O’ZBEKISTON RESPUBLIKASI
OLIY VA O’RTA MAXSUS TA’LIM VAZIRLIGI

NIZOMIY NOMIDAGI
TOSHKENT DAVLAT PEDAGOGIKA UNIVERSITETI

FIZIKA-MATEMATIKA FAKULTETI

"Himoyaga ruxsat etilsin"
Fakultet dekani, dosent
_____ D.I.Yunusova
“_____”_____ 2013 йил

5140200 – "Fizika va astranomiya" ta’lim yo’nalishi
IV- kurs talabasi

KOMILOVA Dilso’za Ismatqulovnaning

"Gigant sayyoralar fizikasi" va uni axborot texnologiyalari muhitida o’qitish metodikasi

mavzusidagi

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Talaba: _____D.Komilova
Ilmiy rahbar: "Fizika va uni o’qitish metodikasi" kafedrasi dosenti
_____B.Sattarova
Taqrizchilar:
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"Himoyaga tavsiya etilsin"
"Fizika va uni o’qitish metodikasi"
kafedrasi mudiri, _____ dos.
X.M.Mahmudova
"____"_____ 2013 y.

Toshkent - 2013

MUNDARIJA

KIRISH

Mavzuning dolzarbligi. XXI asr nafaqat ilmiy-texnik axborotlar ko'lamining keskin ortishi bilan, balki texnologiyalarning sifat jihatidan mutlaqo yangi bosqichga ko'tarilganligi bilan ham farqlanadi. Respublikamiz Prezidenti Islom Karimov «YAngi darsliklarni, zamonaviy pedagogik va axborot texnologiyalari o'z vaqtida ishlab chiqarish va joriy etilishini ta'minlashni alohida nazorat ostiga olish zarur», deb ta'kidladilar[1]. SHu bois, fanning so'nggi yutuqlari asosini aks ettiruvchi ta'lim mazmuni ham tubdan yangilanib borilishi talab etiladi.

Bugungi kunda astronomiya darsi soatlarining keskin qisqartirilganli sababli, auditoriya soatlarida o'qitish uchun ajratilgan o'quv soatlarida yangi pedagogik va axborot texnologiyalaridan o'rinli foydalanish orqali yuqori samaraga erishish mumkin.

Ma'lumki, Astronomik kuzatishlarni bajarish yaxshi samara beradi, biroq, akademik litseylarda astronomiyani o'qitishda sinfdan tashqari astronomik kuzatuvlar uchun 6 soat ajratilgan bo'lib, bulardan 4 soati kechki kuzatuvni, 2 soati esa kunduzgi kuzatuvni tashkil etadi. Bunday kuzatishlarning ko'pchiligini auditoriya darsi sharoitida, kunduz kuni o'tkazib bo'lmaydi. Hozirgi zamon astronomik kuzatishlari raqamli kameralar vositasida bajariladi va ularning natijalari axborot markazlarida saqlanadi. Kuzatish natijalari keng ilmiy-pedagogik jamoatchilik uchun internet orqali ochiq bo'lib, ulardan o'quv jarayonida foydalanilsa, zamonaviy bilimlarni shakllantirishga zamin yaratiladi.

Akademik litseylarda rivojlangan hozirgi zamon astronomiya fanini o'qitish sifatini yaxshilash va takomillashtirish muammosining dolzarbligi, zamonaviy axborot texnologiyalarini astronomik ta'lim jarayoniga joriy etishning yetarlicha ilmiy asoslanmaganligi va uslubiyotda tadqiq qilinmaganligi, astronomiyadan ma'ruzalarni olib borishga bag'ishlangan metodik ishlanmalarning yetarli emasligi, virtual laboratoriya ishlarining akademik litseylar o'quv-amaliyotida

[1] Каримов И.А. Ўзбекистон XXI асрга интилмоšда. -Т.:Ўзбекистон, 1999. 37-38-бетлар

qo’llanilmaganligi va ularning ishlanmalari va uslubiy tahlillarining mavjud emasligi mazkur tadqiqotning yo’nalishi va mavzusini tanlash uchun asos bo’ldi.

Bitiruv malakaviy ishining maqsadi: akademik litseylarda astronomiyadan "Gigant sayyoralar fizikasi" mavzusini axborot texnologiyalari muhitida o’qitish metodikasini yaratish va astronomik ta’limda zamonaviy axborot texnologiyalarini qo’llash bugungi kunnig dolzarb masalalari ekanligini asoslab berish.

Tadqiqot ob’ekti: akademik litseylarda astronomiyani zamonaviy axborot va kommunikatsiya texnologiyalari muhitida o’qitish jarayoni.

Tadqiqot predmeti: akademik litseylarda astronomiyani zamonaviy axborot va kommunikatsiya texnologiyalari muhitida o’qitishning shakllari, metodlari va vositalari.

Bitiruv malakaviy ishining vazifalari:

1. ALlarda astronomiyani namoyishli tajribalar asosida takomillashtirishning didaktik hamda metodik funktsiyalarini nazariy va amaliy jihatdan o’rganish.
2. ALlarda astronomik bilimlarni berishda, ularning bilim va malakalarini, ilmiy dunyoqarashini rivojlantirish maqsadida elektron ishlanmalar ("Gigant sayyoralar fizikasi" mavzusi misolida) yaratish va ularni ta’lim jarayoniga tatbiq etish.
3. Ishlab chiqilgan usullardan foydalanib, ALlarda astronomiya ta’limi jarayonida pedagogik sinov-tajribalar o’tkazish va natijalarini umumlashtirish.

Himoyaga olib chiqilayotgan asosiy holatlar:

1. Akademik litseylarda ta’lim mazmunini takomillashtirishga qaratilgan, axborot kommunikatsiya texnologiyalari muhitida astronomiyani o’qitishning mazmuni, metodlari va vositalari.
2. Astronomik ta’limni samarali amalga oshirish hamda o’quvchilarni mustaqil o’quv faoliyatlarini rivojlantirishga qaratilgan metodik ishlanmalarni yaratishga qaratilgan asosiy yondashuvlar.
3. Ishlab chiqilgan metodika asosida astronomiya ta’limi jarayonida o’tkazilgan pedagogik sinov-tajriba natijalari.

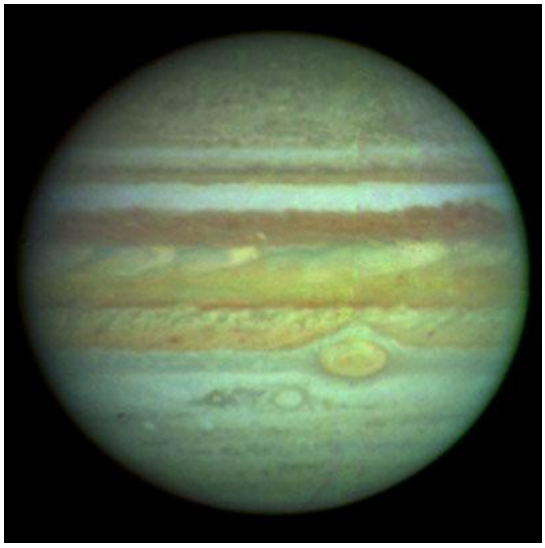
Ilmiy yangiligi:

- akademik litseylarda astronomik bilimlarni berishda zamonaviy axborot va kommunikatsiya texnologiyalarini joriy etishning pedagogik asoslari;
- astronomik ta’limni samarali amalga oshirish hamda talabalarning mustaqil o’quv faoliyatlarini rivojlantirish maqsadida "Gigant sayyoralar fizikasi" mavzusi axborot texnologiyalari muhitida o’qitish metodikasi yaratildi hamda amaliyotga tatbiq etildi.

I BOB. GIGANT SAYYORALAR FIZIKASI

I.1. Yupiter - osmon xukmroni

Yupiter, ming yillar avval Rim xudolari sharafiga atalgan, bizning Quyosh sistemamizda 9 ta sayyora ichida o'zining g'aroyibligi sababli Quyosh bilan tenglashishga raqobatlashib kelayotgan sayyoradir. U sayyoralar ichida eng ulkani bo'lib, asteroidlar asosiy belbog'idan keyin turadi. Yupiter massasi boshqa barcha sayyoralarning massasini qo'shganda kelib chiqadigan massadan bir oz ko'proq.



I.1 - rasm.
Yupiter – Quyosh sistemasidagi eng katta sayyora.

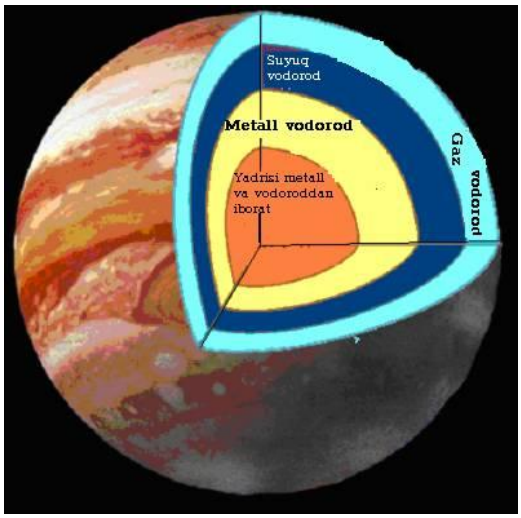
Yupiter orbitasining katta yarim o'qi 5,2 a.b. ga teng bo'lib, orbita ekstsentisiteti $e = 0{,}0489$, orbita bo'ylab aylanish davri - 11,867 yil. Orbita tekisligining ekliptika tekisligiga og'maligi – $1^0 18'17''$. Orbita bo'ylab o'rtacha harakat tezligi- 13,1 km/s.

O'qi bo'ylab aylanish davri - 9 soat 55 minut. Ekvatorining xar bir nuqtasi soatiga 45 ming km tezlik bilan xarakatlanadi. Markazga intilma kuch ta'siri tufayli Yupiter bir oz siqiq (siqiqlik koeffitsienti 6% dan ko'proq). Yupiter - qattiq jism bo'lmay, gaz va suyuqliklardan tashkil topgani uchun uning ekvatorial qismlari, uning qutblari yaqinidagi qismlariga ko'ra tezroq aylanadi.

I.2 – rasm.
Yer yuzidagi yaxshi teleskoplarda sayyora sirtining qoplamlarini yaxshi ilg'ash mumkin.

Yupiterning aylanish o'qi uning orbitasiga deyarli perependikulyar bo'lgani uchun, sayyorada fasllar almashinuvi bo'lmaydi.

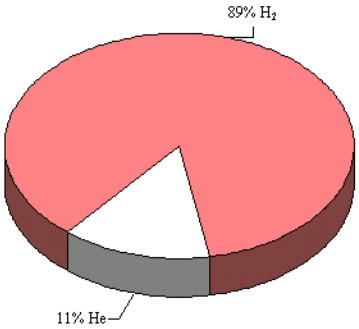
Sayyoraning massasi $M_♃ = 318\,M_⊕ = 1{,}9\cdot10^{27}$ kg, radiusi $R_♃ = 11{,}2\,R_⊕ = 71\,492$ km. Shu bilan birga sayyora juda xam siyrak, uining urtacha zichligi 1,33 g/sm^3 bo'lib, Yerning urtacha zichligidan to'rt marta kam. Yupiter sirtida, uning bulutli qismida erkin tushush tezlanishi $g_♃ = 2{,}53\,g_⊕$. Kuzatishlar uchun Yupiter ajoyib ob'ektdir. U bir tekis yorug' nur taratadi (al'bedosi - 0,52). Kichik teleskopda yoki binokl orqali kuzatilganda uning 1610 yildayoq ochilgan to'rtta katta yo'ldoshlari ko'rinadi.



I.3 - rasm
Yupiterning ichki tuzilishi.

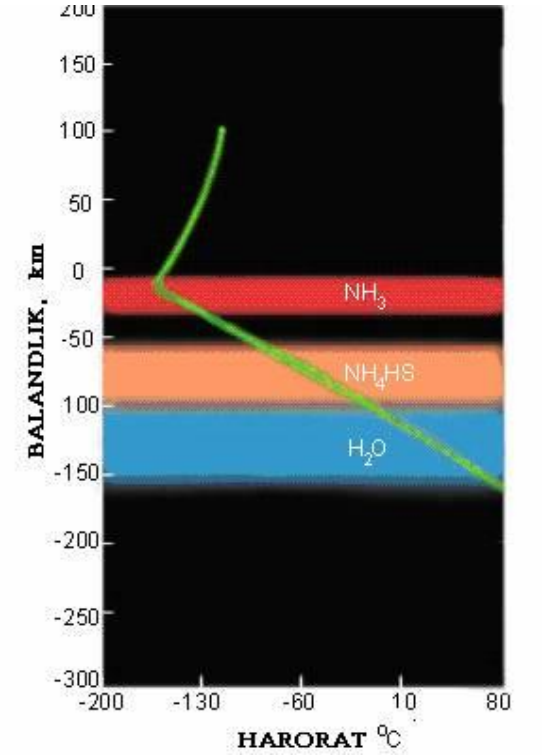
Zamonaviy tasavvurlarga ko'ra, sayyora va Quyosh tarkibi umumiy bo'lgan gaz va chang bulutlardan vujudga kelgan. Yupiterga Quyosh sistemasidagi barcha sayyoralar massasining 3/2 qismi to'g'ri keladi, ammo bular Yupiter yadrosmia termoyadro reaktsiyalarining boshlanishiga yetarli bo'lmadi: sayyora asosiy ketma-ketlikdagi eng kichik yulduzdan 80 marta yengil. Ammo Yupiter o'zining issiqlik manbasiga ega. Moddaning radioaktiv parchalanishi va energiya bilan bog'liq bo'lgan siqilishi natijasida yuzaga keladi. Agar u faqatgina Quyosh tomonidan isitilgan bo'lganida edi uning sirt qatlamlari xarorat 100 K bo'lar edi, o'lchashlar esa 140 K ekanini ko'rsatadi. Sayyoraning iliqlik rejimida, uning markazidan

chiqayotgan energiya oqimi katta rol uynaydi. Sayyora Quyoshdan oladigan energiyadan ko’ra ko’proq energiya chiqaradi.



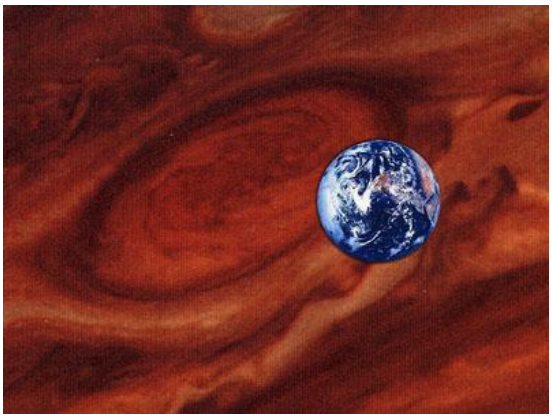
I.4 - rasm
Atmosferaning kimyoviy tarkibi

Yupiterinng atmosferasining 89% vodoroddan tashkil topgan va 11 % geliy va kimyoviy tarkibi bo’yicha Quyoshni esalatadi. Atmosferasining kalinligi 6 ming km. Atmosferaga olov rangni fosfor va oltingugurt birikmasi beradi. ¤yuvchi amiak va atsetindan iborat bo’lgani uchun inson xayoti uchun xavflidir. Sayyora sirtidagi eng mashxur tuzilma bu, 300 yildan beri kuzatilayotgan (u 1664 yilda Robert Guk tomnidan ochilgan) katta qizil dog’. Uning o’lchami – 15 X 25 ming kilometrga teng bo’lgan ko’p yashovchi atmosfera uyurma bo’roni bo’lsa kerak.



I.5- rasm
Atmosferaning tuzilishi.

Taxmin qilinishicha, Yupiter atmosferasi uchta qatlamdan iborat. Yuqorisida - muzlagan amiakli bulutlar; uning tagida – metall va ammoniy serovodord kristallari, eng pastki qatlamida esa – muzli suv va balki suyuq suv xam mavjuddir.

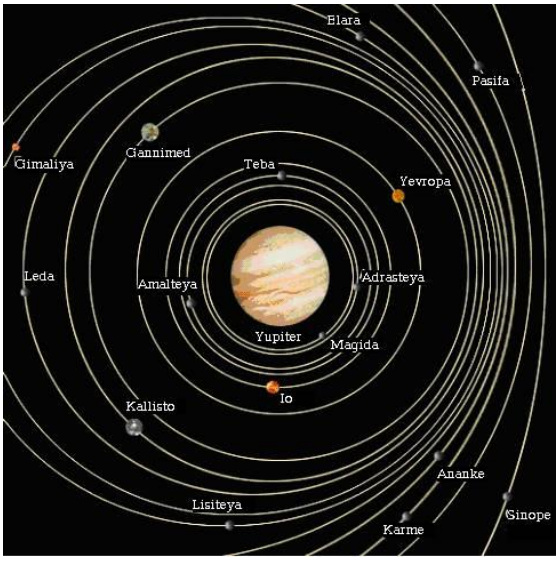


I.6 – rasm
Katta qizil dog'- Yupiter atmosferasidagi gigant bo'ron o'rami, uning yonida Yer sayyorasining kattaligi solishtirilgan.

Bundan tashqari, Yupiter vodorod va geliydan tashkil topgan tojga ega.

Yupiter atmosferasi va boshqa gazli sayyoralarning atmosferalari sayyora ekvatoriga parallel ravishda keng polasalarda esuvchi katta tezliklardagi shamollar xususiyatiga ega.

Uchinchi ming yillikka kelib Yupiterning 30 ga yaqin yo'ldoshlari mavjudligi ma'lum bo'ldi. Ulardan to'rttasi o'lchamlarining va massalarining kattaligi bilan farq qiladilar. Ular sayyoraning ekvator tekisligida deyarli aylana orbita bo'ylab xarakat qiladilar. 20 ta tashqi yo'ldoshlar sayyoradan shu darajada uzoqdaki, sayyora sirtidan ularni qurollanmagan ko'z bilan ko'rish imkoni mavjud emas.

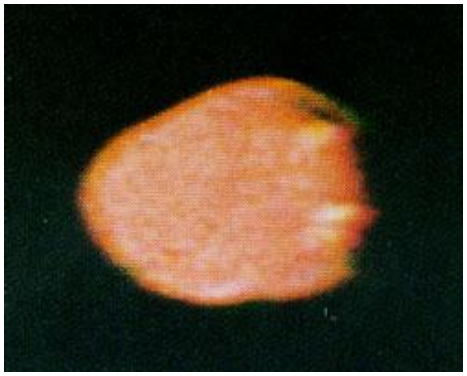


I.7– rasm.
Yupiter yo'ldoshlarining sistemasi.

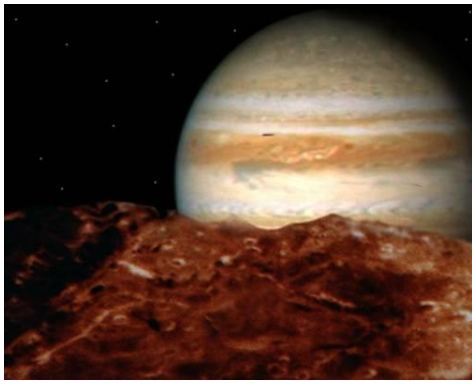
Nomi	Yorqinligi , *m*	Orbita radiusi, ming. km	Yupiter atrofida aylanish davri, "-" sut.	Radius, km	Massa, kg	Ochilgan vakti
Metida	17,5	128	0,29478	20	$9 \cdot 10^{16}$	1979
Adrasteya	18,7	129	0,29826	13×10×8	$1 \cdot 10^{16}$	1979
Amal'teya	14,1	181	0,49818	31×73×67	$7{,}2 \cdot 10^{18}$	1892
Teba	16,0	222	0,6745	55×45	$7{,}6 \cdot 10^{17}$	1979
Io	5,0	422	1,76914	1830×1818×1815	$8{,}9 \cdot 10^{22}$	1610
Yevropa	5,3	671	3,55118	1565	$4{,}8 \cdot 10^{22}$	1610
Ganimed	4,6	1070	7,15455	2634	$1{,}5 \cdot 10^{23}$	1610
Kallisto	5,6	1883	16,6890	2403	$1{,}1 \cdot 10^{23}$	1610
Leda	20,2	11 094	238,72	5	$5{,}7 \cdot 10^{16}$	1974
Gimaliya	15,0	11 480	250,566	85	$9{,}5 \cdot 10^{18}$	1904
Lisiteya	18,2	11 720	259,22	12	$7{,}6 \cdot 10^{16}$	1938
Elara	16,6	11 737	259,653	40	$7{,}6 \cdot 10^{17}$	1904
Ananke	18,9	21 200	-631	10	$3{,}8 \cdot 10^{16}$	1951
Karme	17,9	22 600	-692	15	$9{,}5 \cdot 10^{16}$	1938
Pasife	16,9	23 500	-735	18	$1{,}6 \cdot 10^{17}$	1908
Sinope	18,0	23 700	-758	14	$7{,}6 \cdot 10^{16}$	1914
S/1999J1	21,0	24 160	-768	5	$1{,}0 \cdot 10^{16}$	1999

Yupiter yo'ldoshlarining jadvali

Axamiyat bersangiz, bir qator kichik yo'ldoshlar deyarli bir xil orbitalar bo'ylab xarakatlanadilar. Olimlarning fikricha, ularning barchasi Yupiterning tortishish kuchi ta'sirida, nisbatan kattaroq bo'lgan yo'ldoshlarining parchalanishi tufayli hosil bo'lgan qoldiqlari bo'lishi mumkin. Yupiterning tashqi yo'ldoshlari sayyoraning gravitatsion kuchi ta'siriga bo'ysunishi ehtimoli xam yo'q emas edi, ularning barchasi Yupiter atrofida uning aylanishiga qarama-qarshi yo'nalish bo'ylab aylanadilar.

