QUYOSH RADIUSINI ANIQLASH USULLARI

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Annotatsiya:
Ushbu maqolada Quyoshning fizik ko'rsatkichlari (burchak kattaaligi, radiusi) aniqlash usullari keltirilgan. Bu usullarda Quyosh tasvirining diametrini teleskopsiz va teleskopda o'lchash usullari yoritib berilgan.

Kalit so'zlar: Quyosh, burchakiy kattaligi, radius, Quyosh fizikasi, yorug' dog', difraksiya, eksperiment, difraksion dog', ekran, gardish, kuzatish, umumta'lim maktablari, dioptriya, absolyut va nisbiy xatolik.

Quyosh Yerdagi hayotning bardavomligini ta'minlab turuvchi, yuza qatlamlarini batafsil tekshirish va o'rganish mumkin bo'lgan eng yaqin yulduzdir. Quyoshni o'rganishda to'plangan bilimlar kishilarda Yerdagi hayot kelajagini tasavvur etish imkonini beradi va yulduzlar to'g'risida dastlabki fizik tushunchalarning shakllanishiga olib keladi.

Biz bu maqolamizda Quyoshning fizik ko'rsatkichlarini (burchakiy kattaligi, radiusi) aniqlash usullarini keltirdik, bu usullarda Quyosh tasvirining diametrini teleskopsiz va teleskop yordamida o'lchash nazarda tutiladi.

Astronomik kuzatishlar astronomiya o'qitishda muhim o'rin egallaydi, ular talaba (o'quvchi)larda osmon yoritkichlarini kuzatish va ularning ko'rinishi to'g'risida ma'lum ko'nikmalarning shakllanishiga olib keladi. Quyosh fizikasi mavzusi mazmunini o'rganishda Quyoshni oddiy kuzatish yordamida talaba (o'quvchi) oladigan bilimlariga ham tayanishni nazarda tutish kerak. Bunday kuzatishlar asosida umumta'lim maktablarida va pedagogika oliy ta'lim muassasalarida Quyoshning fizik parametrlarini o'rganish mumkin, ular nurning tarqalishi, to'siq chetida difraksiya va linzada parallel nurning yigilishi to'g'risida fizikadan olingan bilimlarni mustahkamlaydi.
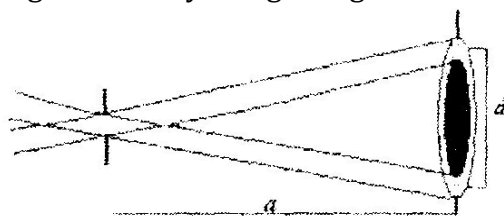
Quyosh fizikasi mavzusini o'qitishda Quyoshni kuzatish va tekshirishlar muhim ahamiyatga ega. Bunday kuzatish-tekshirishlarda Quyosh gardishi diametrini o'lchash kerak bo'ladi. Quyosh energiyasini o'lchashda, avvalo, uning burchak kattaligining yil davomida o'zgarib borishini hisobga olish kerak bo'ladi. Gap shundaki, Quyoshning Yerdan uzoqligi yil davomida o'zgarishi tufayli uning burchak diametri biroz o'zgarishi, Yerning Quyosh atrofida elliptik orbita bo'ylab aylanishi bilan bog'liq; iyulning boshida uning burchakiy diametri 31' 31" bo'lsa, yanvarning boshida 32'36" ga yetadi. Buni aniqlashda bir necha usullardan foydalanish mumkin. Quyoshning ko'rinma radiusini «Astronomik yejegodnik» yoki «Astronomik kalendar»ning har yil chiqariladigan qismidan topish mumkin.

Ishning maqsadi: Quyoshning burchakiy kattalignni o'lchash usullari aniqligini tekshirishdan iborat. Bunda talaba (o'quvchi) osmon yoritkichlarining kattaligini o'lchash usullari bilan tanishadi va ularning aniqligini topadi. Quyoshning ko'rinma diametrini o'lchashning eng sodda usuli - bu dioptriya usulidir.

1-usul: markazida kichik (kattaligi 0,1 mm) aylana teshik qilingan kvadrat shakldagi kartonni shtativga o'rnatamiz. Kartonni Quyosh nurlariga perpendikulyar tarzda qotiramiz. Aylana teshikdan o'tgan yorug'lik dastasini ekranga tushiramiz va ekranni nur bo'ylab aniq aylana gardish hosil bo'lgunicha suramiz. Chetlari aniq bo'lmagan yorug' gardish ko'rinadi. Buning sababi, kichik teshikda difraksiya

hodisa kuzatiladi, yorug' dog' esa difraksiyannng bosh maksimumidir. Teshikdan difraksion dog'ning ko'rinish burchagi teshik diametriga teskari proporsional o'zgaradi: teshik qancha kichik bo'lsa, difraksion dog' shuncha katta bo'ladi.

