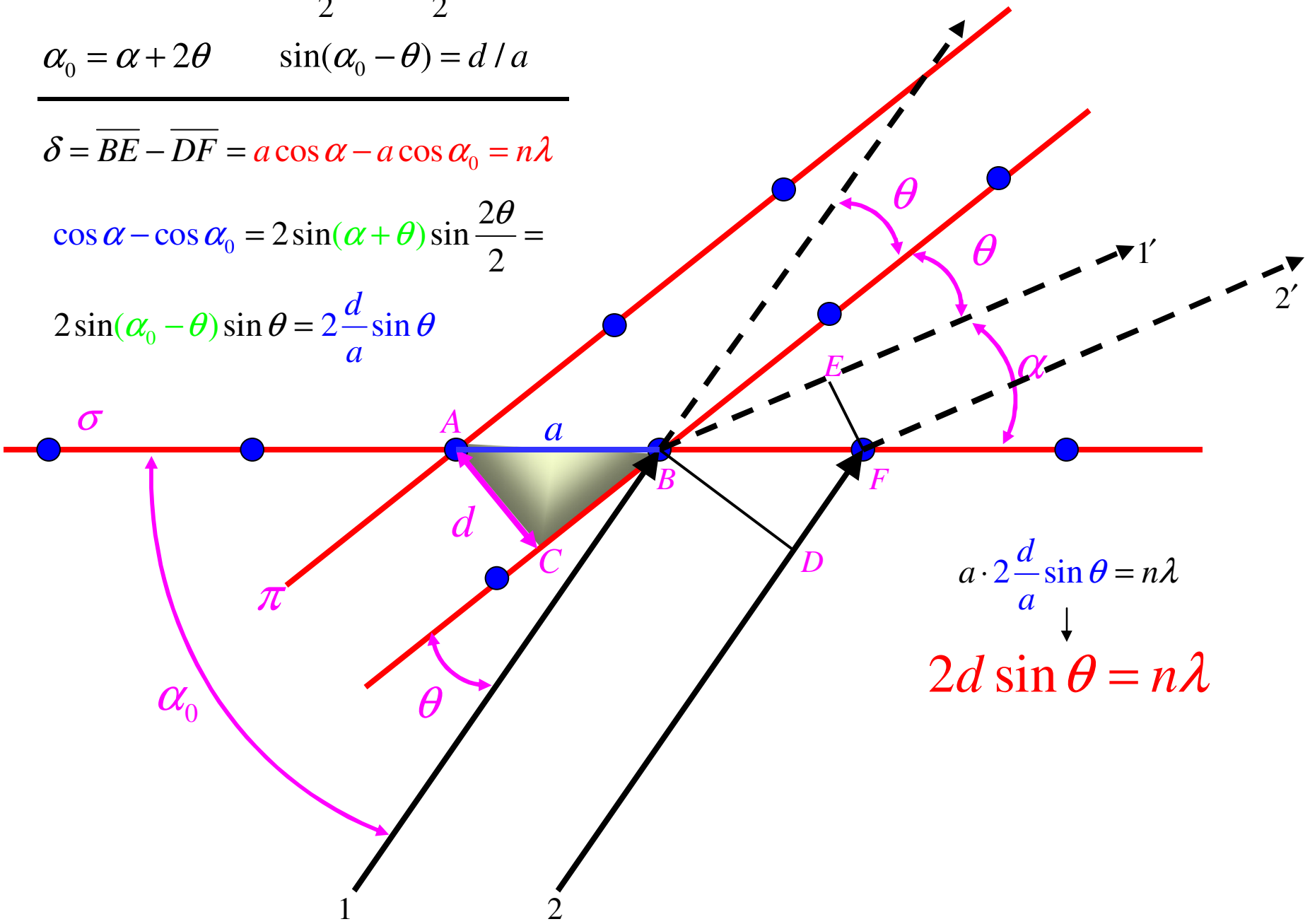
$$\cos x - \cos y = 2\sin\frac{x+y}{2}\sin\frac{y-x}{2}$$