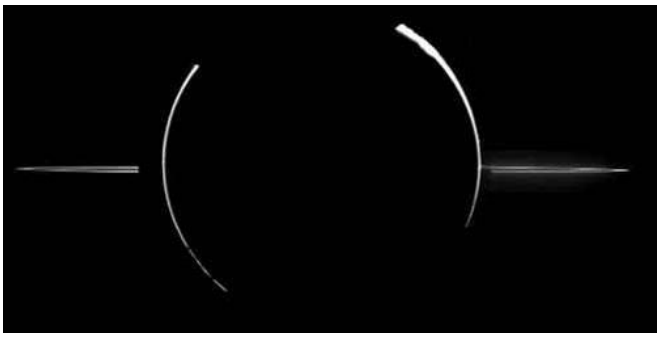


I.8- rasm
Amal'teya Yupiter radiusining 1,5 masofasida aylanadi. Uning al'bedosi bor-yo'²i 10 % ga yetadi.



I.9-rasm
Amal'tey osmoni. Yupiter eniga 40^0 atrofidagi sohani to'smoqda.

Uchkarrali ***Yupiterning xalqasi*** 1979 yilda Yupiter yaqinidan, «Voyadjer» uchib o'tayotgan vaqtida ochilgan. Uning radiusi 129 ming km bo'lib, qalinligi 30 km ga teng. Xalqa juda siyrak bo'lib, chang va mayda tosh zarralaridan tarkib topgan.

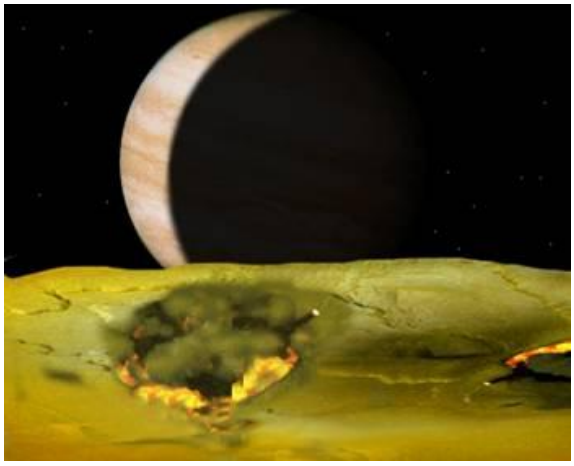


I.10 - rasm
Yupiter halqasi. Sayyoraning soyali tomonidagi ko'rinish.

Iodagi vulqonlar. Io – Yupiter yo'ldoshlarining eng birinchilaridan bo'lib, 1610 yilda Galiley tomonidan ochilgan. Massasi va radiusiga ko'ra yo'ldosh Oyga o'xshagan bo'lib, Yupiter osmonida yorqin qizg'ish disk yoki yarimoy shaklida ko'rinadi. Ioning diametri 3630 km ga teng.

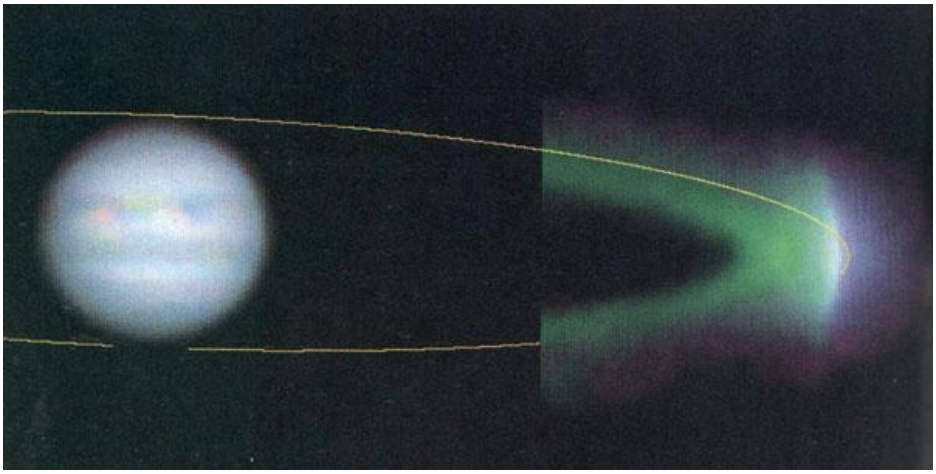
I.11- rasm. Io

I.12– rasm.
Vulqonlar yuzlab kilometr balandlikkacha otilmoqda.

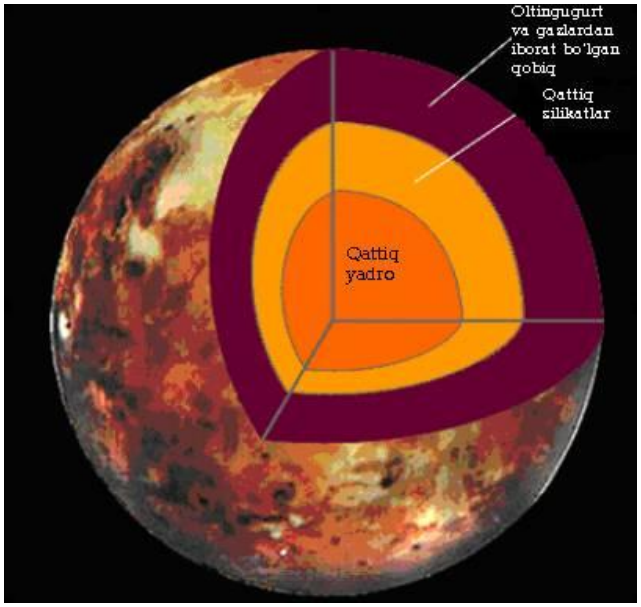


I.13– rasm
Io osmonida Yupiter 20^0 diametrga ega. Oldingi fonda – oltingugurtning oqishi, orqa fonda esa - otilayotgan vulqon.

Ioda 20 ta, otilish balandligi 300 km gacha etadigan xarakatdagi vulqonlar borligi aniqlangan. Ular tomonidan otiladigan gazlarning asosiy turi - bu keyinchalik Io sirtida oq modda ko'rinishida qotib qoladigan oltingugurt dioksidi. Uning ba'zi miqdori kosmosga uchib ketib, Yupiterni o'rab turuvchi xalqani hosil qiladi. Io sirtining qirmizi rangi, uning sirtidagi oltingugurt gazi bilan kondensatsiyalangan oltingugurtning eg'ilib qolishi bilan tushuntiriladi. Ioda Yerdagidan bir million marta siyrak bo'lgan atmosfera mavjudligi aniqlangan. Ammo bu atmosfera Merkuriy atmosferasidan zichroq.



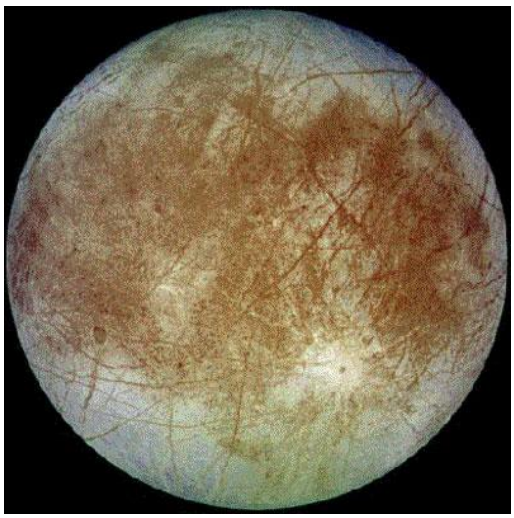
I.14– rasm.
Yo'ldoshning orbitasi koslorod ionlari va oltingugurtdan iborat bo'lgan, o'ziga hoslikka ega.



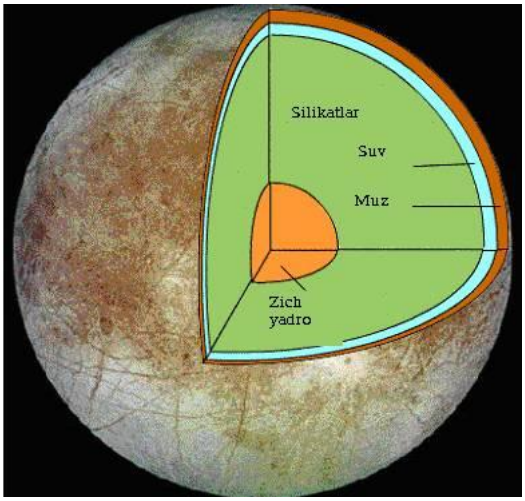
I.15– rasm.
Ionin ichki tuzilishi.

Doimiy seysmologik aktivliklar sababli, Ioning sirti xali yosh bo'lib (bir million yil atrofida): unda deyarli meteorit kraterlari kuzatilmaydi; lekin lavalar oqimi va qora oltingugurt daryolari mavjud. Xisoblashlarga ko'ra, Io Yupiter, Ganimed va Yevropadan kelayotgan oqim ta'sirida qiziydi. Yupiter yo'ldoshlari magnit maydon ta'siri ostida yotadilar va bu holat Iodagi vulqonlar faoliyatini tushuntiradi. Ioning zichligi - 3,55 g/sm^3. Silikatli qobiq ostida temir yadro joylashgan.

Yevropadagi okean. Yevropaning radiusi 1569 km bo'lib, uning usti suvli muz bilan qoplangan. Ko'rinishidan, muz qobiq ostida 100 kilometr chuqurlikda suvli okean mavjud bo'lishi mumkin. Yo'ldoshning zichligi ancha yuqori bo'lib, 3,04 g/sm^3 ga teng.



I.16– rasm.
Yupiter yo'ldoshi Yevropa.



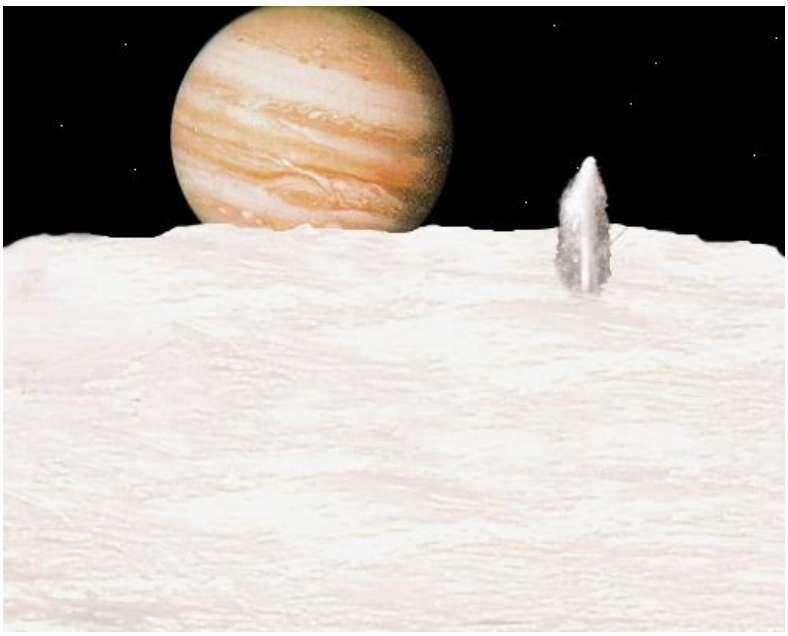
I.17- rasm
Yo'ldoshning ichki tuzilishi.

1995 yil 7 dekabrda «Galileo» kosmik stantsiyasi Yupiter orbitasiga chiqdi, bu esa uning to'rtta yo'ldoshini: Io, Ganimed, Yevropa va Kallistoni o'rganishga katta imkoniyat yaratdi. Magnitometrik o'lchashlar Yevropa va Kallisto yaqinida

Yupiterning magnit maydonining kuchayishini qayd qildi. Katta qiymatga ega bo'lgan induktsiyaning va kuzatilayotgan magnit maydonning kuchlanishini tushuntirish uchun, ushba yo'ldoshlarda ferromagnit moddadan iborat yadro mavjud degan ²oyaning bo'lishiga yo'l quymaydi, bunday holatda magnit maydon, masofaning kubiga proportsional holatda tushishida, kuzatilayotgandan sakkiz marta kam bo'lishi kerak edi. Ko'rinishidan yo'ldoshlarda magnit maydonning variatsiyalanishi, «sitrosti» okeanlarining sho'rligi, Yer okeanlarining sho'rligiga (37,5 ‰) yaqinligi bilan aniqlanadi. Yevropada sirtosti okeanlarining mavjudligi yigirma yillardan buyon munozaralarga sabab bo'lmoqda.

I.18– rasm.
Yevropa sirtidagi dars ketgan va qo'porilgan Yerlar.

Yo'ldoshda akkretsion, radiogen va issiqlikning oqib kelishi manbalari ichki qatlamlarning suyuqliklarga ega bo'lishi va tashqi qatlamdagi qalinligi 100 km ga etadigan suvning sirtyaqin qatlamining shakllanishiga imkon yaratuvchi, yetarli darajada kuchlidir.



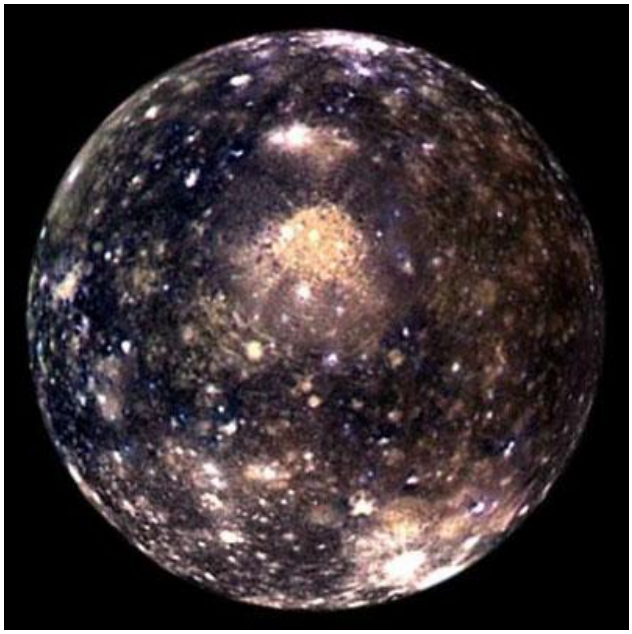
I.19– rasm.
Qadimda erigan muz, Yevropa sirtiga otilib chiqib, uning sirtining keng maydonlarini suv bosgan bo'lishi xam mumkin.

Ganimed – Yupiterning va butun Quyosh sistemasining eng katta yo'ldoshi bo'lib, uning radiusi 2631 km. O'zining diametri bo'yicha u Merkuriydan xam katta. Ammo Ganimedning o'rtacha zichligi bor yo'g'i 1,93 g/sm^3: yo'ldoshda muz juda ko'p.

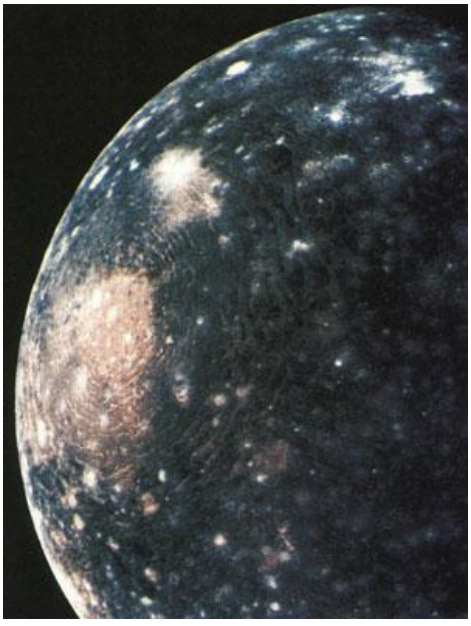
I.20- rasm
Ganimed.

Suratlardagi tashqi ko'rinishi bilan Ganimed Oyni eslatadi, lekin u ancha katta. Ganimed sirtining 40% qadimiy, quvvatli muzli qobiqdan iborat. Ganimed siritdagi to'qnashish natijasida hosil bo'lgan kraterlar, 3,5 milliard yillar avval yo'ldoshning yaralishi davrida hosil bo'lgan. Yosh kraterlar och rangda ko'rinadilar. Ganimed qobig'i muz aralashmasi va to'q rangdagi tog' jinslaridan tashkil topgan.

Kallistoning o'lchami taxminan Merkuriy bilan teng – kattaligi bo'yicha Ganimel va Titandan keyingi uchinchi o'rinda turadi. Uning diametri 4800 km, zichligi esa □= 1,83 g/sm^3. Kollistoda suvli muz 60% ni tashkil etadi. Kallisto sirtida kuchlanishi 750 mTl bo'lgan o'zining magnit maydoni topilgan. Shuning uchun silikatli qobiq ostida metall yadro mavjud, deb taxmin qilinmoqda.



I.21– rasm. Kallisto.



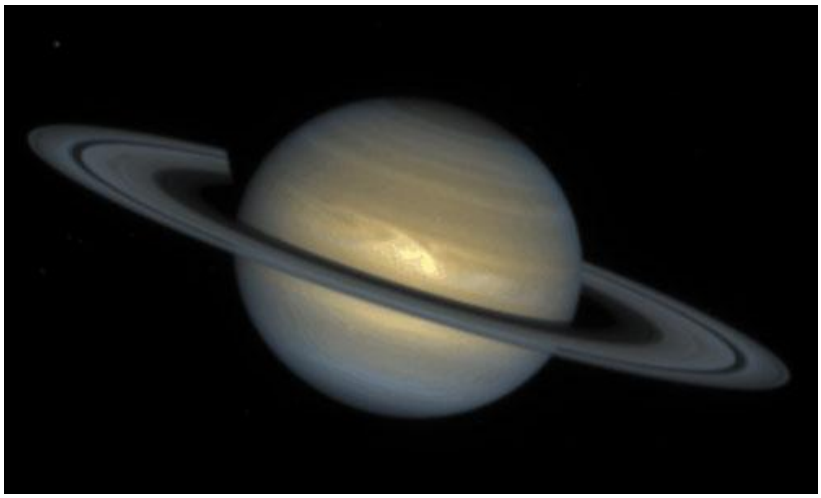
I.22-rasm
Suratning chap qismida gigant meteorit urilishi natijasida hosil bo'lgan Valgallning kontsentrik dars ketgan sistemasini ko'rish mumkin. Uning diametri

300 km dan ortadi.

Xuddi Ganimedniki sngari, och rangdagi kraterlar – keyinroq hosil bo'lgan tuzilmalardir. Kollisto sirtining yoshi milliardlab yillar bilan o'lchanadi; unda vulqonlar xarakati deyarli kuzatilmaydi. Agar Yevropada suvning miqdori mavjudligi xaqiqat deb hisoblansa, unda Kollistoda uning mavjud emasligi xaqiqatga yaqinroqdir. Lekin, akkretsion va radiogen issiqlik manbalari uchun kerak bo'lgan miqdorga yaqin bo'lsada, «Galileo»ning bortidan olib borilgan kuzatishlar, ushba sayyora metal qobiq va muzdan iborat ekanligini ko'rsatmoqda.

I.2. Suvdan xam yengil halqali sayyora

Agar teleskopdan uni kuzatilsa, yoki «Voyadjerdan» olingan suratlarga qaralsa, Saturn eng chiroyli sayyora bo'lsa kerak degan xulosaga kelinadi. Saturnning go'zal xalqalarini Quyosh sistemasidagi xech bir ob'ekt bilan adashtirib bo'lmaydi.



I.23– rasm.
Saturn. Xabbl nomli teleskopdan olingan muratlar.