Teshikka yaqin joylashtirilgan ekranda hosil bo'lgan dumaloq, shakldagi yorug' dog' hali Quyoshning tasviri emas. Chunki, teshik qancha kichik bo'lsa, bu difraksion dog' (bosh maksimum)ning diametri shuncha katta bo'ladi va bu dog' teshikda Quyosh nurlarining difraksiyalanishi tufayli hosil bo'ladi. Ekranni teshikdan uzoqlashtira boshlasak, dog' ham kattalasha boradi va uning ichida unga simmetrik ravishda yorug' gardish hosil bo'ladi. Ekranni teshikdan uzoqlashtirgan sari gardish tez kengaya boshlaydi. Bunda yorug' dog' ham kengayadi, biroq bu kengayish gardishnikidan sekin bo'ladi. Ma'lum uzoqdikda ichma-ich simmetrik joylashgan ikkita, ichkisi tashqisidan yorug'roq, gardishlar hosil bo'ladi. Ichki gardish bu Quyosh gardishi bo'ladi, tashqisini esa teshikda difraksiyalangan Quyosh nurlari hosil qiladi. Bu usullar bilan bajarilgan kuzatishlarda Quyosh tasvirining diametri tashqi va ichki gardishlar diametri yig'indisining taxminan yarmiga teng.

1-rasm.

Agar yorug' gardish diametri d va teshikdan karton-ekrangacha bo'lgan masofa a bo'lsa, Quyoshning burchakiy diametrini radianlarda hisoblab topish mumkin.

$$\gamma(\text{радиан}) = \frac{\text{ёруг диск диаметри}(d)}{\text{картондан экрангача масофа}(a)}$$

Bu usulni boshqacha ko'rinishda ham bajarish mumkin. Quyosh nurlari perpendikulyar tushadigan bino derazasidan diametri d=5 mm o'lchamda aylana ochib, teshikdan o'tgan Quyosh nurlari yo'liga perpendikulyar ekran joylashtiramiz. Ekranda chetlariga nisbatan o'rtasi yorug' bo'lgan gardishni ko'rish mumkin. Gardish diametrini va teshik bilan ekran orasidagi masofani bilgan holda, Quyoshning burchakiy diametrini (yoy minutlarida) yuqoridagi formula yordamida hisoblab topish mumkin. Teshikdan ekrangacha masofa qancha katta bo'lsa, Quyosh tasvirining diametri shuncha katta va o'lchash xatosi shuncha kichik bo'ladi, Agar ekrangacha masofa 10 m bo'lsa, ekranda Quyosh gardishining diametri taxminan 10 sm bo'ladi.

2-usul: Quyoshning burchakiy diametrini maktab teleskopi yordamida ham o'lchash mumkin. Bunda teleskop obyektivini Quyosh nurlari yo'liga to'g'rilaymiz. Obyektivdan o'tgan va yig'ilgan Quyosh nurlari yo'liga karton-ekran joylashtiramiz. Ekranni tasvir aniq, bo'lguncha, gardish cheti aniq, ko'ringuncha nur dastasi bo'ylab siljitamiz va mahkamlaymiz. Obyektiv fokus masofasining yuzdan biriga teng kattalikda yorug' gardish hosil bo'ladi. Agar obyektiv fokus masofasi 1 m bo'lsa, gardish diametri taxminan 1 sm bo'ladi (dioptriyadagi singari), Bu gardishcha diametrini 1 mm aniqlikda o'lchash mumkin. Bunday aniqlikka 3 yoy minut to'g'ri keladi va u bilan Quyosh gardishi diametrining yil davomida o'zgarishini aniqlab bo'lmaydi. O'lchash aniqligini oshirish

uchun tasvir (gardish)ni kattalashtirish kerak. Buning uchun okulyar qo'llash mumkin. Fokus masofasi 10-20 mm bo'lgan okulyarni fokus masofasi F bo'lgan teleskop fokal tekisligi orqasiga o'rnatamiz va uning orqasiga teleskop optik o'qiga tik ekran joylashtiramiz. Ekranni optik o'q bo'ylab, tasvir aniq ko'ringuncha suramiz. Ekranda hosil bo'lgan gardish shaklidagi Quyosh tasviri fokal tekisligidagidan F/f marta katta bo'ladi (f-okulyarning fokus masofasi). Agar F=100 sm va f=20 sm bo'lsa, kattalashtirish 50 marta bo'ladi. Demak ekrandagi gardish diametri 50 sm bo'ladi. Bu gardish diametrini 1sm aniqlik bilan o'lchay olsak, unga Quyosh gardishida $\dfrac{31'}{50} = \dfrac{1860''}{50} = 37,1''$ to'g'ri keladi. Bu aniqlik qo'yilgan masalani yechish uchun yetarlidir.

Pedagogika oliy ta'lim muassasalarida astronomiya fanidan laboratoriya ishlarini tashkil etishda Quyosh gardishining ko'rinma diametrini aniqlashda yuqorida ko'rsatilgan usullardan foydalanib, o'lchashlarda olingan natijalarni kamida uch marta bajarib, o'lchashlarning o'rtacha qiymati va xatoligi (absolyut, nisbiy) aniqlanishi mumkin.

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