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SFERIK KO‘ZGU VA UNDA TASVIR YASASH MAVZUSINI O’QITISHNING ILMIY-NAZARIY ASOSLARI

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Annotation:
Provides information about teaching physics based on pedagogical technologies.

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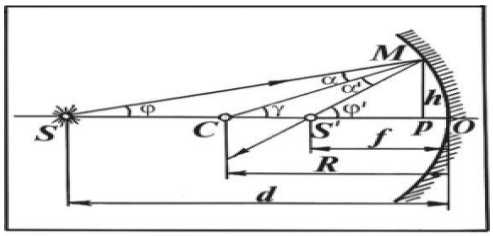
Hozirgi kunda mamlakatimiz ta’lim tizimida amalga oshirilayotgan chuqur islohatlar ta’lim sifatini oshirishda va har tamonlama yetuk kadrlarni tayyorlashda muhim ahamiyat kasb etmoqda. Bunday kadrlarni tayyorlashda fanlarning ilmiy-nazariy asoslarini yangicha yondoshuvlar asosida o’qitish dolzarb pedagogik muammo hisoblanadi. Ushbu maqolada aynan shu masala “Optika” bo’limining “Sferik ko’zgu va unda tasvir yasash” mavzusi misolida ko’rib chiqilgan.

Sferik ko‘zgu yaxshi ishlov berib silliqlangan shar sirtining bir qismidir. Yorug‘lik nuri sferik sirtning ichki va tashqi sirtidan qaytishiga qarab sferik ko‘zgular mos ravishda botiq va qavariq ko‘zgular deyiladi. 1- rasmda botiq sferik ko‘zgu tasvirlangan. Shar sirtining C markazi ko‘zguning optik markazi, shar sigmentining O uchi esa ko‘zguning qutbi deyiladi. C optik markazidan o‘tadigan har qanday nur ko‘zguning optik o‘qi, sfera markazi C dan va ko‘zgu qutbi O dan o‘tadigan CO optik o‘q ko‘zguning bosh optik o‘qi deyiladi.



1-rasm

Faqat bosh optik o‘q yaqinida va optik o‘qqa kichik burchak ostida kelayotgan nurlar markaziy nurlar yoki paraksial nurlar deb ataladi. Yorug‘lik chiqaruvchi S nuqtadan ko‘zgugacha bo‘lgan OS=d masofa, shu nuqta tasviri S′ dan ko‘zgugacha bo‘lgan OS′=f oraliq va sferik ko‘zgu radiusi OC =R orasidagi bog‘lanishni topaylik. Ravshanki, α — tushish burchagi bo‘ladi, chunki bu burchak tushayotgan nur va shar sirtiga perpendikulyar bo‘lgan MC=R radius orasida hosil bo‘ladi, α′ —qaytish burchagi. Uchburchakning tashqi burchagi to‘g‘risidagi teoremaga muvofiq SMC uchburchak uchun quyidagini yozish mumkin: γ=α+φ.

Xuddi shuningdek, S′MC uchburchak uchun φ′=α′+γ bo‘ladi. α=α′ ekanligini nazarga olib, quyidagi tenglikni hosil qilamiz:

$2\gamma = \varphi + \varphi'$. (1)

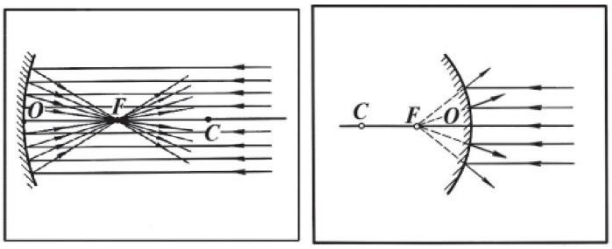
Paraksial nurlar bilan ish ko‘rilayotgani uchun bu burchaklarning hammasi juda kichik bo‘ladi va ular uchun quyidagi taqribiy tengliklarni yozish mumkin:

$\varphi' = tg\varphi' = \frac{h}{S'P} = \frac{h}{f}; \quad \varphi = tg\varphi = \frac{h}{SP} = \frac{h}{d}; \quad \gamma = tg\gamma = \frac{h}{CP} = \frac{h}{R}.$

Burchaklarning bu qiymatlarini (1) ifodaga qo‘yib, h ga qisqartirib, quyidagi formulani hosil qilamiz:

$\frac{1}{d} + \frac{1}{f} = \frac{2}{R}.$ (2)

Bu formula S nuqtadan chiqayotgan boshqa nurlar uchun ham o‘rinlidir, shuning uchun barcha qaytgan nurlar S′ nuqtada kesishadi, ya’ni S′ nuqta S nuqtaning tasviri bo‘ladi. Agar d $\to \infty$ bo‘lsa, u holda $f = \frac{R}{2}$ bo‘ladi, biroq d→∞ bo‘lganda ko‘zguga tushayotgan nurlar optik o‘qqa parallel, binobarin, bu nurlar ko‘zgudan qaytgandan keyin bu o‘qni qutbdan $\frac{R}{2}$ masofadagi nuqtada kesib o‘tadi (2-a,b rasm). Bu nuqta ko‘zguning fokusi F deyiladi.



2-a rasm 2-b rasm

Ko‘zguning qutbidan fokusgacha bo‘lgan masofa fokus masofasi deyiladi. Ko‘zguning fokusi orqali o‘tgan va optik o‘qqa perpendikulyar bo‘lgan tekislik ko‘zguning fokal tekisligi deyiladi. Fokus masofasi ham fokus singari F harfi bilan belgilanadi. Shunday qilib, sferik ko‘zguning F fokus masofasi ko‘zgu sferasi radiusining yarmiga teng. U vaqtda ko‘zguning fokus masofasi tushunchasidan foydalanib, (2) formulani quyidagicha yozish mumkin:

$\frac{1}{F} = \frac{1}{d} + \frac{1}{f}$ (3)

Qavariq ko‘zgu bo‘lgan holda, optik o‘qqa parallel nurlar qaytgandan keyin sochiladi, bu nurlarning davomi ko‘zguning orqa tomonida optik o‘qni bir nuqtada kesib o‘tadi. Bu nuqta ko‘zguning mavhum fokusi deyiladi (2-b rasm).

Sferik ko‘zgu formulasi tasvir va ko‘zguning fokusi haqiqiy bo‘lgan hol uchun keltirilib chiqarildi. Agar tasvir mavhum bo‘lsa $\frac{1}{f}$ had, ko‘zgu fokusi mavhum bo‘lsa $\frac{1}{F}$ had oldilariga minus ishorasi qo‘yiladi. Bunda F va f kattaliklarning o‘zi musbat deb hisoblanadi. Sferik ko‘zgu formulasidan sferik ko‘zguning fokus masofasi:

$F = \frac{f \cdot d}{f + d}$ (4)

ekanligi kelib chiqadi. Fokus masofaga tiskari bo’lgan kattalik ko‘zguning optik kuchi deb ataladi va fokus masofasi metr (m) hisobida o‘lchanganda optik kuch dioptriya (D) degan maxsus birlik bilan ifodalanadi:

$[D] = \frac{1}{[F]} = \frac{1}{1\,m} = 1\,D$ (5)

Yuqoridagi kattaliklardan shuni aytish mumkinki kuzgularning fokus masofasi kuzkuning egrilik radusining yarimiga teng bo’lar ekan.

Ushbu maqolada keltirilgan ilmiy nazariy yondoshuvlardan fizika o'qitish jarayonida samarali foydalanish dars sifatini oshirishga va keng ilmiy dunyoqarashga ega kadrlarni tayyorlashda muhim ahamiyat kasb etadi.

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