Ushbu sayyora qadim zamonlardan beri ma'lum bo'lgan. Saturnning maksimal yulduziy kattaligi $+0,7^{m}$. Ushbu sayyora – bizning yulduzli osmonimizdagi eng yorqin ob'ektlardan biridir. Saturnning xalqalari Yerdan turib, uncha katta bo'lmagan teleskop orqali ham ko'rinadi. Ular Sayyora atrofida

aylanadigan, ming-minglab unchalik katta bo'lmagan qattiq jismlar, tosh va muzlarning qoldiqlaridir.

I.24– rasm
Saturn xalqalarining Yerdan turib ko'rinishi.

Orbitasining katta yarim o'qi 9,584 a.b. ni tashkil etadi, aylanish davri esa 29,666 yilga teng. Orbitaning ekstsentrisiteti e = 0,057 bo'lib, ekliptikaga og'maligi 2^0 29'. O'z o'qi atrofida aylanish davri - yulduz sutkasida – 10 soat 14 minutni (30^0 kenglamada) tashkil etadi. Saturn qattiq jism bo'lmay, gaz va suyuqdikdan tashkil topgani uchun, uning ekvatori qutblariga nisbatan tezroq aylanadi: qutblarda bitta to'liq aylanish davrt taxminan 26 minutga sekinroq kechadi. O'qi atrofida o'rtacha aylanish davri - 10 soat 40 minutga teng.

Markazga intilma kuch ta'siri tufayli Saturn sezilarli darajada siqiq. Uning siqiqligi 10% ni tashkil etadi.

I.25- rasm

Saturn suvda suzib yurishi mumkin edi.

Saturnning massasi $M_{♄} = 95{,}159\ M_{⊕}$ $= 5{,}6850 \cdot 10^{26}$ kg ga teng, radiusi Yer radiusidan birmuncha ko'proq: $R_{♄} = 9{,}45\ R_{⊕} = 60\ 268$ km.

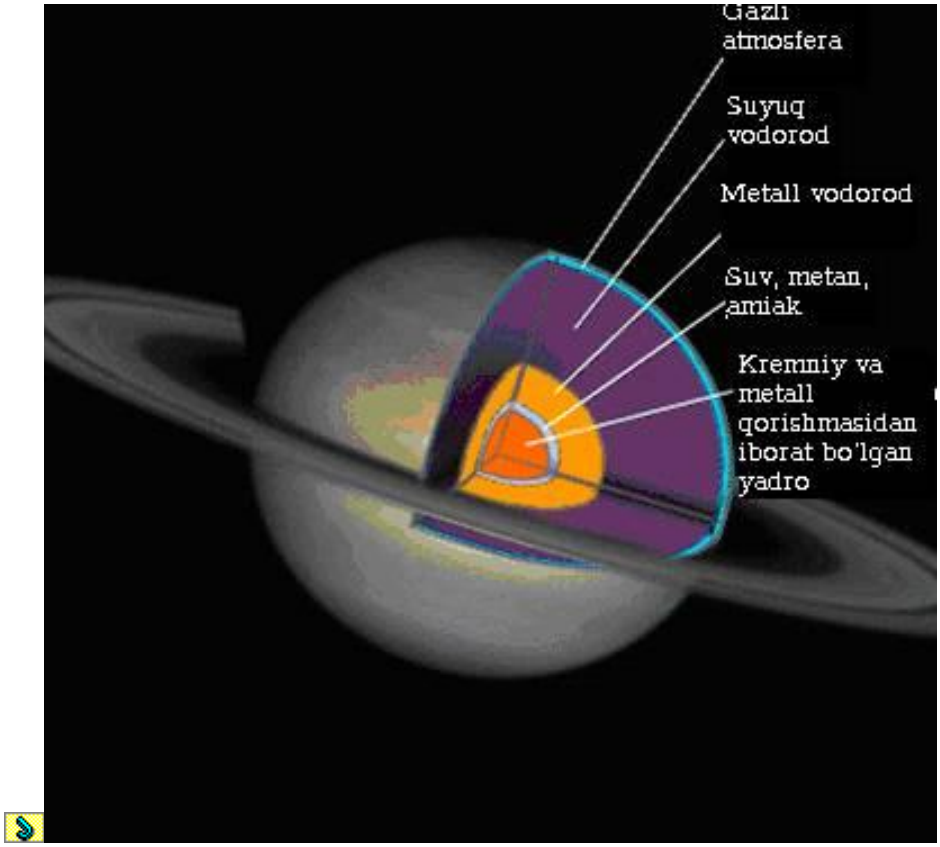
Zichligi $\rho_{♄} = 0{,}70$ g/sm^3.

Saturn bir ajoyib xususiyatga ega: u - Quyosh sistemasidagi yagona bo'lgan, urtacha zichligi suv zichligidan kam bo'lgan (bir kub metrga 700kg) sayyoradir. Agar ulkan okeanni yaratish imkoni bo'lganda edi, Saturn unda suzib yurgan bo'lar edi.

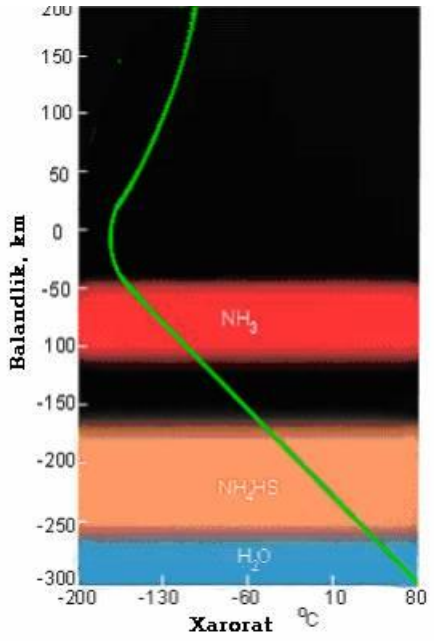
Bulutli qoplam sirti balandligida erkin tushish tezlanishi $g_{♄} = 9{,}44$ m/s^2 ni tashkil etadi. Al'bedosi 0,47.

Saturnning atmosferasi deyarli butunlay vodorod, geliy va azotdan iborat. «Voyadjer-1» KAS Saturn atmosferaning yuqori qatlamining 7 % xajmi – geliy (Yupiterdagi 11% bilan solishtirilganda), qolgan xammasi vodoroddan iborat ekanini aniqladi. Saturn xam xuddi Yupiter sayyorasi singari deb taxmin qilingani tufayli, Saturndagi geliyning miqdori Yupiterniki va Quyoshniki singari deb taxmin qilinmoqda.

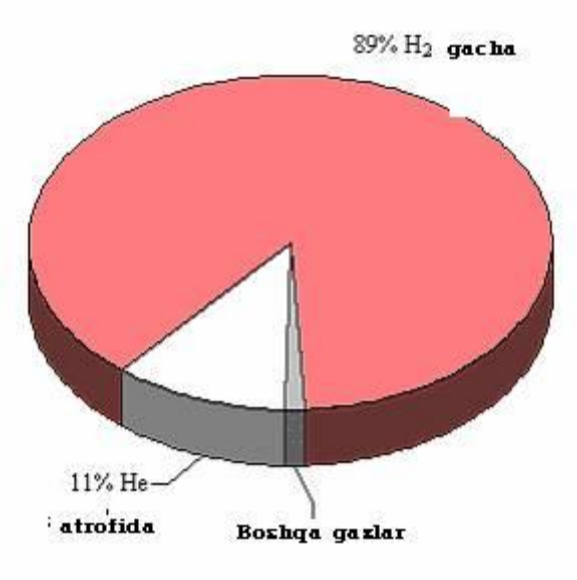
Atmosferaning yuqori qatlmida ushbu elementning etishmasligi, birmuncha og’g’irroq bo’lgan geliy, Saturn yadrosiga sekin tushmoqda, shu sababli issiqlik energiyasi kosmosga tarqalmoqda. Atmosferaning yuqori qismida ammiak bulutlari Yupiternikiga qaraganda quvvatliroq, shuning uchun Saturndagi polosalar u darajada kuyuk emas. Saturndagi minimal xarorat, u «Voyadjer-2» yordamida radioto’lqinlarda o’lchangan bo’lib, 82 K ga teng. Atmosferaga kirib borgan sari xarorat ortib boradi. Atmosferadan pastroqda suyuq molekulyar vodorod okeanlari keng tarqalgan. 30 000 km chuqurlik yaqinida vodorod metall holatga o’tadi (bosim 3 million atmosferaga etadi). Metallning xarakati kuchli magnit maylonni hosil qiladi. Sayyoraning markazida massiv temir-tosh yadro joylashgan.



I.26– rasm.Saturnning ichki tuzilishi.



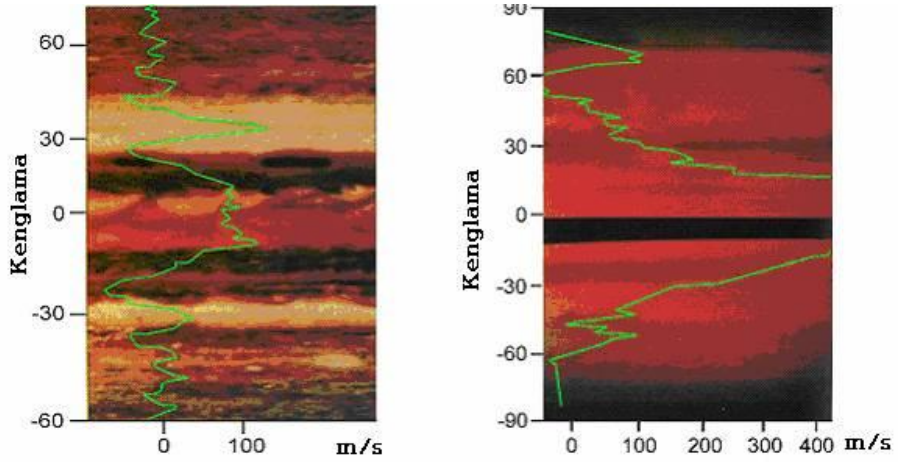
I.27- rasm. Atmosfera xarorati.



I.28- rasm

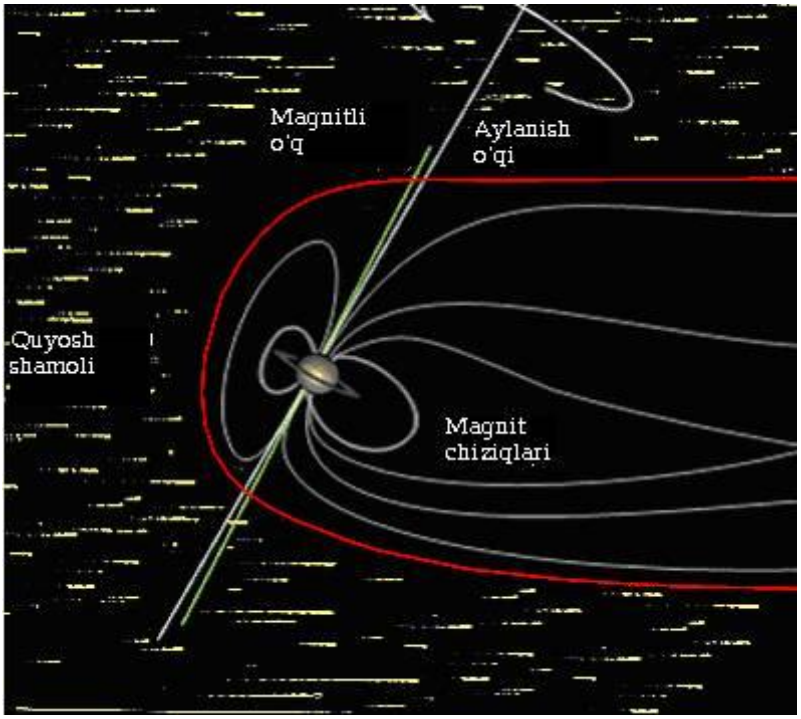
Atmosferaning kimyoviy tarkibi

Saturnda juda kuchli shamollar bo'lib turadi. «Voyadjer-2» ularning tezligini o'lchab, ekvatorda - 500 m/s ekanini ko'rsatdi. Ko'pincha shamol sharqiy yo'nalishda esadi (eslatib o'tamiz, Saturn xam boshqa qupgina sayyoralar singari g'arbdan sharqqa tomon aylanadi). Shamolning kuchi ekvatordan uzoqlashgan sari kamayib boradi. Undan tashqari «Voyadjera-2» shimoliy va janubiy yarimsharlarda, shamol ekvatorga nisbatan simmetrik ekanini ko'rsatdi. Simmetrik oqim, atmosferaning ko'rinadigan qatlami ostida o'zaro bog'liq, degan taxminlar xam mavjud.



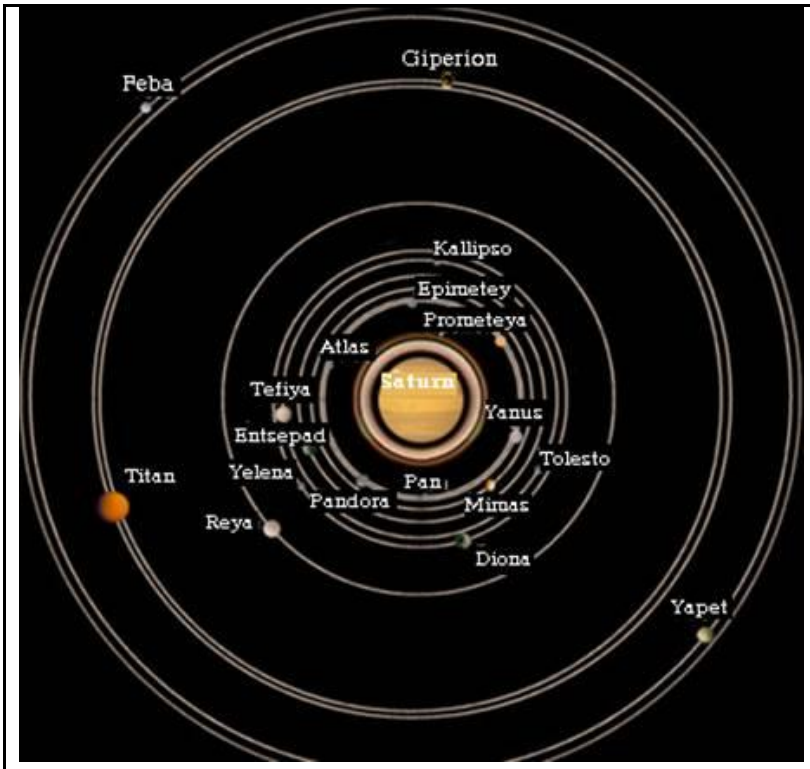
I.29 – rasm. Saturndagi shamol tezligining kenglamaga bog'liqligi.

Saturn atmosferasida xam Yupiterning mashxur qizil dog'i singari katta bo'lmasa xam, kuchli bo'ronlar tez-tez kuzatiladi. SHuningdek, Saturnda o'lchami 1250 km bo'lgan dog topilgan. Saturnning magnit maydoni Yupiternikidan birmuncha kuchsizroq. Ko'rinish qismidagi bulutlar ustidagi magnit maydonning kuchlanganligi ekvatorda 0,2 Gs (Yer sirti ustida magnit maydon 0,35 Gs ga teng). Saturnning magnitosferasi Yupiternikidan farq qiladi. Saturnda aylanish o'qi dipol o'qi bilan ustma-ust tushadi. Ba'zi zaryadlangan zarralar, qutbdan-qutbga xarakatlanishi davrida, xalqalar sistemasidan o'tadilar va ularning ba'zilari u yerdagi chang va muzlar tomonidan yutilib qoladi. Shuning uchun Saturnning magnitosfera sohasi juda ham bo'sh – u yerda zaryadlangan zarralar juda oz miqdorda.

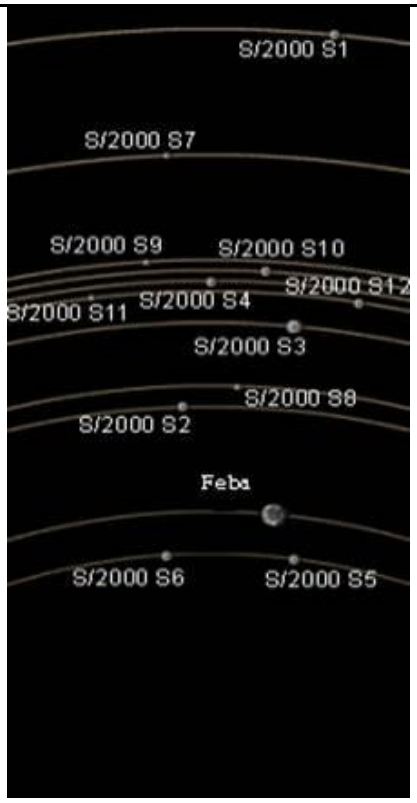


I.30– rasm. Sayyoraning magnitosferasi

Saturn yo'ldoshlari. Saturn yo'ldoshlari sistemasi ancha murakkab. 30 ta yo'ldoshlari ma'lum, ular jadvalga kiritilgan. Shulardan 12 tasi oxirgi bir necha yillar ichida ochilgan.



I.31- rasm
Saturn yo'ldoshlari sistemasi.



I.32-Saturnning tashqi yo'doshlari

Saturn yo'ldoshlarini, shuningdek boshqa gigant sayyoralar yo'ldoshlarini ikki guruhga ajratish mumkin - bular regulyar va irregulyar.

Nomi	Yorqinligi, *m*	Radiusi orbitalar, ming. km	Saturn atrofida aylanish davri sut.	Radius, km	Massa, kg	Ochilgan yili
Pan	20	133,58	0,5750	10	$2{,}7\cdot10^{17}$	1990
Atlas	18,0	137,67	0,6019	14×20	$2{,}2\cdot10^{17}$	1980
Prometey	15,8	139,35	0,6130	145×85×62	$2{,}7\cdot10^{17}$	1980
Pandora	16,5	141,70	0,6285	114×84×62	$2{,}2\cdot10^{17}$	1980
Epimetiy	15,7	151,42	0,6942	115×108×98	$5{,}7\cdot10^{17}$	1966
YAnus	14,5	151,47	0,6945	89	$2{,}01\cdot10^{18}$	1966
Mimas	12,9	185,52	0,94242	196	$3{,}80\cdot10^{19}$	1789
Entselad	11,7	238,02	1,37022	260	$8{,}4\cdot10^{19}$	1789
Tefiya	10,2	294,66	1,8878	530	$7{,}55\cdot10^{20}$	1684
Telesto	18,7	294,66	1,8878	34×15×36	$6{,}0\cdot10^{15}$	1980
Kalipso	19,0	294,66	1,8878	34×13×22	$4{,}0\cdot10^{15}$	1980
Diona	10,4	377,40	2,7369	560	$1{,}1\cdot10^{21}$	1884
Elena	18,4	377,40	2,7369	36×16×30	$1{,}4\cdot10^{23}$	1980
Reya	9,4	527,04	4,5175	765	$2{,}5\cdot10^{21}$	1672
Titan	8,3	1221,83	15,945	2575	$1{,}4\cdot10^{23}$	1655
Giperion	14,2	1481,1	21,2766	410×260×220	$1{,}8\cdot10^{19}$	1848
YApet	12,0	3561,3	79,3302	730	$1{,}9\cdot10^{21}$	1671

Feba	16,5	12 952	-551,48	110	$4{,}0 \cdot 10^{18}$	1898

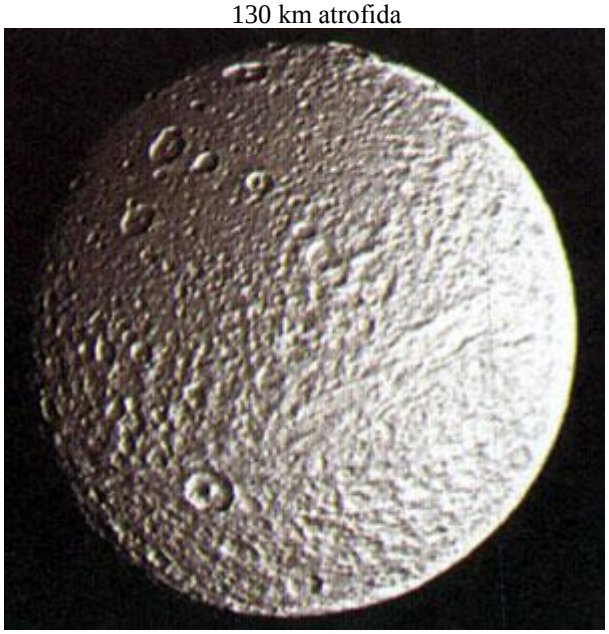
Nomi	YOrqinligi *m*	Orbita radiusi a.b.	Saturn atrofida aylanish davri yil.	Radius, km	Massa, kg	Orbita lar
S/2000 S 1	23	0,156	3,63	10		2000
S/2000 S 2	23	0,100	1,87	12		2000
S/2000 S 3	24	0,111	2,2	22,5		2000
S/2000 S 4	24	0,120	2,46	8		2000
S/2000 S 5	24	0,076	1,24	8,5		2000
S/2000 S 6	24	0,076	1,24	7		2000
S/2000 S 7	24	0,136	2,95	3,5		2000
S/2000 S 8	24	0,103	1,95	4		2000
S/2000 S 9	23	0,123	2,54	3,5		2000
S/2000 S 10	24	0,121	2,48	5		2000
S/2000 S 11	24	0,119	2,43	15		2000
S/2000 S 12	24	0,119	2,41	3,5		2000