$$\alpha_0 = \alpha + 2\theta \qquad \sin(\alpha_0 - \theta) = d/a$$

$$\delta = \overline{BE} - \overline{DF} = a\cos\alpha - a\cos\alpha_0 = n\lambda$$

$$\cos\alpha - \cos\alpha_0 = 2\sin(\alpha+\theta)\sin\frac{2\theta}{2} =$$

$$2\sin(\alpha_0 - \theta)\sin\theta = 2\frac{d}{a}\sin\theta$$

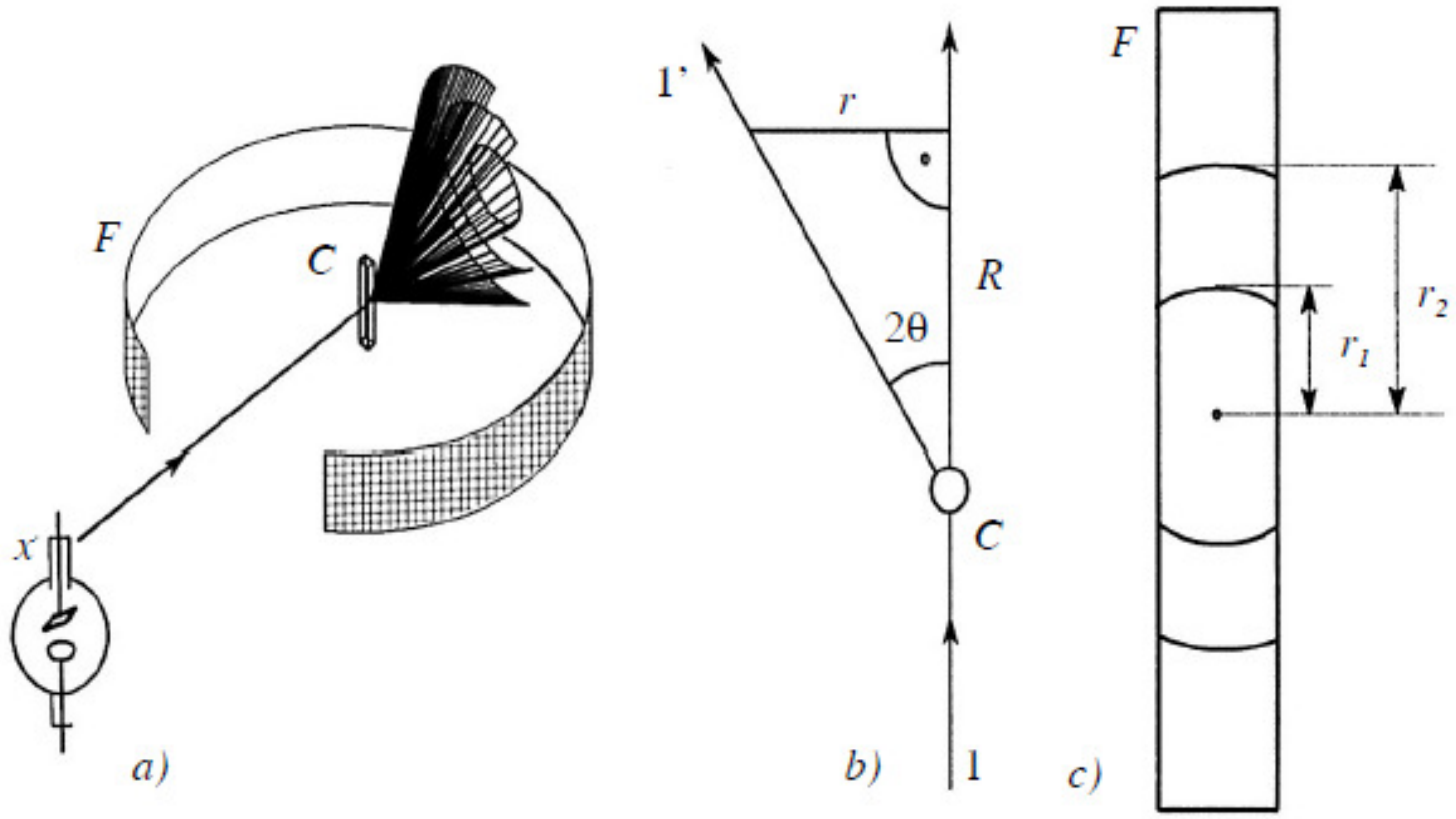


$$a \cdot 2\frac{d}{a}\sin\theta = n\lambda$$

$$\downarrow$$

$$2d\sin\theta = n\lambda$$

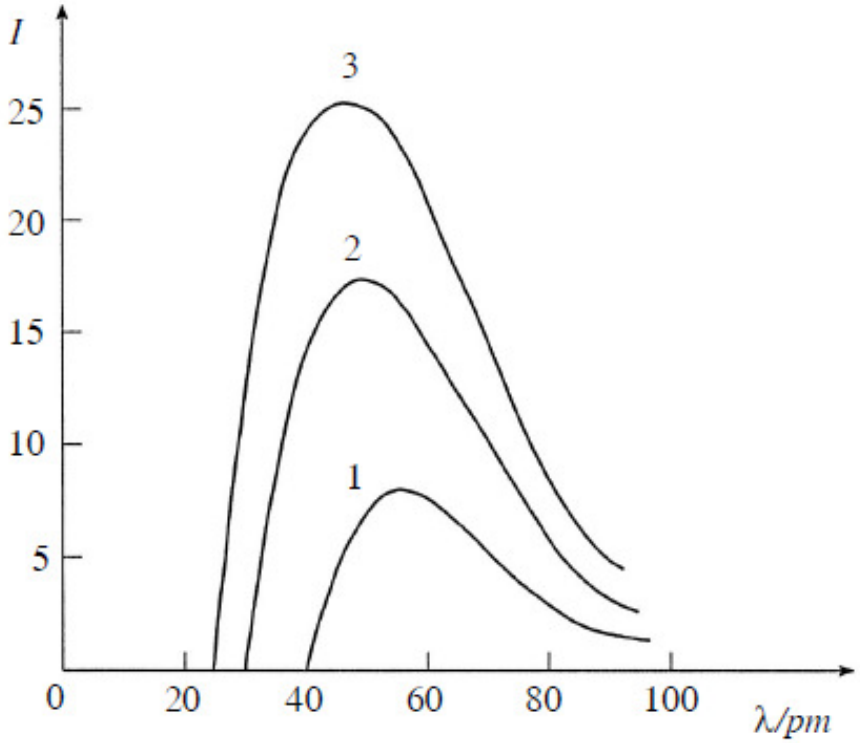
Дифракција x-зрачења, Дебај-Шереров метод