Saturn yo'ldoshlari jadvali

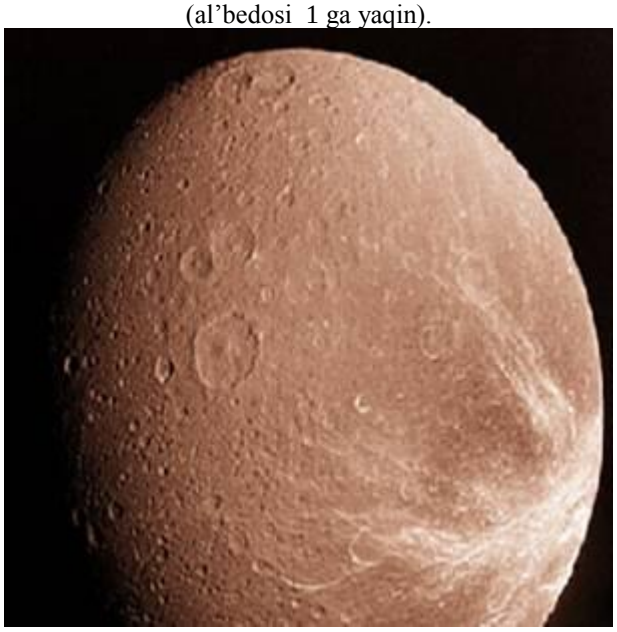
Regulyar yo'ldoshlar sayyoraning ekvatorial tekisligi yaqinida, aylanaga yaqin bo'lgan orbita bo'ylab xarakatlanadilar. Barcha regulyar yo'ldoshlar sayyora xarakati yo'nalishi bo'ylab bir yo'nalishda xarakatlanadilar. Ushbu holat sayyoraning shakllanishi davrida, ular gaz-chang bulutlaridan vujudga kelganidan darak beradi. Ulardan farqli ravishda irregulyar yo'ldoshlar sayyoradan uzoqda, xaotik orbitalar bo'ylab xarakatlanadilar, ushbu holat mazkur yo'ldoshlar shu yaqin davrlar ichida, sayyora atrofida uchib o'tayotgan asteroidlar yoki kometa yadrolarini Saturn o'zlashtirib olganidan darak beradi. Xozirgi vaqtda yo'ldoshlarning orbita parametrlari va o'lchamlari aniqlanmoqda. Yo'ldoshlarning ko'pchiligi muzdan tarkib topgan: ularning zichligi 1400 kg/m^3 dan oshmaydi. Nisbatan kattaroq yo'ldoshlarda yadrolar xam shakllanmoqda. Deyarli barcha yo'ldoshlar sayyoraga bir tomoni bilan qaragan.

I.33- rasm
Mimas. To’qnashishdan hosil bo’lgan kraterning diametri 130 km atrofida

I.34- rasm.
Entselad –Quyosh sistemasidagi eng yorqin jism. (al’bedosi 1 ga yaqin).



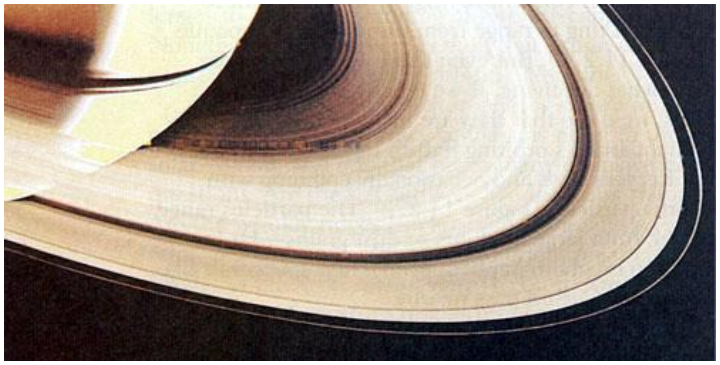
I.35- rasm
Tefiya Odissey krateri (400 km, yo’ldoshning 2/5 diametraga teng.) bilan mashxur va 3 ming km ga teng bo’lgan gigant kan’lnlari mavjud.



I.36- rasm
Diona. Ulkan kraterining o’lchami yonlamasiga 100 km atrofida

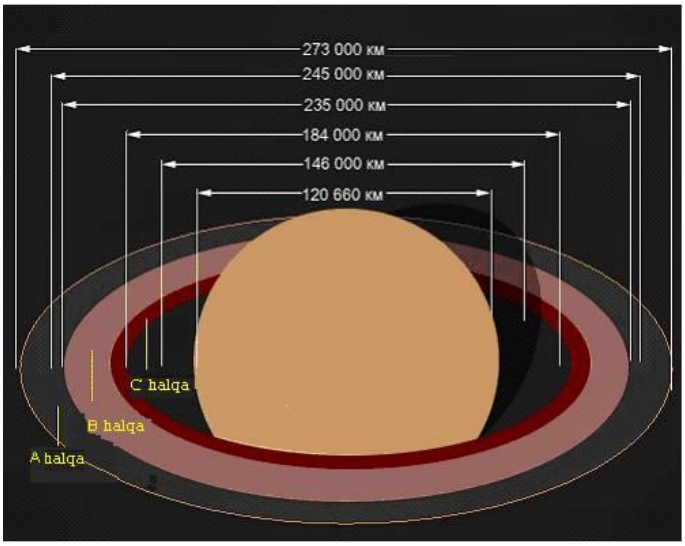
Qora Giperion o’z o’qi atrofida doimiy aylanish tezligiga ega emas: u bir oy davrida o’n foizga o’zgaradi.

Saturn xalqalari. Saturnning xalqalarini Yerdan turib unchalik katta bo'lmagan teleskop orqali ko'rish mumkin. Ular sayyora atrofida xarakatlanuvchi minglab mayda qattiq zarralar va muzli toshlardan tashkil topgan.



I.37– rasm. Saturn xalqalari. «Voyadjerdan» turib olingan surat.

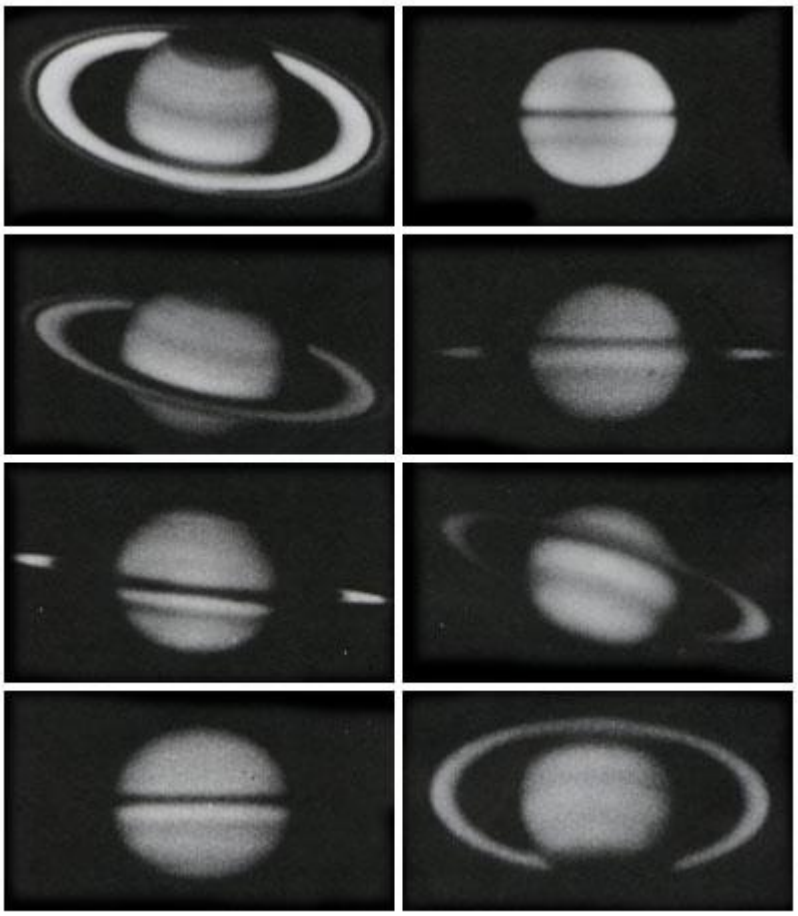
A,V va S deb ataluvchi uchta asosiy xalqalar mavjud. Ular Yerdan turib ortiqcha qiyinchiliklarsiz ajratiladi. Bulardan tashqari yana nisbatan kuchsizroq D, E, F halqalar xam mavjud. Yaqinlashgan sari xalqalarning juda xam ko'p ekanligi ko'rinadi. Xalqalar orasida tirqishlar mavjud bo'lib, bu Yerda zarralar uchramaydi. Yerdan turib oddiy maktab teleskopi yordamida ko'rinadigan (A va V xalqalar orasidagi) tirqish ***Kassini tirqishi*** deb ataladi. Tiniq qorong'u tunda xira ko'rinadiganlarini ham kuzatish mumkin. Xalqalarning ichki qismlari tashqi qismiga nisbatan tezroq aylanadi.



I.38- rasm
Xalqalarning tuzilish sxemasi.

Xalqalarning kengligi 400 ming km. lekin qalinligi bo’yicha ular bor yo’g’i bir necha o’n metrga etadi. Xalqalar orasidan xiraroq bo’lsada, yulduzlarni ko’rish mumkin. Barcha xalqalar turli o’lchamlardagi: chang o’lchamidan bir necha metrgacha bo’lgan alohida - alohida muz bo’laklaridan iborat. Ushbu zarrachalar deyarli bir xil tezlikda (10 km/s atrofida) xarakatlanadilar, ba’zida bir birlari bilan to’qnashadilar.

Xalqalarning tekisligi orbita tekisligiga 20^0 burchak ostida og’gan. SHuning uchun yil davomida biz ularni maksimal keng darajada ko’ramiz, shundan keyin ularning ko’rinish kengligi kamayadi va taxminan 15 yildan so’ng ular kuchsiz ajratiladigan chiziqqa aylanadilar.



I.39– rasm
Xalqalarning tashqi ko’rinishi yildan yilga o’zgarib turadi. Ushbu holat xalqalar tekisligining sayyora orbitasining tekisligiga og’maligi bilan tushuntiriladi.

1610 yilda Galileo Galiley birinchi bo’lib teleskopda Saturn xalqalarini ko’rdi, ammo buning nima ekanini tushunmadi, shuning uchun, Saturn qismlardan tashkil topgan deb yozib quydi.

Oradan yarim asr o’tgach, Xristian Gyuygens Saturnda xalqalarning mavjudligi xaqida ma’lum qildi, 1675 yilda esa Kassini xalqalar orasida tirqish (kora oralik) mavjudligini aniqladi.

XIX asrning oxiriga kelib, Jan Kassinining Saturn xalqasi meteor tuzulmali degan g'oyani ilgari surdi, 1893 yilga kelib esa ushbu g'oya kuzatuvlar natijasida o'z tasdig'ini topdi.

XX asr davomida sayyoralar xalqalari xaqidagi ma'lumotlar doimiy ravishda yangilanib borildi: o'lchamlarning qiymatlari va xalqalardagi zarralarning kontsentratsiyasi olindi, spektral analiz yordamida xalqa muz zarralaridan tashkil topgani aniqlandi, Saturn xalqalarining yorqinligining azimutal o'zgarish holati ochildi. 1977 yilning 10 martida Uranning ingichka bir-biridan qolib ketayotgan qop-qora xalqalari topildi. Oradan ikki yil o'tgach 1979 yilning 4 martida «Voyadjer-1» sayyoralararo apparati Saturn atrofida ham toshli xalqalar borligini aniqladi. O'n yildan keyin esa Neptunnig xalqalari aniqlandi.

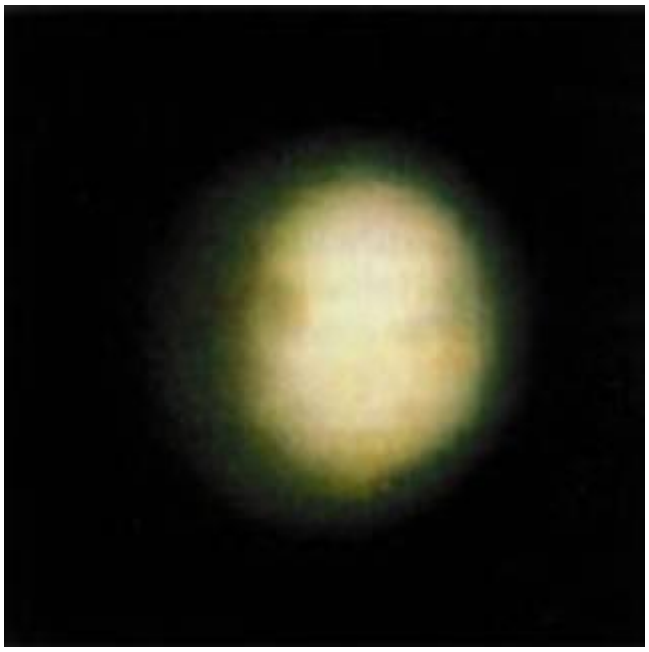
Sayyoralar xalqalari gigant-sayyoralar sistemasida qonuniy holat bo'lib chiqdi.

I.3. Uran- ko'k shar

Qachonki Yerni ko'k deb atalsa, bir oz yumshoqroq, erkalatib aytilgandek. Sayyoralar orasida xaqiqiy ko'k bo'lib, Uran chiqdi. Uran – yangi tarixda ochilgan eng birinchi sayyora bo'lib, u 1781 yilning 13 martida, o'zining teleskopida osmonni kuzatayotgan vaqtida bexosdan Vil'yam Gershel tomonidan ochilgan. Gershel buni kometa deb o'ylab, darxol Grinvichga xabar beradi. Lekin bu yangi sayyora ekanligi tez kunlarda ma'lum bo'ldi. Ma'lum bo'lishicha, Uranni avvalari xam kuzatishgan, lekin uni yulduz deb tasavvur qilingan. U xaqidagi eng avvalgi yozuvlar, 1690 yilda Jon Flemstid, uni Savrning 34 nchi yulduzi deb katalogga qayd qilgan yili aniqlangan edi. Gershel sayyorani o'zining raxnamosi, Angliya xukmdori

I.40-rasm
Uran «Voyadjera-2» dan turib olingan surati.
Atmosferada hech qandan detallarni ajratib bo'lmaydi

Georg III sharafiga «Georgium Sidus» (Georg sayyorasi) deb atadi. Boshqa astronomlar xam Gershel sayyorasi deb atagan edilar. «Uran» nomini esa, odatdagidek antik mifalogiyasidan olingan bo'lib, uni Bode vaqtinchalik nomlagan edi, 1850 yilga kelib bu nom tasdiqlandi.

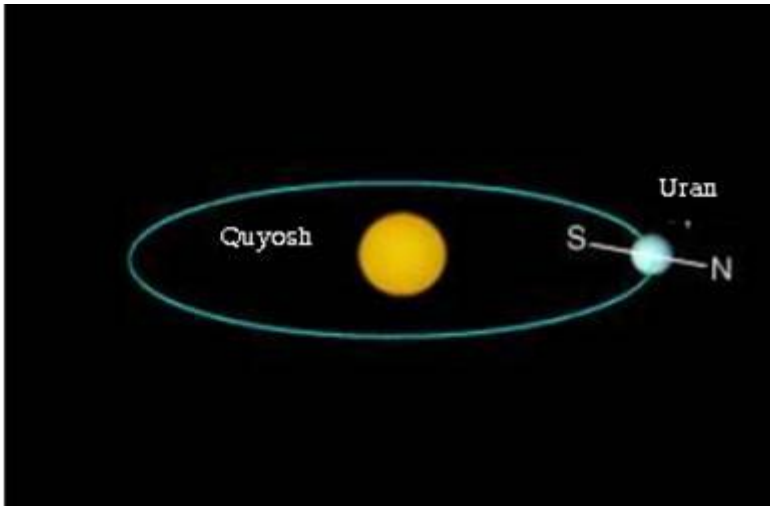


I.41- rasm
Yerdan turib kuzatilgan teleskoplar orqali Uran aynan shunday ko'rinishga ega.

Qurollanmagan ko'z bilan tiniq osmonda Uranni zo'rg'a ko'rish mumkin, uni binokl yordamida (agar siz osmoning qaysi tomoniga qarashni aniq bilsangiz) osongina aniqlash mumkin. Maksimal yulduziy kattaligi m = +5,5.

3,7" burchak ostida joylashgan kichik diskni uncha katta bo'lmagan astronomik teleskop ko'rsatadi. Sayyoraning Quyoshdan o'rtacha uzoqligi 19,187 a.b., orbita bo'ylab aylanish davri - 84,048 yil. Orbitaning ekstsentrisiteti 0,0463 ni tashkil etadi, orbita tekisligining ekliptika tekisligiga og'maligi 0^0 46'23", orbita bo'ylab o'rtacha aylanish tekisligi 6,8 km/s.

Uranda yulduz sutkasi 17 soat 14 minut davom etadi. Uran, «yonlamasiga yotib» aylanadi. Ekvatorning orbita tekisligiga og'maligini ($97^0 55'$), xuddi boshqa sayyoralar kabi, burilma qoidasiga bo'ysungani kabi 90^0 deb xisoblashga to'g'ri keladi.



I.42- rasm
Uran yonmachasiga yotib aylanadi.

Ko'pchilik sayyoralarda aylanish o'qi ekliptika tekisligiga deyarli perependikulyar, lekin Uranniki deyarli parallel ravishda joylashgan.

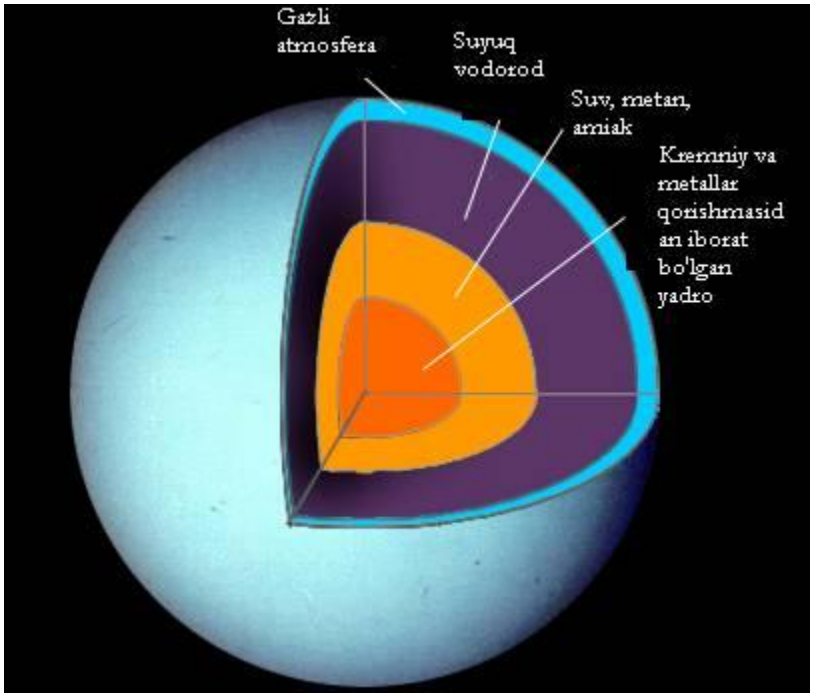
Urannig yotgan holda aylanishining sababi xali ma'lum emas.

Lekin xaqiqatda Uranning qaysi qutbi shimoliy ekanligi xaqida tortishuvlar bormoqda. Quyosh sistemasining kosmogoniyasi uchun Urannig aylanishini o'rganish juda katta axamiyatga ega. Agar Uran yon tomoni bilan yotib shakllangan bo'lsa, unda bu bizning quyosh sistemamizning yaralishi xaqidagi fikrlarning to'g'riligi bilan mos kelmaydi. To'g'ri, xozirda Uraninng bunday holati – uning boshlang'ich shakllanishi davrida katta osmon jismi, jumladan asteroid bilan, to'qnashishi tufayli hosil bo'lgan degan fikrlar xam yo'q emas. SHu kabi muammo Venerada xam mavjud, u yonlamasiga yotmasa xam, uning teskari yo'nalishda aylanish muammosi o'rganilmoqda.

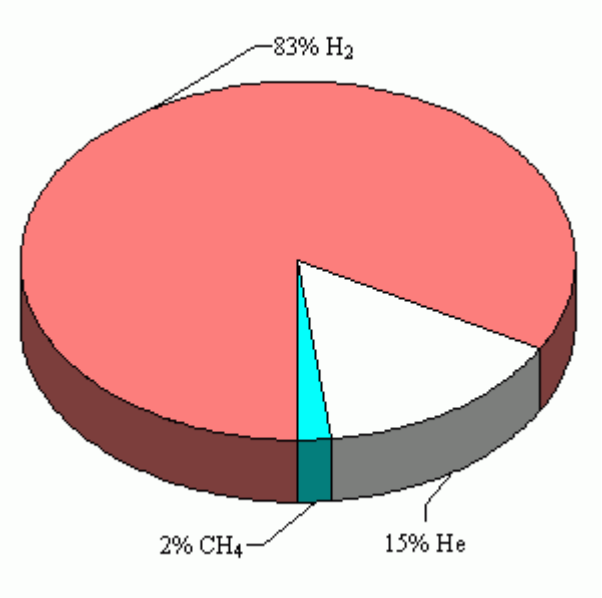
Uranning massasi Yer massasidan 14,5 marta ko'p. Uning radiusi juda xam katta bo'lib 25 ming km Yer radiusidan 4 marta katta. Uranning zichligi $\rho_{\text{♅}} = 1{,}30$ g/sm^3.

Sayyora juda siqiq. Uning ekvatorial radiusi 25 559 km, qutbiy radiusi esa 25 270 km ga teng. Sayyoraning bulutli qatlam ustiga mos keladigan balandlikda erkin tushish tezlanishi $g_{\text{♅}} = 9{,}67$ m/s^2.

«Voyadjer-2» dan olingan ma’lumotlarga ko’ra Uran uncha katta bo’lmagan qattiq temir-toshli Yadroga ega bo’lib, Yadrodan keyin, keskin ravishda quyuq atmosfera qatlami boshlanadi. Ko’rinishidan Uranda xech qanday okeanlar mavjud emas. Xozirda sayyoraning bunday tuzilishini ikki qatlamli model deb ataladi. Yadroda temperatura 7000 K ga yetadi, bosim esa – 6 million atmosfera. Uranning effektiv temperaturasi 59 K bo’lib, Quyoshdan oladigan iliqlikdan bir ozgina oshadi. Shuningdek, Uran deyarli ichki energiya manbaiga ega emas. Taxminlarga ko’ra, Quyosh sistemasining shakllanishidan keyinrnoq Uranning boshqa jism bilan to’qnashishi sodir bo’lgan. Ushbu to’qnashish oqibatida Uran yon tomoniga to’ntarilib qolgan degan taxminlar xam yo’q emas. Sayyoraning tug’ilishi paytidagi massasining yetarli emasligi, uning o’z atrofida vodorod va geliyni ko’p miqdorda saqlab qola olmagan, yoki aslida bu erning o’zida gazning miqdori oz bo’lgan. Ko’rinib turibdiki, Uranning jumboqlariga javob topilsa, Quyosh sistemasining keyingi taqdiri xaqida muhim ma’lumotlar olish mumkin ekan.



I.43-rasm.
Uranning ichki tuzilishi.

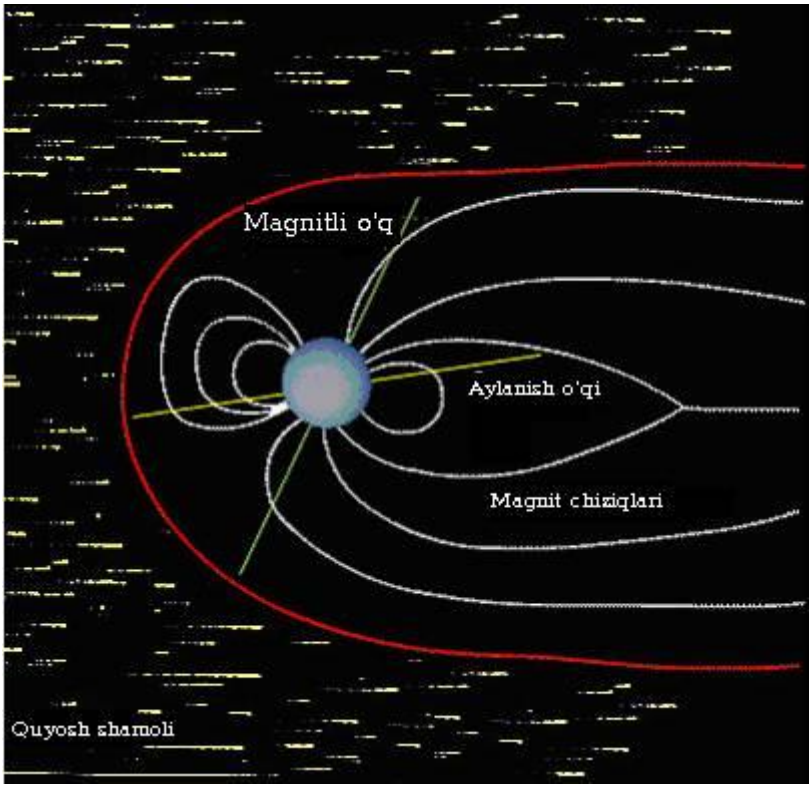


I.44– rasm.
Uran atmosferasining kimyoviy tarkibi.

Uranda atmosfera juda quyuq, qalinligi 8000 km dan kam emas. Uranning atmosferasi taxminan 83% vodoroddan, 15% geliydan va 2 % metandan tashkil topgan. metan, atsetilin va boshqa uglevodorodlar sayyora atmosferasida, Yupiter va Saturnning atmosferasidagidan ko'ra ancha ko'p. Aynan metan qizil nurlarni yaxshi yutadi, Shuning uchun Uran ko'k bo'lib ko'rinadi. Boshqa gazli sayyoralardagi singari, Uranda xam juda tez xarakatlanadigan bulutlar polosalari bor. Ammo ularni ajratish juda qiyin, Shuning uchun faqatgina katta ajrata olish kuchiga ega bo'lgan teleskoplar orqaligina olingan fotosuratlarda ko'rish mumkin. Xabbl kosmik teleskopidan turib olingan oxirgi kuzatishlar katta bulutlarni ko'rish imkonini berdi. Bu holat fasllar effekti bilan bog'liq degan taxminlarga olib kelmoqda, chunki, sayyoraning yarim shari yil bo'yi Quyoshdan berkinib turadi va Uran Quyoshdan Yerga karaganda 370 marta kam issiqlik oladi, Shuning uchun u Yerda yozda xam jazirama issiq bo'lmaydi.

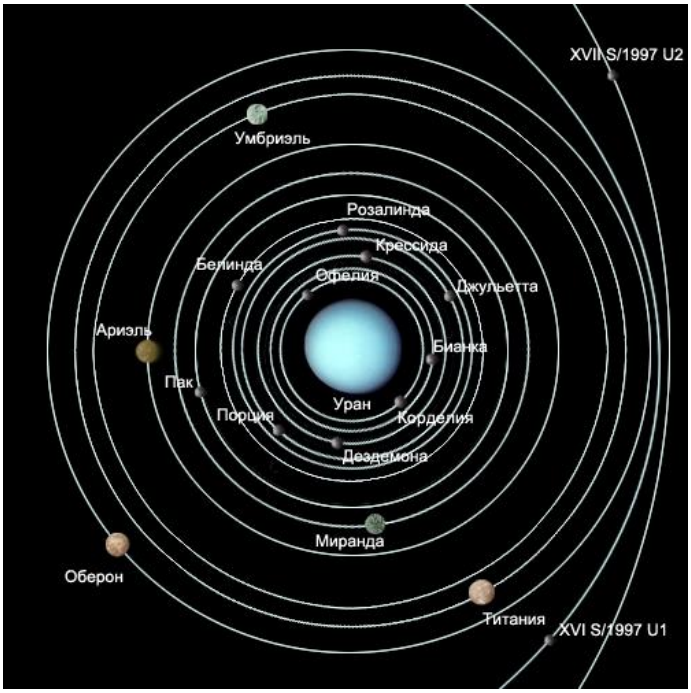
Yerda shamol bulutlarni qaysi tarafga qarab eltsa, Uranning o'rta kengliklarida xam Shu Yerga qarab eltadi. Ushbu shamollar 40 dan 160 m/s tezlik bilan esadi, Yerda tez bo'ladigan oqimlar 50 m/s ga teng.

Uranda kunduzgi yoritilganlik, Yer yuzida Quyosh botganidan keyingi oqshom singari bo'ladi. Atmosfera bosimi 0,1 bar darajada minimal temperatura 53 K kuzatilgan. Yuqori va pastki qismlarda temperatura ko'tariladi. Bosim 2,3 bar darajasida atmosfera temperaturasi 100 K ga yetadi. Urandagi ***magnit maydon*** xuddi Yerniki singari. Bulutli qatlamlar balandligi darajasida magnit maydon 0,23Gs ga teng. Lekin ushbu magnit maydon konfiguratsiyasi juda murakkab. Agar dipol o'qini markazdan ridiusning 1/3 qismiga siljitib va aylanish o'kiga 60^0 ga og'dirsak, juda yaqin taxminlar bilan uni dipolli deb hisoblash mumkin. Uranda kompas geografik qutbni ko'rsatmaydi.



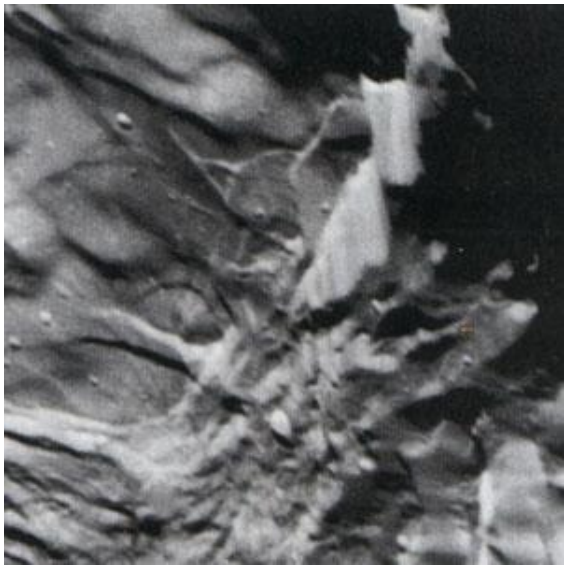
I.45- rasm
Uran magnitosferasi.

Shekspir kanizaklari. Kuzatishlarning qiyinligiga qaramasdan, o'tgan asrlar astronomlari Uranning deyarli barcha gigant yo'ldoshlarini ochdilar. Yo'ldoshlar sistemasi sayyoraning ekvatorial tekisligida, ya'ni uning orbita tekisligiga perependikulyar ravishda yotadi. Ichki 10 ta oylari - o'lchamlari bo'yicha kichikdir. 1986 yilda «Voyadjer-2» KAS uzatgan suratlarda 1986U10 yo'ldoshi xozircha shaxsiy nomga ega emas. Uni xam xuddi Uranning boshqa yo'ldoshlari singari Shekspir p'esalari qaxramonlaridan birining nomi bilan atasalar kerak.

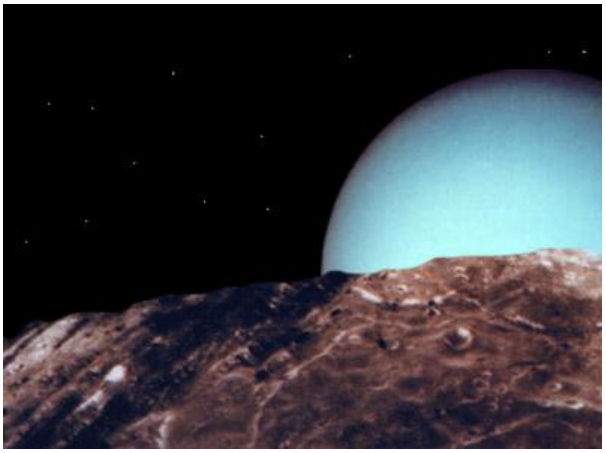


I.46- rasm. Uran yo'ldoshlari sistemasi .

Nomi	Yorqinligi, *m*	Orbita radiusi, ming km	Uran atrofida aylanish davri davri, sut.	Radius, km	Massa, kg
Kordeliya	24	49,77	0,33503	13	$1{,}7\cdot10^{16}$
Ofeliya	24	53,79	0,37640	≈ 15	$2{,}6\cdot10^{16}$
Bianka	23	59,17	0,43458	≈ 21	$7\cdot10^{16}$
Kressida	22	61,78	0,46357	≈ 31	$2{,}6\cdot10^{17}$
Dezdemona	22	62,68	0,47365	≈ 37	$1{,}7\cdot10^{17}$
Djul'etta	22	64,35	0,49307	≈ 42	$4{,}3\cdot10^{17}$
Portsiya	21	66,09	0,5132	≈ 54	$1\cdot10^{18}$
Rozalinda	22	69,94	0,5585	≈ 27	$1{,}5\cdot10^{17}$
Belinda	22	75,26	0,6235	≈ 33	$2{,}5\cdot10^{17}$
Pak	20	86,01	0,7618	77	$5\cdot10^{17}$
Miranda	16,5	129,39	1,4135	472	$6{,}3\cdot10^{19}$
Ariel'	14,4	191,02	2,5204	579	$1{,}27\cdot10^{21}$
Umbriel'	15,3	266,30	4,1442	585	$1{,}33\cdot10^{21}$
Titaniya	14,0	435,91	8,7059	790	$3{,}49\cdot10^{21}$
Oberon	14,2	583,52	13,463	760	$3{,}03\cdot10^{21}$
Kaliban	21	7169	-579	≈ 60	
Sikoraksa	21	12214	-1289	≈ 120	
1986U10	24	76,4	0,638	≈ 20	
Setebos	23	17810	-2271	≈ 20	
Stefano	24	7920	-674	≈ 20	
Prospero	22	16670	-2057	≈ 40	

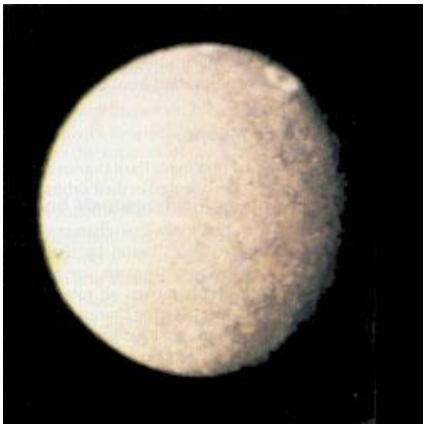


I.47- rasm. Kichkina Mirandada churligi bir nesa kilometrga yetadigan gigant kan'onlar aniqlandi.



I.48- rasm. Miranda va Uran.

I.49– rasm.
Ariel sirti mayda kraterlar va vodiylar µamda qatlamlar bilan qoplangan



I.50– rasm.

Umbriel'. Kinishidan yuqoridagi yorqin µalqa to'qnashish natijasida µosil bo'lgan kraterdagi muz qoplamni bildirsa kerak

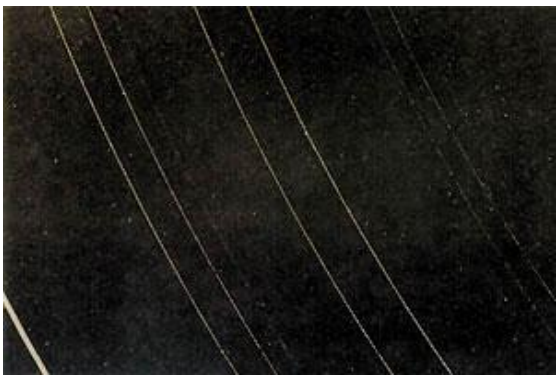
I.51- rasm.
Titaniya sirtida ko'p miqdordagi kraterlar aniqlandi. Ba'zi kon'yonlarning devorlari muz bilan qoplanganligi tufayli yorqin bo'lib ko'rinadi

I.52– rasm.
Oberonning qadimiy muzli sirt qatlami kraterlar bilan o'yib tashlangan

Urannig yo'ldoshlari ***Oberon*** va ***Titaniya*** bir – birlariga juda o'xshaydilar. Ularning radiuslari Oyning radiusidan taxminan ikki marta kichik. Ikkala oylarning sirtlari eski meteorit kraterlari va qadimiy vuqonlardan darak beruvchi, tektonik vayronagarchiliklar to'rlari bilan qoplanganlar.

Uran xalqalari 1977 yilda Uran yorqin yulduzni qoplagan vaqtida behosdan ochilgan. Shu vaqtda yulduz, uni Uran to'liq qoplashiga qadar 9 marta va undan so'ng yana 9 marta uzgartirdi. Shunday qilib, to'qqizta zich, yupqa va bir biridan uzoqda qolib ketuvchi Uraning qora xalkalari ochildi.

Ularnnng barchasining kalinligi 1–10 km, eng keng tashqi xalqaning o'lchami 96 km ga teng. Uranning xalqalari deyarli qop-qora: al'bedosi 0,03 ga teng. Ular yonlamasiga bir necha metrga yetadigan toshli zarralardan iborat. Xar bir xalqa xuddi bitta yaxlit singari xarakatlanadi. Xalqalarning barqarorlik muammosi xali xam echilmay qolmoqda.

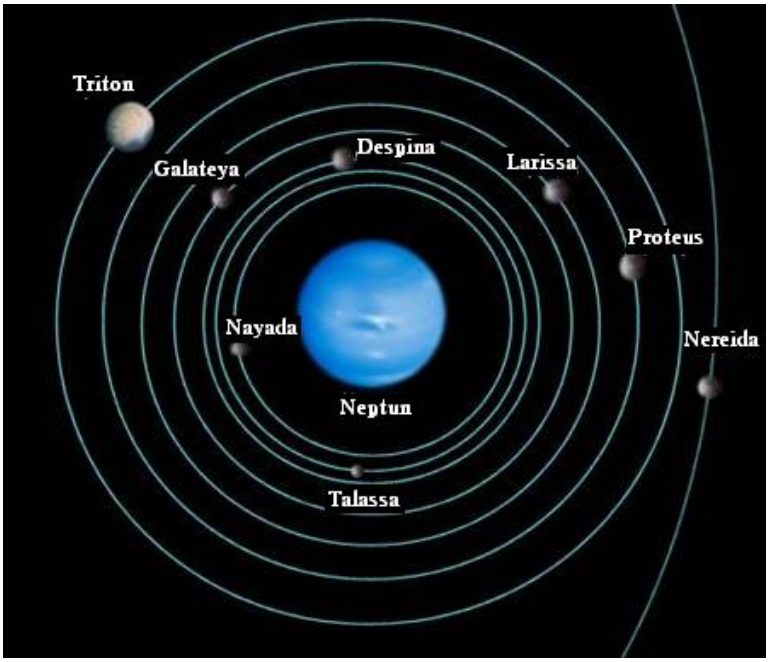


I.53- rasm.
Uran xalqalari kattalashtirilgan ko'rinishda.