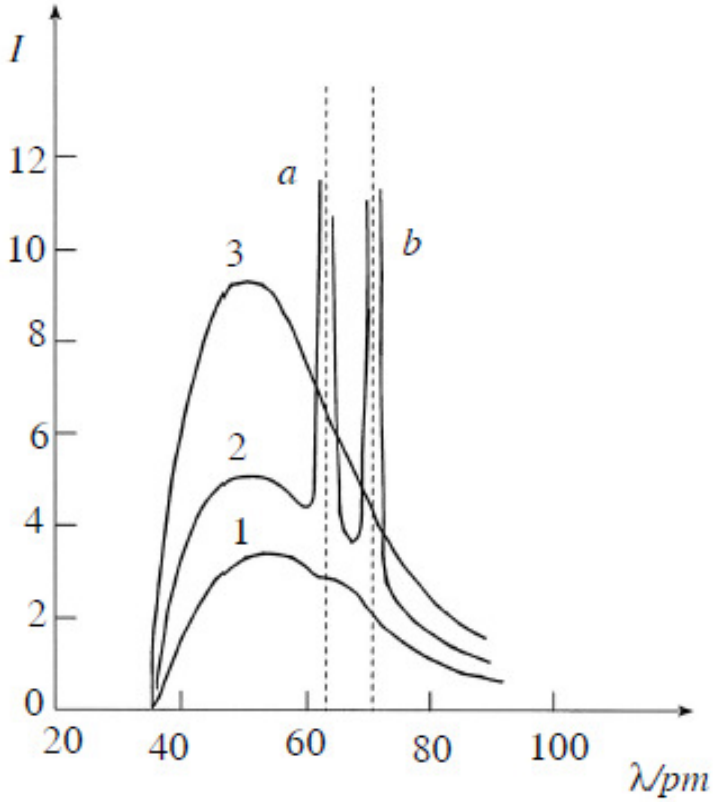


$$r / R = \tan 2\theta = \frac{\sin 2\theta}{\cos 2\theta} \approx \sin 2\theta = 2 \sin\theta \cos\theta \approx 2 \sin\theta$$

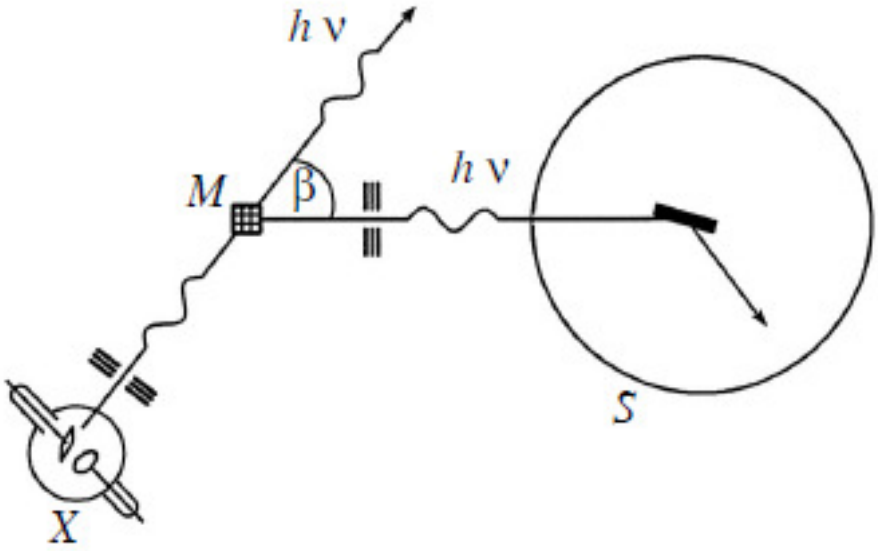
$$2d \sin\theta = n\lambda \Leftrightarrow 2d \frac{r}{R} = n\lambda$$

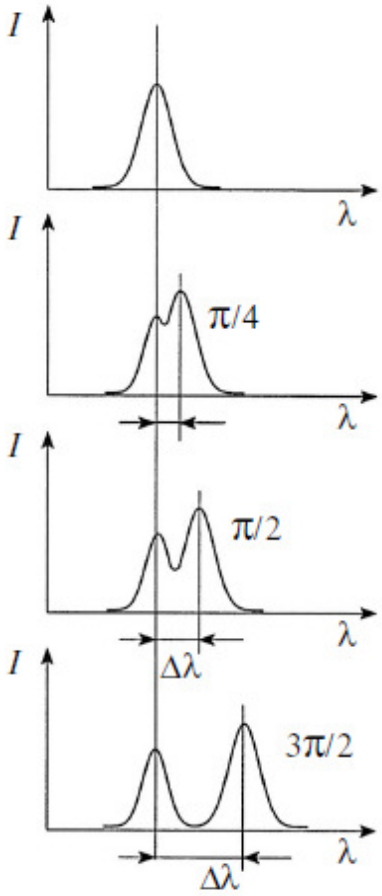
Континуално и карактеристично рендгенско зрачење

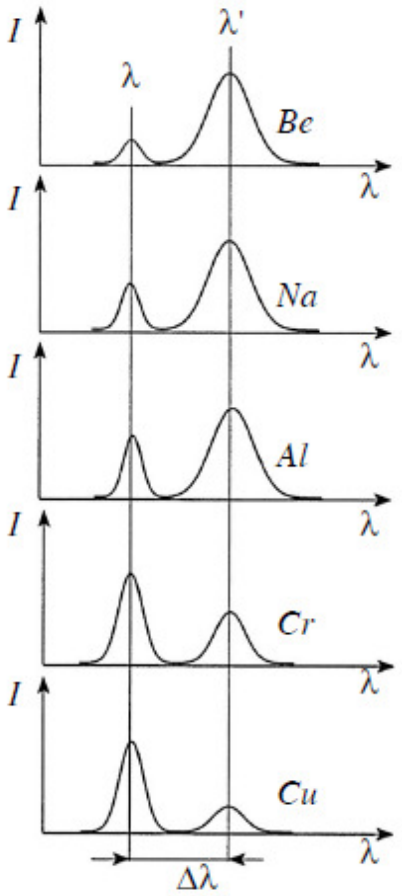


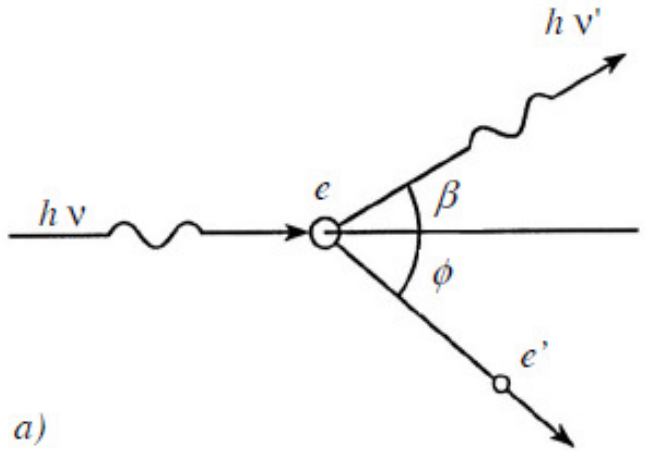


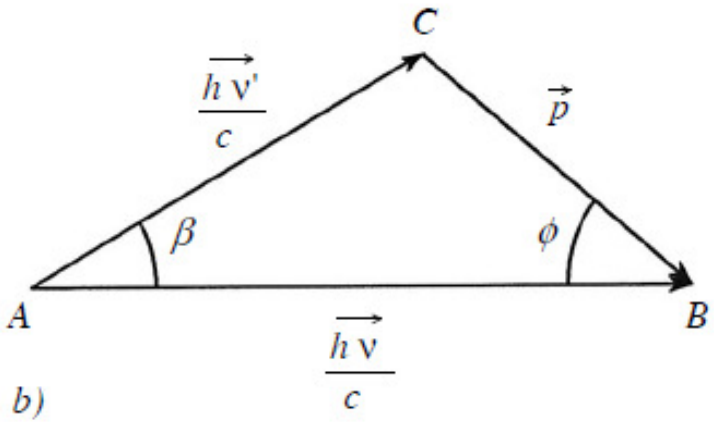
Комптонов ефекат











$$h\nu + m_0c^2 = h\nu' + mc^2$$

$$\vec{p}_f = \vec{p}'_f + \vec{p}_e$$

$$\rightarrow \quad p^2 = \left(\frac{h\nu}{c}\right)^2 + \left(\frac{h\nu'}{c}\right)^2 - 2\left(\frac{h\nu}{c}\right)\left(\frac{h\nu'}{c}\right)\cos\beta$$