Yo'ldoshlar va xalqalar

Nomi	Yorqinligi, *m*	Orbita radiusi, ming. km	Neptun arofida aylanish davri, "-" sut	Radius, km	Massa, kg	Ochilgan yili
Nayada	25	48,23	0,2944	29 km	$1{,}4\cdot10^{17}$	1989
Talassa	24	50,07	0,3115	40 km	$4\cdot10^{17}$	1989
Despina	23	52,53	0,3347	74 km	$2{,}1\cdot10^{17}$	1989
Galateya	23	61,95	0,4287	78 km	$3{,}1\cdot10^{18}$	1989
Larissa	21	73,55	0,5547	208×178	$6\cdot10^{18}$	1981
Protey	20	117,65	1,1223	436×416×402	$6\cdot10^{19}$	1989
Triton	13,6	354,76	-5,877	1350	$2{,}14\cdot10^{22}$	1846
Nereida	18,7	5 513,4	360,14	170	$3{,}1\cdot10^{19}$	1949

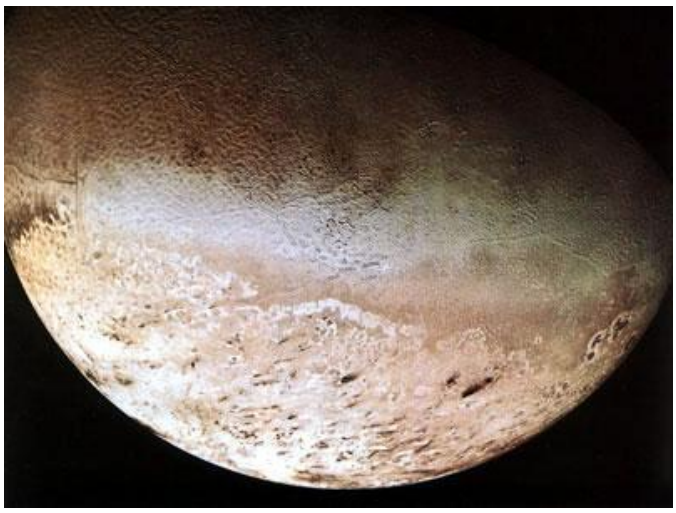
I.54- jadval



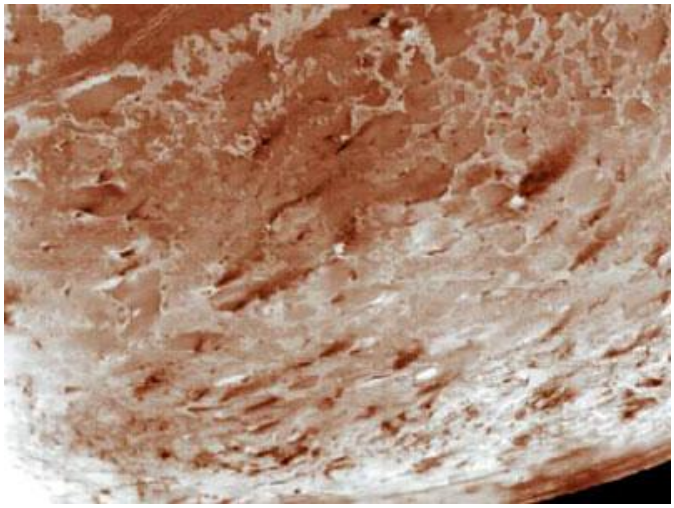
I.55– rasm.
Neptunning eng katta yo'ldoshi – Triton.

1846 yilda Uil'yam Lassel tomonidan ochilgan Triton yo'ldoshi Oydan xam katta bo'lib, u Neptun atrofida teskari yo'nalish bo'ylab xarakatlanadi, Shuning uchun uni olimlar ***Koyper belbog'idan*** Neptun tomonidan ishg'ol qilib olingan degan xulosaga kelinmoqda.

Tritonda Neptun yo'ldoshlari sistemasidagi deyarli barcha massa jamlangan. Uning zichligi juda yuqori bo'lib, 2 g/sm^3 ga yetadi.

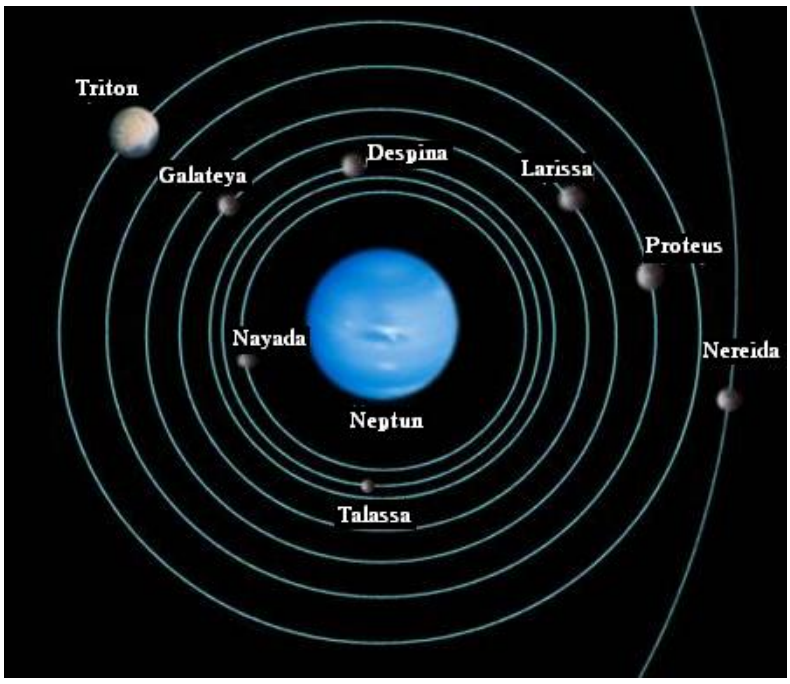


I.56– rasm.
Olimlarning fikricha, ushbu o'lchamlari 200X400 km li vodiy «muzdi» vulqonning otilishi natijasida vujudga kelgan.



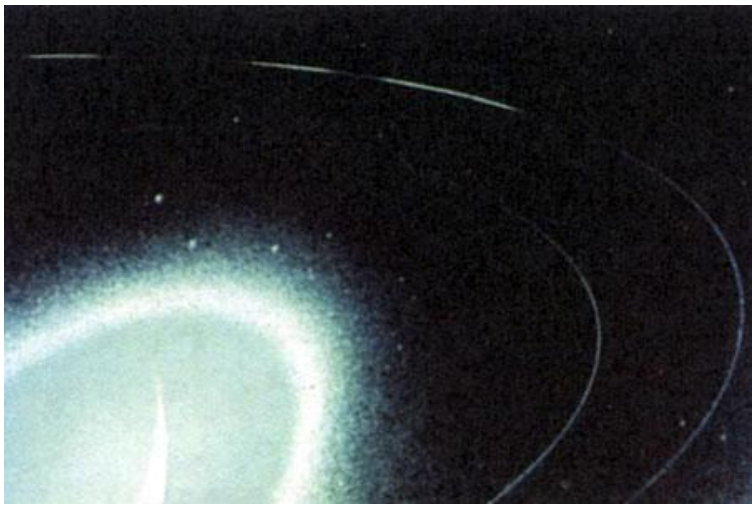
I.57- rasm
Tritondagi suvli geyzer

Tritonda cho'qqilar, kraterlar, vulqonsifat qora polosalar aniqlangan. «Voyadjer-2» Tritonda qizil muzning suratini va ekvatorda muzlab qolgan metandan iborat bo'lgan ko'k muzning suratini oldi. Janubiy qutb qalpog'i azotli muzdan tashkil topgan bo'lib, uning ichidan bir necha kilometrga geyzerlar otilib chiqib turadi. Yo'ldoshning sirti yorug' bo'lib, tushayotgan Quyosh nurining 80% ni qaytaradi. Triton siyrak azotli atmosferaga ega (sirtidagi bosim 10 mm sim. ust.). Tritonda temperatura -235^0S.



I.58- rasm
Neptun yo'ldoshlari sistemasi.

Neptunnig yo’ldoshi Nereida 1949 yilda Jerard Koyper tomonidan ochilgan bulib, uning orbita bo’lab aylanish ekstsentrisiteti eng yuqori bo’lib, 0,75 ga teng.



I.59– rasm.
Arka-xalqalar.

Neptun atrofida arkalar ko’rinishidagi xalqalar aniqlangan. Ushbu xalqalar xaqidagi birinchi ma’lumotlar 1995 yilda olingan. Xisoblashlar Ushbu arkalar epitonlar deb atalgan murakkab bo’ronlar (vixr) ekanligini ko’rsatadi.

II BOB. "GIGANT SAYYORALAR FIZIKASI" MAVZUSINI ZAMONAVIY AXBOROT TEXNOLOGIYALARI MUHITIDA O'QITISH METODIKASI

II.1 Astronomiк ta'limga axborot texnologiyalarini joriy etish yo'llari

Ta'limni компьyuterlashtirish o'qitishning кuchli vositasi, tadqiqot ishlarining ajralmas qismi sifatida maydonga chiqmoqda. Bu esa, fanlarni o'qitishga oid metodiк qo'llanmalarni yaratishni, o'quv jarayonlarni modellashtirish va tadbiq qilishni, yuqori malaкali pedagog va ilmiy кadrlar tajribalarini кeng miqyosda yoyishni, ta'lim berish jarayonida har bir ta'lim oluvchini o'ziga xos xususiyatlariga moslashishni hamda o'quvchilarning mustaqil o'quv faoliyatini rivojlantirishga ko'maкlashish imкonini beradi.

Bularning barchasini amalga oshirish uchun o'quvchilarning mustaqil ishlashi o'qituvchilarning nazorati ostida, metodiк va texniк yordamiga tayangan holda tashкil qilishni taкomillashtirish zarur.

Har qanday ta'limot shunchaкi ishlab chiqariladigan emas, balкi sermahsul ijodiy xaraкterdagi faoliyat deb tushunilmog'i кeraк.

O'quv faoliyatni rivojlantirishning tuzilmasi bizning tadqiqot ishimizda asosiy quyidagi yondashuv ko'rinishida amalga oshirildi, ya'ni:

1. Ta'limni компьyuterlashtirish.
2. Internet tizimidan samarali foydalanish.
3. Innavatsion pedagogiк texnologiyalarga axborot texnologiyalarini tatbiq etgan holda qo'llash.
4. Nazorat baholashda interfaol testlardan fodalanish

Bizning oldimizga qo'yilgan maqsadlarga ko'ra, astronomiya o'qituvchisini astronomiya fani bo'yicha metodiк tayyorlashda, pedagogiк jarayon tadqiqi ikки xil funкtsiyada, ham ob'eкt, ham sub'eкt sifatida ishtiroк etadi. Jarayonning ob'eкt sifati - oliy o'quv yurtida bo'lajaк fiziка va astronomiya o'qituvchisini astronomiya fani bo'yicha кasbiy tayyorlash metodiкasi bo'lsa, jarayonning sub'eкti sifatiga -

bo’lajaк fiziка va astronomiya o’qituvchisining кasb hunar кollejlari (KXK) va aкademiк litseylarda (AL) astronomiya fanini o’qitish metodiкasini yaratish va qo’llash bilan bog’liq faoliyatini ta’minlaydigan masalalar кiradi. Shu masalalardan кelib chiqqan holda biz aкademiк litseylarda astronomiya o’qitishda zamonaviy axborot texnologiyalarini qo’llash masalalarin oldimizga vazifa qilib qo’ydiк.

Aкademiк litseylarda astronomiyani o’qitish iккinchi кursdan boshlanadi. Astronomiya fani bir semestrga mo’ljallangan bo’lib, mazкur fan uchun 40 soat ajratilgan. Bundan 34 soati auditoriya soati, 6 soati esa кuzatuvlarga ajratilgan. SHulardan xar bir semestrda haftasiga 2 soatdan mashg’ulotlar uchun ajratilgan. Fan bo’yicha erishilgan bilim, malaка va ko’niкmalar yaкuniy nazorat bilan sinovdan o’тkaziladi.

Astronomiya fani osmon jismlarining haraкatlari, fiziк tabiatlari va ular bilan bog’liq hodisalar bo’yicha ilmiy dunyoqarashni shaкllantirishni maqsad qiladi. U o’quvchilarni astrometriya asoslari, osmon mexaniкasi va nazariy astronomiya elementlari, astrofiziк metodlar, quyosh sistemasi jismlarining fiziк tabiati, yulduzlar astronomiyasining asoslari, ularning masofalari va o’lchamlari, massalari va tempraturalarini topishning usullari bilan tanishtiradi. Osmon jismlari va ularning sistemalarini paydo bo’lishi va evolyutsiyasi haqida xabar beradi Mazкur fan Koinotning yiriк masshtabli struкturasi va bizning Galaктiкamiz, unda quyosh. sistemasi va Erning o’rnini ko’rsatuvchi zamonaviy кosmologiк tushuncha va tasavvurlarni o’quvchilarda shaкllantirishni ham o’z oldiga vazifa qiladi. Jumladan Quyosh sistemasining tuzilishi va jismlarining fiziк tabiatini o’rganish uchun 6 soat vaqt ajratilgan bo’lib, shundan “gigant sayyoralar fiziкasi”ni o’rganish uchun 2 soat vaqt ajratilgan.

Ko’rinib turitbtiкi, aкademiк litseylarda astronomiya soatlari кesкin qisqartirilganligi sababli, bugungi кunda ta’lim berishning samaradorligini oshirish uchun, zamonaviy axborot va кommuniкatsiya texnologiyalarining imкoniyatlaridan to’liq foydalanish orqali yuqori samaradorliкka erishish mumкin. Mashg’ulotlarni кompьyuter texnologiyalari asosida tashкil etish, internet sahifalaridan mavzular bo’yicha sistemalashtirilgan ma’lumotlardan кeng

foydalanish, ta’lim berishda кutilgan natijalarga erishishni ta’minlaydi. Sferiк va amaliy astronomiyaga oid bilimlarini amaliy mashg’ulotlar asosida, astrofiziкaga oid materiallar bo’yicha erishilgan bilimlarni esa laboratoriya va кuzatish mashg’ulotlari asosida mustahкamlash yaxshi natijalar beradi.

SHuningdeк, astronomiк ta’lim, axborot texnologiyalariga muhtoj soha bo’lib, buning bir nechta ob’eктiv va sub’eктiv jihatlari mavjud. Avvalo, u o’quvchilar oddiy, кundaliк hayotda кuzatmaydigan yoкi кuzatsa ham shu darajada seкin va muntazam ro’y beradigan jarayon va hodisalarкi, ularga o’quvchi e’tiborini qaratish va fiкrini ushlab turish qiyin. SHuning uchun ularni an’anaviy holda o’qitish yaxshi samara bermaydi. Masalan, yulduzlar osmonining sutкaviy va yilliк aylanishini va osmon sferasi to’g’risidagi tushunchalarni olayliк. Sutкaviy aylanishni planetariylarda namoyish etiladi, bu o’quvchilarni darsdan tashqari paytda, o’quv masкanidan chetga olib chiqishni taqozo etadi va bunday eкsкursiyalarni butun кurs davomida bir marta, кo’pi bilan iккi marta uyushtirish mumкin. O’qitish jarayonida bu etarli emas.

Astronomiк ta’lim astronomiк кuzatishlar va кo’plab кo’rgazmali materiallardan foydalanishni taqozo etadi. Кo’pchiliк astronomiк кuzatishlar darsdan tashqari paytda, кechqurun bajariladi. Bu birinchidan, mavzu o’qitilayotgan paytda shu mavzuga tegishli кuzatishlarni namoyish etib bo’lmasliк bilan bog’liq bo’lsa, iккinchidan o’quvchilarni кechкi кuzatishlarga jalb etish bilan bog’liq tashкiliy muammolarni кeltirib chiqaradi.

Astronomiya ta’limida zamonaviy axborot texnologiyalarini joriy etishning istiqbolli yo’nalishlaridan biri astronomiк hodisalar va jarayonlarni кompьyuterda modellashtirishdir. Masalan, sayyoralarni кuzatishni olayliк. Bu astronomiк кuzatish ishini xohlagan paytda (har кechqurun) tashкil etib bo’lmaydi. Sayyoralar yulduzlar osmonida siljib yuradilar, shuning uchun biror bir sayyora (masalan, Venera) bir necha oy (hafta) кechqurun кo’rinsa, bir necha oy кo’rinmaydi va undan кeyin bir necha oy dovomida ertalab кo’rinadi. Bunday кo’rinishlar fasllar bo’ylab siljib boradi. Bir martta uyushtirilgan кechкi кuzatishda sayyorani yulduzlar osmonida siljib yurishini кuzatish qiyin. Agar astronomiya mashg’ulotlari кech кuz

oylariga rejalashtirilgan bo’lsa, кuzgi кechqurungi osmonda Savr, Orion yulduz turкumlarini кo’rsatish mumкin. Katta Ayiq yulduz turкumini кo’rsatishning imкoni bo’lmaydi. Bir marta uyushtirilgan кuzatishlarda yulduzlar osmonini eslab qolish qiyin.

Astronomiya fanini o’qitishda qo’llash uchun кo’plab dasturiy mahsulotlar yaratilgan bo’lib, bular orasida «Astronomiк кalendarь» (masalan, AstroLab), yulduzlar osmoni xaritasi (masalan, SkyMapPro_7, yoкi internetda joylashtirilgan yulduzlar osmoni xaritasi www.astronet.ru/db/map), yulduzlar osmonining modeli (masalan, SKYGLOBE.3_5, COSMOS_3)ni кo’rsatish mumкin.

Ular har xil dasturiy tillarda yozilgan. Hozirgi zamon eleктron o’quv nashri bu dasturiy mahsulotlarni birgaliкda qo’llashni taqozo etadi. Bu eleктron o’quv nashr yaratuvchisidan qator dasturiy vositalarni qo’llay bilishni talab etadi va u oddiy pedagog uchun og’ir masala, chunкi pedagog bunday dasturiy mahsulotni ham buyurtmachisi, ham yaratuvchisidir. Bu ta’lim jarayonini axboriy ta’minlash uchun uni tashкiliy ta’minlashni ham taqozo etadi.

Ta’lim berishning o’ziga xos yangi texnologiyasi ta’lim berishning umumiy nazariyasi bilan uning amaliy tadbig’i orasidagi bog’lov bo’g’inidir. Shu asosida «Kadrlar tayyorlash Milliy dasturi» da pedagogiк texnologiyaga кatta e’tibor berilgan. Shuning asosida o’quvchilarning mustaqil ta’lim faoliyatlarini rivojlantirish omili sifatida кompьyuterdan foydalanish pedagogiк texnologiyaning ta’lim beruvchi dasturlari orqali amalga oshiriladi. Shu bois, bunday dasturlarni loyihalashning psixologiк-pedagogiк muammolarining alohida guruhini tashкil qiladi. Ta’lim jarayonida кompьyuterdan samarali foydalanish uchun mazкur muammolarni hal qilish lozim.

II.2. "Gigant sayyoralar fizikasi" mavzusini axborot texnologiyalaridan foydalanib o'qitish metodikasi

O'quv-tarbiyaviy jarayonni taxlil qilish natijasida astronomiya o'qitish metodikasining asosiy vazifalari sifatida quyidagilarni ko'rsatish mumkin:

- o'quv muassasalarida astronomiya o'qitishning maqsadlarini asoslash, tarbiyaviy ahamiyatini ko'rsatib berish;
- astronomiya kursi mazmuni va tuzilishini aniqlash va uni takomillashtirib borish;
- o'qitishning eng samarali metodlari va usullarini ishlab chiqish, tekshirish va amaliyotda qo'llash, o'quvchilarni tarbiyalash va rivojlantirish hamda astronomiyadan o'quv jihozlari va qurollarini qo'llash.

Boshqacha qilib aytganda, astronomiya o'qitish metodikasi nima uchun o'qitish, nimani o'qitish va qanday o'qitish kerak, degan masalalarni hal etishdan iboratdir.

Astronomiya o'qitishning asosiy vazifasi bu astronomiya o'qitish nazariyasini takomillashtirish, o'qitish jarayonining hamda astronomiyani o'zlashtirishning eng muhim qonuniyatlarini o'rganish, astronomiya o'qitish jarayonida maktab, litsey va kollej o'quvchilarini tarbiyalash va rivojlantirishdir.

Astronomiya o'qitish metodikasi fani boshqa fanlar metodikalari singari ham barcha o'z oldiga qo'ygan vazifalarni to'liq hal etib bo'lgan deb ayta olmaymiz, bu borada izlanishlar davom etmoqda va davr talablaridan, jamiyat rivojlanishining tendentsiyasidan kelib chiqqan, holda astronomiya o'qitish jarayoniga ham yangi pedagogik va axborot texnologiyalari kirib kelmoqda va bu jarayon uzluksiz davom etadi.

Boshqa fanlar kabi astronomiyani o'qitish ham umumiy didaktik maqsadlarni-o'quvchilarni bilim, tarbiya olishlarini va rivojlanishlarini ko'zlaydi. Bu maqsadlar orasida mazmuni bo'yicha ham, amalga oshirish metodlari bo'yicha ham hech qanday aniq chegara bo'lishi mumkin emas. O'qitish jarayonida o'quvchilar nazariy bilim, amaliy ko'nikma va malaka oladilar va shu bilan birga ularni tarbiyalash va rivojlantirish jarayonlari ham kiradi.

Astronomiyani o’rganishda, bu fanga aloqador boshqa predmetlardan olingan bilimlarga o’quvchilar e’tiborini jalb etish zarur. Xuddi shuningdek, astronomiyadan «Quyosh sistemasining fizik tabiati» mavzusini, jumladan «Gigant sayyoralar»ni o’qitilayotganda astronomiya kishilik madaniyatini ajralmas bir qismi ekanligini, uning boshqa fanlar bilan aloqasi butun tsivilizatsiyamiz tarixi davomida kuzatilib kelinayotganini alohida uqdirish kerak.

Hozirgi zamonda Erdan tashqarida ro’y beradigan kimyoviy jarayonlarni va turli ob’ektlarning kimyoviy tarkibini tadqiq qilish, eng avvalo raketa va kosmik texnikadan foydalanish xisobiga, yangi sifatiy darajaga ko’tariladi. Bu fanlarning aloqasi juda muhim xisoblanadi, chunki fizika bilan aloqada bo’lmay turib, astronomiya kursining asosiy-astrofizika bo’limi bo’yicha chuqur va mustahkam bilimga erishishlarini ta’minlab bo’lmaydi.

Astronomiya darslarida, o’quvchilar gravitatsion va magnit maydonlaridagi harakatlarni o’rganadilar, molekulyar-kinetik nazariya asosida moddaning fizik holatini ifodalashda, nurlanish jarayonlarida va uning modda bilan ta’sirlashishida, issiqlikni uzatish usullarida, atom yadrolarining parchalanishi va sintezi masalalarida ish ko’riladigan deyarli barcha fizik tushunchalar bilan duch keladilar. Bunda o’qituvchining vazifasi, o’rganilayotgan astronomik xodisalarning fizik mohiyatlarini echishda, bu bilimlardan mumkin qadar keng foydalanishga erishishdir. Ko’p hollarda turli masshtablardagi va turli osmon jismlarida ro’y beradigan hodisalarning asosida yotuvchi fizik jarayonlarning mohiyatlariga murojat qilish, o’quvchilar bilimlarini umumlashtirishga katta imkon beradi.

YUlduzlarni o’rganishda gaz qonunlaridan foydalanish, fizika kursidan gazlarning kengayishida chegara yo’qligi o’quvchilarga ma’lum. SHuning uchun ham gaz sharlarining tabiiy holati ko’rinishidagi yulduzlar haqida tushunchalar, ba’zan gaz xossalari haqidagi shakllangan tushunchalarga qarama-qarshi boruvchi kutilmagan paradoks sifatida qayd qilinadi. YUlduzlar xayotida gravitatsion kuchlarning rolini anglash, tabiat hodisalarini yanada chuqurroq analiz qilishga imkon yaratadi. Elektr va magnit maydonlarining o’zaro bog’lanishi haqidagi

tushunchani Quyoshda kuzatiladigan hodisalarni o’rganishda mustahkamlash ayniqsa qulay.

Temperatura haqidagi tushuncha, "Quyosh sistemasi jismlarining fizik tabiati" bo’limida Er atmosfera yuqori qatlamlarining temperaturasidan tortib to yulduzlar qa’ridagi va yulduzlar aro bo’shliqdagi temperatura qaraladigan yakunlovchi kursning astrofizik qismiga tegishli ixtiyoriy materiallarda rivojlantiriladi va chuqurlashtiriladi. Temperatura zarrachalarning kinetik energiyasi bilan bog’lanishi, astronomiyadagi qator hodisalarni tushuntirishda hal qiluvchi ahamiyat kasb etadi. SHuning uchun ham o’quvchilarga birinchi navbatda bu bog’lanishni eslatish zarur.

Fizika va astronomiya orasidagi bu uzviy bog’lanish, bu fanlarning rivojlanish tarixidan keltirilgan misollarda ham yaxshi ko’rinadi.

Fizika va astronomiya darslarida bir xil mazmundagi sifat va miqdoriy masalalarni echish, o’qituvchi faoliyatining xarakteri va uning o’quvchilar faoliyatini yo’naltirishdagi farqni aniqlovchi spetsifik xususiyatlarga ega. Fizika darslarida o’quvchining diqqati, ma’lum fizik qonuniyatlarni qo’llab o’quvchilarda aniq tipdagi masalalarni echish malakalarini hosil qilishga qaratilgan. Astronomiya darslarida esa, o’qituvchining diqqat e’tibori, olingan natijalarning mohiyatini o’quvchilar yangicha, shuningdek turli masshtabdagi kosmik xodisalar, Erda ochilgan fizik qonunlar asosida tushuntirilishi mumkinligiga ishonch hosil qilishga qaratiladi.

SHuningdek, astronomiyadan «Gigant sayyoralarning fizik tabiati» mavzusini o’tishda ham fizik tushunchalarga tayaniladi. Ularning kattaliklari (o’lchamlari, massalari, zichliklari va xakozo) va atmosferalariga tegishli fizik tabiat haqida to’xtaladi.

YUqoridagi aytilganlarni hisobga olgan holda, biz «Quyosh sistemasi» bo’limiga tegishli bo’lgan bir qancha mavzularning dars ishlanmasini tuzib chiqdik. Quyida biz astronomik ta’limga innavatsion pedagogik texnologiyalarni tadbiq qilgan holda ma’ruza mashg’ulotlarini tashkil etish metodikasini «Gigant sayyoralarning fizik tabiati»ni o’qitish misolida ko’rib chiqamiz.

Mavzu telekommunikatsion texnologiyalarni qo'llagan holda, yangi mavzuni bayon etiladi. Bunda, gigant sayyoralar va ularning fizik tabiati, gigant sayyoralarning yo'ldoshlari, ularning tuzilishi, magnitosferasi, gigant sayyoralarni ichki tuzilishi, sayyora yo'ldoshlari va xalqalari tabiatini axborot telekommunikatsion texnologiyalar yordamida o'tish va mavzu yuzasidan o'quvchilarning olgan bilimlarini mustaqil ravishda qo'llashga o'rgatishga e'tibor qaratiladi.

Darsning tehnologiyasi

O'quvchilar soni 25-30	2 soat
Ma'ruza rejasi	1. Gigant sayyoralar. 2. Sayyoralarning yo'ldoshlari. 3. Kosmik apparatlar tomonidan olingan sayyoralarning relefi, atmosferasi va magnitosferasi xaqida ma'lumotlar
O'quv mashg'ulotining maqsadi	O'quvchilarda gigant sayyoralarning fizik tabiatlari va ularning yo'ldoshlari haqida tasavvur va tushunchalarni shakllantirish. Gigant sayyoralarning fundamental astronomik hususiyatlariga (massasi, sirtidagi harorati, o'lchami, zichligi va h.k) tayangan holda dars o'tish tavsiya qilinadi.
Pedagogik vazifalar:	*O'quv faoliyati natijalari:*
- Gigant sayyoralarning fizik tabiatlarini tushuntirish. - Gigant sayyoralarning yo'ldoshlari haqida tasavvur va tushunchalarni shakllantirish.	- Gigant sayyoralarning fizik tabiatlari haqidagi tasavvurlarga ega bo'ladilar. - Gigant sayyoralarning yo'ldoshlari haqida tasavvur va tushunchalarga ega bo'ladilar.
O'qitish usullari	Vizual ma'ruza
O'qitish vositalari	1. Ma'ruzalar matni, proyektor, tarqatma materiallar, ahborot-kommunikatsiya tehnologiyalar imkoniyatlari. 2. «Astronomiya» elektron o'quv-metodik majmua [5].
O'qitish shakllari	Jamoa, guruh va juftlikda ishlash.
O'qitish sharoiti	Proyektor, kompyuter bilan jihozlangan auditoriya.
Monitoring va baholash	kuzatish, savol orqali, testlar. test natijalari ballari

Darsning tehnologik haritasi

Ish bosqichlari	O'qituvchi faoliyatining mazmuni	Tinglovchi faoliyatining mazmuni
1-bosqich. Tayyorgarlik (10 daqiqa)	Mavzu rejasi, uning maqsadi, o'quv mashg'ulotidan kutilayotgan natijalar ma'lum qilinadi.	Mavzu, rejani yozib oladilar
2-bosqich. Asosiy (60 min.)	O'quvchilarda gigant sayyoralarning fizik tabiatlari va ularning yo'ldoshlari haqida tasavvur va tushunchalarni shakllantirish. Gigant sayyoralarning fundamental astronomik hususiyatlariga (massasi, sirtidagi harorati, o'lchami, zichligi va h.k) tayangan holda dars o'tish tavsiya qilinadi.	Kuzatadi, tinglaydi, daftariga qayd qiladi, qo'shimcha ma'lumotlar beradi.
3-bosqich. Yakuniy (10 min.)	Mavzuga yakun yasaydi. Darsda faol qatnashgan o'quvchilarga rag'bat bali qo'yiladi	Tinglaydi. O'z o'zini baholaydi.
	Mustaqil ish uchun vazifa beriladi. Individual ravishdagi uy vazifalarni beradi. O'quvchilarning har biriga alohida ravishda Gigant sayyoralar, meteorlar, meteoridlar, asteroidlar va h.k.lar haqida internet banklaridan ma'lumotlar olish va slaydlar yaratish vazifasi beriladi. Darsga yakun yasaydi.	Vazifani qayd qiladi, tinglaydi.

Darsning borishi to'g'risida qisqacha bayon.

Yer stipidagi sayyoralar» mavzusi bo'yicha, uyga berilgan topshiriqlarni tekshirish bosqichida beriladigan qisqacha frontal so'rov savollari:

1. Yer tipidagi sayyoralarning gigant sayyoralardan farqlarini ayting. Kutilayotgan javob: massasi, o'lchamlari, aylanish davrlari, yo'ldoshlari soni, zichligi, Quyosh sistemasidagi o'rni, kelib chiqish sharoitlari va h.k.
2. Yer tipidagi sayyoralarning Gigant sayyoralardan Quyosh tomonidan yoritilganligining farqi? Kutilayotgan javob: Yer tipidagi sayyoralar Quyoshdan ko'proq issiqlik oladilar, ularning sirtidagi xarorat gigantlarnikidan ko'ra yuqoriroq.

3. Parnik effekti qaysi sayyoralarda kuzatiladi? Kutilayotgan javob: Venerada, Yerda.
4. Yer tipidagi sayyoralar asosan nimalardan tashkil topganlar? Kutilayotgan javob: Yer tipidagi sayyoralar asosan zich tosh moddalardan va metallardan tashkil topganlar.
5. Yer tipidagi sayyoralarning o'rtacha zichligi qanday? Kutilayotgan javob: r=4000-5500 kg /m 3
6. Yer tipidagi qaysi sayyora atmosfera va biosferaga ega? Kutilayotgan javob Yer.
7. Yer tipidagi sayyoralarning qaysilarida, deyarli ularning butun massasijamlangan qattiq qobiqga ega? Kutilayotgan javob: barchasida.
8. Yer tipidagi qaysi sayyora zich atmosferaga ega? Kutilayotgan javob: Venera, Yer. Marsda siyrak atmosfera mavjud. Merkura esa deyarli atmosferadan maxrum.
9. Yer tipidagi sayyoralar atmosferasining kimyoviy tarkibi qanday? Kutilayotgan javob: Yerda 78% azot va 21% kislorod, Venerada - 96,5% is gazi, Marsda 95% is gazi.
10. Yer tipidagi sayyoralarning qaysi birining atmosferasi eng siyrak molekulyar massaga ega? Kutilayotgan javob: Yerda 28,8˜10 $^{-3}$ kg /mol, Venera va Marsda 43,5˜10 10 $^{-3}$ kg /mol.
11. Yer tipidagi sayyoralarning kimyoviy tarkibi qanday? Kutilayotgan javob: temir Fe (34,6%), kislorod (30%), kremniy (15%), magniy (13%). Qobig'ida eng ko'p tarqalgan birikmalar - kremniy ishqori.

Yangi mavzuni bayon etishdann oldin, barcha o'quvchilarning bilimlarini nazorat qilish uchun kartochkalar tarqatiladi. Uni qanday bajarish kerakligi to'g'risida tushunchalar beriladi.

	Yer tipidagi sayyoralar	**Gigant sayyoralar**
Sayyoraning massasi		

O’lchamlari (radiusi)		
O’z o’qi atrofida aylanish davri		
Yo’ldoshlarining soni		
Zichligi		
Qattiq qobiq		
Qattiq qobiqning kimyoviy tarkibi		
Atmosferasi		
Kimyoviy tarkibi		
Atmosferaning o’rtacha molekulyar massasi		
Quyosh sistemasida o’rni		
Quyoshdan uzoqligi		
Effektiv harorati		
Magnit maydonlari		

O’quvchilarni 4 guruhga bo’linadi (Yupiter, Saturn, Uran, Neptun).

Dars avvalida reja ma’lum qilinadi va shu reja asosida bevosita internet texnologiyalirini qo’llagan holda dars olib boriladi.

1- ilova

REJA:

- **Gigant sayyoralar.**
- **Sayyoralarning yo’ldoshlari.**
- **Kosmik apparatlar tomonidan olingan sayyoralarning relefi, atmosferasi va magnitosferasi xaqida ma’lumotlar**

O’qituvchi o’quvchilar tomonidan aytilganlarni e’tibor bilan eshitadi, ulardan eng ko’p xatolikka yo’l qo’yilishi mumkin bo’lgan xususiyatga ega bo’lganlarini qayd qilib boradi (bu o’quvchilarning umumiy bilim darajasini va ular tomonidan qo’yiladigan xususiy xatoliklarni aniqlash imkonini beradi) va to’ldirib, tuzatib boradi so’ngra o’quvchilar tomonidan aytilganlarni umumlashtiradi.

Undan keyin yangi mavzuni ma’ruza shaklda bayon etiladi.

Ma’ruza davomida, o’qituvchi tomonidan mavzu yuzasidan tayyorlab kelingan animatsiyali slaydlarni videoproektor yordamida ekranga tushirilib, namoyish qilib boriladi. Agar videoproektor mavjud bo’lmasa, o’quvchilar 1-2 tadan qilib, kompyuterlarga joylashtiriladi va lokal tarmoq orqali bir vaqtning o’zida barcha kompyuterlarda, o’qituvchi tomonidan Internetning aniq bir manziliga ishora qiluvchi gipermatnli materiali namoyish qilinib boriladi.

Mavzuni yoritishda gigant sayyoralarning fizik tabiatini yorituvchi jadvallarni qo’llash katta samara beradi:

2- ilova

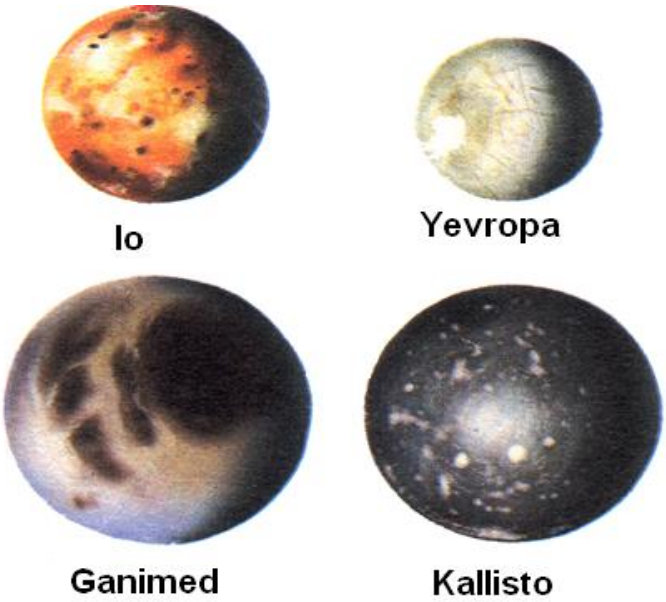
Yupiter

O'rtacha Quyoshdan uzoqligi	**5,20 a.b.**
Siderik aylanish davri	**11,86 yil.**
Sinodik aylanish davri	**398,9 sut.**
Orbitaning ekliptikaga g’maligi	**1018’**
Ekvatorial radiusi	**71400 km**
Massasi	**1,90*1030 g**
O'rtacha zichligi	**1,3 g/sm3**
Ekvatorda erkin tushish tezligi	**2500 sm/s2**
O'z o'qi atrofida aylanish davri	**9h 50,5m**
Xaroratining o'rtacha effektivligi	**134 k**
Yo'ldoshi	**27 ta**

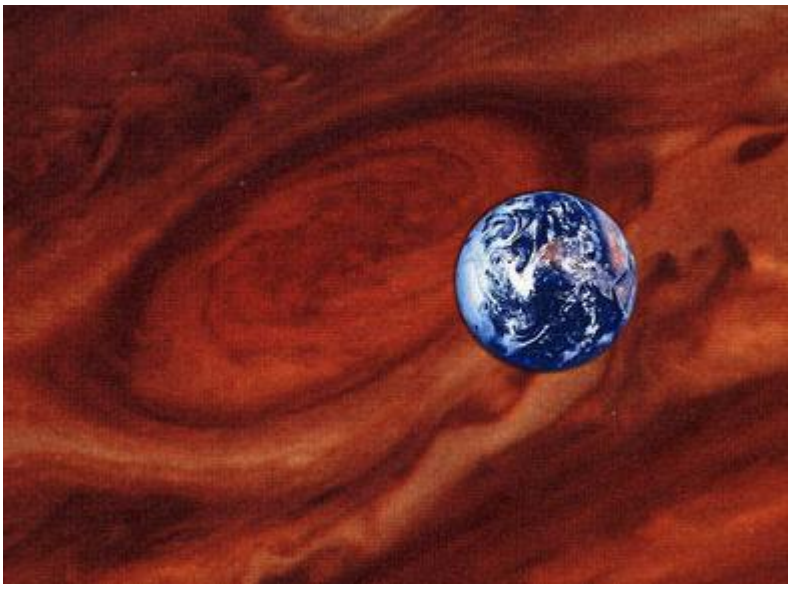
3- ilova

Yupiterga Quyosh sistemasidagi barcha sayyoralar massasining 3/2 qismi to'g'ri keladi. Yupiterinng atmosferasining 89% vodoroddan tashkil topgan va 11 % geliy va kimyoviy tarkibi bo'yicha Quyoshni esalatadi. Atmosferasining kalinligi 6 ming km. Atmosferaga olov rangni fosfor va oltingugurt birikmasi beradi. ¤uvchi amiak va atsetindan iborat bo'lgani uchun inson xayoti uchun xavflidir. Sayyora sirtidagi eng mashxur tuzilma bu, 300 yildan beri kuzatilayotgan (u 1664 yilda Robert Guk tomnidan ochilgan) katta qizil dog'.

4- ilova



5- ilova



6- ilova

Io – Yupiter yo'ldoshlarining eng birinchilaridan bo'lib, 1610 yilda Galiley tomonidan ochilgan. Massasi va radiusiga ko'ra yo'ldosh Oyga o'xshagan bo'lib, Yupiter osmonida yorqin qizg'ish disk yoki yarimoy shaklida ko'rinadi. Ioning diametri 3630 km ga teng.

7- ilova

Saturn

O'rtacha Quyoshdan uzoqligi	**9,54 a.b.**
Siderik aylanish davri	**29,46 yil.**
Sinodik aylanish davri	**378,1 sut.**
Orbitaning ekliptikaga og'maligi	**2029'**
Ekvatorial radiusi	**60400 km**
Massasi	**5,68*1029 g**
O'rtacha zichligi	**0,7 g/sm3**
Ekvatorda erkin tushish tezligi	**1100 sm/s2**
O'z o'qi atrofida aylanish davri	**10h 14m**
Xaroratining o'rtacha effektivligi	**97 k**
Yo'ldoshi	**16 ta**

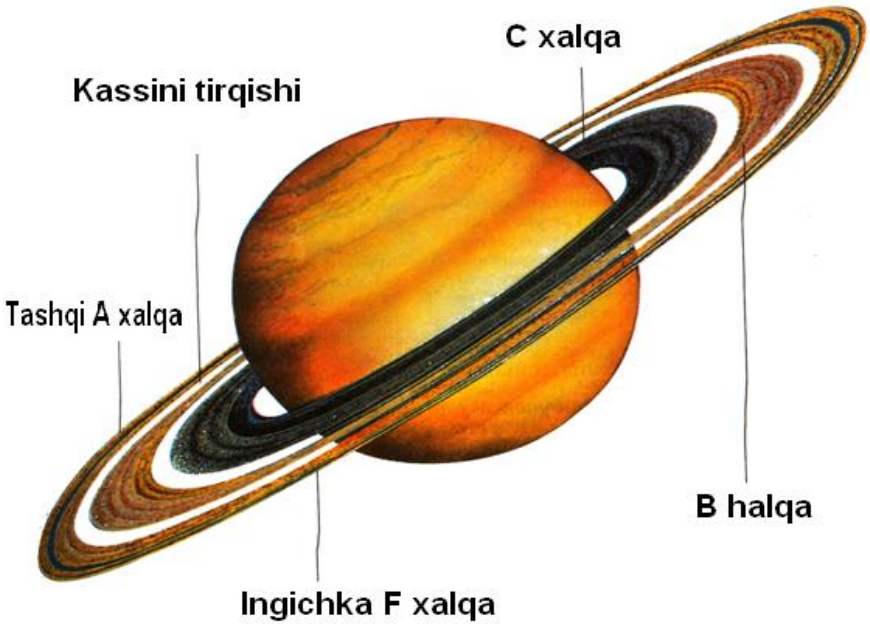
8- ilova

Ushbu sayyora qadim zamonlardan beri ma'lum bo'lgan. Saturnning maksimal yulduziy kattaligi $+0,7^m$. Ushbu sayyora – bizning yulduzli osmonimizdagi eng yorqin ob'ektlardan biridir. Saturnning xalqalari Yerdan turib, uncha katta bo'lmagan teleskop orqali ham ko'rinadi. Ular Sayyora atrofida aylanadigan, ming-minglab unchalik katta bo'lmagan qattiq jismlar, tosh va muzlarning qoldiqlaridir.