$$h\nu + m_0c^2 = h\nu' + \sqrt{p^2c^2 + m_0^2c^4}$$

$$p^2c^2 = \left(h\nu + m_0c^2 - h\nu'\right)^2 - m_0^2c^4$$

$$p^2c^2 = (h\nu)^2 + (h\nu')^2 - 2h\nu h\nu'\cos\beta$$

$$\rightarrow -h\nu\nu' + \nu m_0c^2 - \nu' m_0c^2 + h\nu\nu'\cos\beta = 0$$

$$m_0c^2(\nu - \nu') = h\nu\nu'(1 - \cos\beta)$$

$$\downarrow$$

$$\left(\frac{1}{\nu'} - \frac{1}{\nu}\right) = \frac{h(1-\cos\beta)}{m_0c^2}$$

$$\lambda' - \lambda = 2\frac{h}{m_0c}\sin^2\frac{\beta}{2}$$

$$\vec{p} = m\vec{v} = \frac{m_0\vec{v}}{\sqrt{1-\frac{v^2}{c^2}}} \rightarrow p \equiv \left|\vec{p}\right| = m\left|\vec{v}\right| = \frac{m_0 v}{\sqrt{1-\frac{v^2}{c^2}}} \rightarrow v = \frac{pc}{\sqrt{m_0^2c^2 + p^2}}$$

$$\mathrm{d}A = \vec{F}\cdot\mathrm{d}\vec{r} = \frac{\mathrm{d}\vec{p}}{\mathrm{d}t}\cdot\vec{v}\mathrm{d}t = \vec{v}\cdot\mathrm{d}\vec{p}$$

$$\vec{v}\mathrm{d}\vec{v} = \mathrm{d}\left(\frac{\vec{v}\cdot\vec{v}}{2}\right) = \mathrm{d}\left(\frac{\left|\vec{v}\right|^2}{2}\right) = \mathrm{d}\left(\frac{v^2}{2}\right) = v\mathrm{d}v$$

$$\mathrm{d}\vec{p} = m_0\mathrm{d}\left[\vec{v}\left(1-\frac{v^2}{c^2}\right)^{-1/2}\right] = m_0\left[\left(1-\frac{v^2}{c^2}\right)^{-1/2}\mathrm{d}\vec{v} + \vec{v}\left(-\frac{1}{2}\right)\left(1-\frac{v^2}{c^2}\right)^{-3/2}\left(-\frac{2\vec{v}\mathrm{d}\vec{v}}{c^2}\right)\right]$$

$$\mathrm{d}\vec{p} = m_0\mathrm{d}\vec{v}\left(1-\frac{v^2}{c^2}\right)^{-3/2}\left[\left(1-\frac{v^2}{c^2}\right)+\frac{v^2}{c^2}\right] = \frac{m_0\mathrm{d}\vec{v}}{\left(1-\frac{v^2}{c^2}\right)^{3/2}}$$

$$\mathrm{d}A = \vec{v}\mathrm{d}\vec{p} = \frac{m_0 v\mathrm{d}v}{\left(1-\frac{v^2}{c^2}\right)^{3/2}}$$

$$A = T = \sqrt{p^2c^2 + m_0^2c^4} - m_0c^2$$

$$E = T + m_0c^2$$

$\left(w = 1-\frac{v^2}{c^2}\right)$

$$A = \int_0^v \frac{m_0 v\mathrm{d}v}{\left(1-\frac{v^2}{c^2}\right)^{3/2}} = \frac{m_0c^2}{\left(1-\frac{v^2}{c^2}\right)^{1/2}}\Bigg|_0^v = \frac{m_0c^2}{\left(1-\frac{v^2}{c^2}\right)^{1/2}} - m_0c^2$$