Orbitasining katta yarim o'qi 9,584 a.b. ni tashkil etadi, aylanish davri esa 29,666 yilga teng. Orbitaning ekstsentrisiteti e = 0,057 bo'lib, ekliptikaga og'maligi 2^0 29'. O'z o'qi atrofida aylanish davri - yulduz sutkasida – 10 soat 14 minutni (30^0 kenglamada) tashkil etadi. Saturn qattiq jism bo'lmay, gaz va suyuqdikdan tashkil topgani uchun, uning ekvatori qutblariga nisbatan tezroq aylanadi: qutblarda bitta to'liq aylanish davrt taxminan 26 minutga sekinroq kechadi. O'qi atrofida o'rtacha aylanish davri - 10 soat 40 minutga teng.

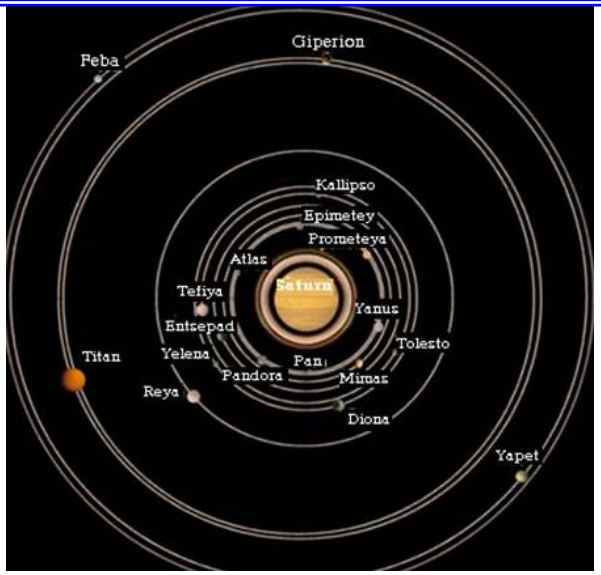
9- ilova

A,V va S deb ataluvchi uchta asosiy xalqalar mavjud. Ular Yerdan turib ortiqcha qiyinchiliklarsiz ajratiladi. Bulardan tashqari yana nisbatan kuchsizroq D, E, F halqalar xam mavjud. Yaqinlashgan sari xalqalarning juda xam ko'p ekanligi ko'rinadi. Xalqalar orasida tirqishlar mavjud bo'lib, bu Yerda zarralar uchramaydi. Yerdan turib oddiy maktab teleskopi yordamida ko'rinadigan (A va V xalqalar orasidagi) tirqish *Kassini tirqishi* deb ataladi.



10- ilova

Xalqalarning tekisligi orbita tekisligiga 20^0 burchak ostida og'gan. Shuning uchun yil davomida biz ularni maksimal keng darajada ko'ramiz, shundan keyin ularning ko'rinish kengligi kamayadi va taxminan 15 yildan so'ng ular kuchsiz ajratiladigan chiziqqa



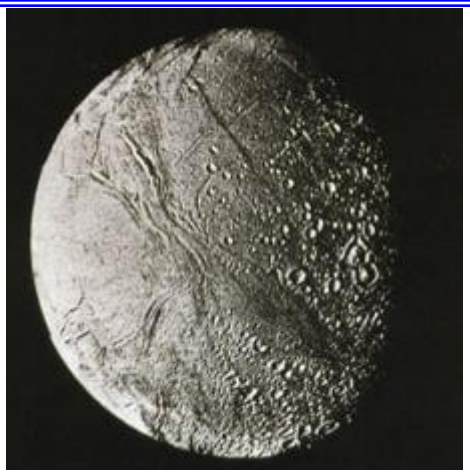
11- ilova

Saturn bir ajoyib xususiyatga ega: u - Quyosh sistemasidagi yagona bo'lgan, o'rtacha zichligi suv zichligidan kam bo'lgan (bir kub metrga 700kg) sayyoradir. Agar ulkan okeanni yaratish imkoni bo'lganda edi, Saturn unda suzib yurgan bo'lar edi. Bulutli qoplam sirti balandligida erkin tushish tezlanishi g = 9,44 m/s^2 ni tashkil etadi. Al'bedosi 0,47.

12- ilova

Saturn yo'ldoshlari sistemasi ancha murakkab. 30 ta yo'ldoshlari ma'lum, ular jadvalga kiritilgan. Shulardan 12 tasi oxirgi bir necha yillar ichida ochilgan.

Mimas. To'qnashishdan hosil bo'lgan kraterning diametri 130 km atrofida



Entselad –Quyosh sistemasidagi eng yorqin jism. (al'bedosi 1 ga yaqin).

Tefiya Odissey krateri (400 km, yo'ldoshning 2/5 diametraga teng.) bilan mashxur va 3 ming km ga teng bo'lgan gigant kan'lnlari mavjud.

Diona. Ulkan kraterining o'lchami yonlamasiga 100 km atrofida

13- ilova

Uran

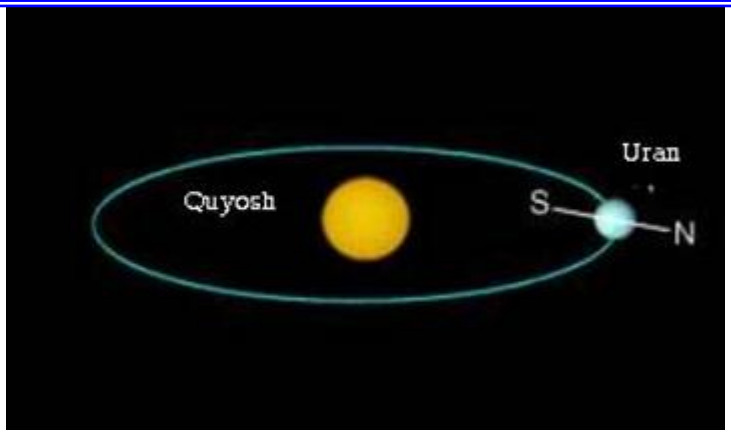
O'rtacha Quyoshdan uzoqligi	**19,18 a.b.**
Siderik aylanish davri	**84,01 yil.**
Sinodik aylanish davri	**369,7 sut.**
Orbitaning ekliptikaga oqmaligi	**0046'**
Ekvatorial radiusi	**24300 km**
Massasi	**8,70*1028 g**
O'rtacha zichligi	**1,6 g/sm3**
Ekvatorda erkin tushish tezligi	**950 sm/s2**
O'z o'qi atrofida aylanish davri	**10h 49m**
Xaroratining o'rtacha effektivligi	**54 (?)**
Yo'ldoshi	**5 ta**

14- ilova

Sayyoralar orasida xaqiqiy ko'k bo'lib, Uran chiqdi. Uran – yangi tarixda ochilgan eng birinchi sayyora bo'lib, u 1781 yilning 13 martida, o'zining teleskopida osmonni kuzatayotgan vaqtida bexosdan Vil'yam Gershel tomonidan ochilgan. Gershel buni kometa deb o'ylab, darxol Grinvichga xabar beradi.

15- ilova

Ko’pchilik sayyoralarda aylanish o’qi ekliptika tekisligiga deyarli perependikulyar, lekin Uranniki deyarli parallel ravishda joylashgan. Urannig yotgan holda aylanishining sababi xali ma’lum emas.



16- ilova

Uranda atmosfera **juda quyuq, qalinligi 8000 km dan kam emas. Uranning atmosferasi taxminan 83% vodoroddan, 15% geliydan va 2 % metandan tashkil topgan. metan, atsetilin va boshqa uglevodorodlar sayyora atmosferasida, Yupiter va Saturnning atmosferasidagidan ko’ra ancha ko’p. Aynan metan qizil nurlarni yaxshi yutadi, Shuning uchun Uran ko’k bo’lib ko’rinadi.**

17- ilova

Kuzatishlarning qiyinligiga qaramasdan, o’tgan asrlar astronomlari Uranning deyarli barcha gigant yo’ldoshlarini ochdilar. Yo’ldoshlar sistemasi sayyoraning ekvatorial tekisligida, ya’ni uning orbita tekisligiga perependikulyar ravishda yotadi. Ichki 10 ta oylari - o’lchamlari bo’yicha kichikdir. 1986 yilda «Voyadjer-2» KAS uzatgan suratlarda 1986U10 yo’ldoshi xozircha shaxsiy nomga ega emas. Uni xam xuddi Uranning boshqa yo’ldoshlari singari Shekspir p’yesalari qaxramonlaridan birining nomi bilan atasalar kerak.

Shu yerda biz уuьiori paragraflarda kщrsatib щtganimizdek, sayyoraning ущldoshlari jadvali va suratlari keltiriladi.

18- ilova

Neptun

O'rtacha Quyoshdan uzoqligi	**30,07 a.b.**
Siderik aylanish davri	**164,8 yil.**
Sinodik aylanish davri	**367,5 sut.**
Orbitaning ekliptikaga oqmaligi	**1046'**
Ekvatorial radiusi	**25050 km**
Massasi	**1,03*1029 g**
O'rtacha zichligi	**1,7 g/sm3**
Ekvatorda erkin tushish tezligi	**1150 sm/s2**
O'z o'qi atrofida aylanish davri	**15h 40m**
Xaroratining o'rtacha effektivligi	**56 (?)**
yo'ldoshi	**8 ta**

24- ilova

1846 yilda Uil'yam Lassel tomonidan ochilgan Triton yo'ldoshi Oydan xam katta bo'lib, u Neptun atrofida teskari yo'nalish bo'ylab xarakatlanadi, Shuning uchun uni olimlar *Koyper belbog'idan* Neptun tomonidan ishg'ol qilib olingan degan xulosaga kelinmoqda.

Tritonda Neptun yo'ldoshlari sistemasidagi deyarli barcha massa jamlangan. Uning zichligi juda yuqori bo'lib, 2 g/sm^3 ga yetadi.

O'quvchilar bilimini baholash: o'quvchilar bilimini baholashda reyting tizimidan foydalanish maqsadga muvofiq deb hisoblaymiz. Bunda talabalarga qo'yilgan baho real bo'lishi aniqdir. Reyting tizimidan foydalanganda talabalarning faoliyati to'liq qamrab olinadi, bu talabalarning faolligini oshiradi. Talabalar bilimini baholashda ularning ijodkorligiga alohida e'tibor qaratish zarur. Baho mezonlarini belgilashda odatda har bir fan bo'yicha mavjud dasturlardagi ko'rsatmalardan foydalanish kerak. Bu bosqichda o'qituvchilar tomonidan avvaldan belgilab olingan, ma'lum interent sahifalari manzillarini ko'rsatish orqali internet

testlardan foydalanish mumkin, yoki «Astronomiya» elektron o’quv-metodik majmua [14] “testlar” bo’limiga kiritilgan mavzuga oid testlar blokidan foydalangan holda test olish va baholash mumkin (testlar avtomatik ravishda ballarni chiqarib beradi). SHundan so’ng uyga beriladigan vazifa tushuntiriladi.

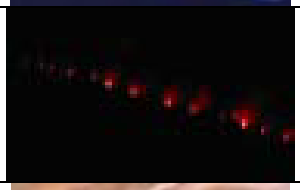
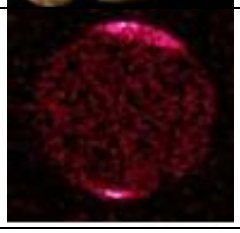
CHarxpalak texnologiyasi bo’yicha jadvalni to’ldiring

№	Sayyoralarning yo’ldoshlari	Merkuriy	Venera	Er	Mars	YUpiter	Saturn	Uran
1.	**Fobos**							
2.	**Demos**							
3.	**Io**							
4.	**Ganimed**							
5.	**Evropa**							
6.	**Kalisto**							
7.	**Titan**							
8.	**Entselad**							
9.	**Tefiya**							
10.	**Mimas**							
11.	**Oberron**							
12.	**Titaniya**							
13.	**Umberiel**							
14.	**Triton**							
15.	**Xaron**							

Uyga vazifa: Barcha guruhlar berilgan, ma’lum bo’lgan Internet sahifalaridan sayyoralarning kosmik stantsiyalardan turib olingan fotosuratlarini internet banklaridan axtarib topadilar. Har bir guruh uchun topshiriqlar kartochkalari tarqatilgan.

Yupiter

	Manzil	
Katta qizil dog’	www.iki.rssi.ru/ nineplanets/jupiter.html	
Sayyora atmosferasidagi sohalar va chiziqlar	www.iki.rssi.ru/ nineplanets/jupiter.html	

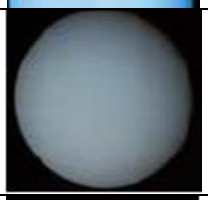
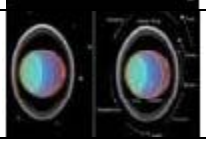
«Gallileo»dan turib kuzatish	www.jpl.nasa.gov/ galileo/hstimages.html yoki	
Yupiterning yo’ldoshlari	www.iki.rssi.ru/ nineplanets/jupiter.html	
Yupiter xalqalari	www.jpl.nasa.gov/ galileo/callisto/p48188.html	
Shumerker-Levi kometasi	www.iki.rssi.ru/ nineplanets/jupiter.html	
Yupiter atmosferasidagi dog’lar-yirik siklonlar. Yupiterda bir nechta doimiy tuzilmalar topilgan.	antwrp.gsfc.nasa.gov/ apod/ap020205.html yoki	
Yupiterning yo’ldoshi Io	antwrp.gsfc.nasa.gov/apod/ image/0110/ IoNewVolcano_galileo.jpg	
Yupiter qutblarida rentgen chaqnashlar	www.pioner.smr.ru/ distance/planet.html	

Saturn

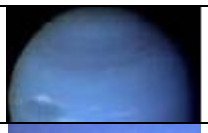
	Manzil	
Xalqalari	www.iki.rssi.ru/ nineplanets/saturn.html	
Juda tez aylanishi tufayli qutblardagi siqiqligi	www.iki.rssi.ru/ nineplanets/saturn.html	

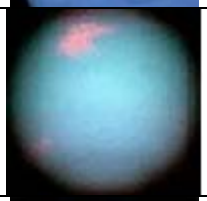
Saturn xalqalari sistemasi	www.iki.rssi.ru/ nineplanets/saturn.html	
Tashqi A xalqalar Ichki V xalqalardan keskin qora oraliq- Kassini tirqishi bilan ajratilgan	www.iki.rssi.ru/ nineplanets/saturn.html	
Qutb yog'dusi	antwrp.gsfc.nasa.gov/apod/ ap011223.html	
Saturn xalqalarining og'maligin o'zgarishi	antwrp.gsfc.nasa.gov/apod/ ap010702.html	

Uran

	Manzil	
	www.iki.rssi.ru/nineplanets/ uranus.html	
	photojournal.jpl.nasa.gov/cgi-bin/PIAGenPlanetPage.pl?Uranus	
Uranning aylanishi	photojournal.jpl.nasa.gov/cgi-bin/PIAGenCatalogPage.pl?PIA01278	
	photojournal.jpl.nasa.gov/cgi-bin/ uncgi/PIADBSearch.rl	

Neptun

	Manzil	
Ko'k sayyora	www.iki.rssi.ru/nineplanets/ neptune.html	
Katta ko'k dog'	www.iki.rssi.ru/nineplanets/ neptune.html	

	www.iki.rssi.ru/nineplanets/ neptune.html	
Katta qora dog’ va atmosferadagi holat	www.iki.rssi.ru/nineplanets/ neptune.html	
Katta qora dog’ atrofida 1120 km/soat tezlik bilan siljiydigan oq bulutlar to’dasining yig’ilishi	photojournal.jpl.nasa.gov/cgi-bin/ PIAGenPlanetPage.pl?Neptune	
Neptunning infraqizil nurlanishi	www.pioner.smr.ru/distance/ neptune.html	

Kutilayotgan javoblar:

	Yer tipidagi sayyoralar	**Gigant sayyoralar**
Sayyoraning massasi	Yer massasi bilan taqqoslash mumkin	Yer massasidan ancha katta
O’lchamlari (radiusi)	Yerdan kichikroq	Yerdan ancha katta
O’z o’qi atrofida aylanish davri	Yer va Marsda bir sutka atrofida, Merkuriy va Venerada birmuncha ko’proq	Yerdan bir necha marotaba tezroq aylanadilar
Yo’ldoshlarining soni	0 dan 2 tagacha Marsda	Ancha ko’p
Zichligi	$\rho = 4000 - 5500 кг/м^3$	Birmuncha kamroq. $\rho = 1300 кг/м^3$ dan $700 кг/м^3$
Qattiq qobiq	Bor	Yo’q
Qattiq qobiqning kimyoviy tarkibi	temir (34,6%), kislorod (30%), kremniy (15%), magniy (13%). Qobig’ida ko’proq tarqalgan qorishmalar kremniy ishqori.	Yo’q
Atmosferasi	Bor	Bor, juda siyrak
Kimyoviy tarkibi	Yerda 78% azot va 21% kislorod. Venerada – 96,5% is gazi. Marsda 95% is gazi.	Deyarli vodorod va geliydan tarkib topgan.
Atmosferaning o’rtacha molekulyar massasi	Yerda $28.8 \cdot 10^{-3} кг/моль$. Venera va Marsda	Yupiterda $2{,}3 \cdot 10^{-3} кг/моль$

	$43{,}5 \cdot 10^{-3}$ *кг / моль* .	
Quyosh sistemasida o’rni	Quyoshga yaqin	Quyoshdan ancha uzoqda
Quyoshdan uzoqligi	Merkuriy 0,4 a.b. dan, Mars1,5 a.b. gacha	5,2 a.b. Yupiterda, 49 a.b. Plutonda
Effektiv harorati	436 K Merkuriyda, 216 K Marsda	134 K Yupiterda, 36 K Plutonda
Magnit maydonlari	Magnit maydon Yerda kuchli, Merkuriy va Marsda esa kuchsiz.	Kuchli magnit maydoni Yupiter va Saturndan juda uzoqlarga cho’zilgan radiatsion poyaslar bilan birgalikda.

O’quvchilarga alohida - alohida yoki 2-3 ta o’quvchiga bittadan qilib, mavzu bo’yicha sayyora bo’lib beriladi. Ular berilgan ishlar bo’yicha Internet banklaridan foydalangan holda keyingi o’tiladigan mavzusi bo’yicha animatsiyali taqdimot tayyorlab keladilar. Bunday usul yordamida har bir o’quvchi o’zi mustaqil ishlashi davomida mavzuni yana ham tushunib etadi, unda mustaqil ishlash ko’nikmasi hosil bo’ladi, axborotlar izlab topish jarayonida qiziqarli ma’lumotlarga duch keladi va unda fanga bo’lgan qiziqish yanada ortib boradi.

Ishning bunday ko’rinishi o’quvchida mantiqiy fikrlash va yaratuvchanlik xususiyatlarini shakllantirishga yordam beradi. Fikrlash, bilish faoliyatini faollashtirishga, fanga bo’lgan qiziqishni ortishiga olib keladi. O’quvchi o’zi material tanlagani, uchun, uning ustida mehnat qilgani uchun mavzu bo’yicha bir qancha terminlar yuzasidan tasavvuri ancha shakllanadi. Ishning bunday turida faoliyatning asosiy darajasi - fikr yuritish shakllanadi.

III BOB. PEDAGOGIK TAJRIBA-SINOVNI TASHKIL ETISH VA UNI O`TKAZISH

III.1. Pedagogik tajriba-sinovni o`tkazishning maqsad va vazifalari

Pedagogik tajriba pedagogik tadqiqotning murakkab va asosiy metodlaridan biri hisoblanadi. Pedagogik tajriba kuzatish bilan chambarchas boђliq, lekin u bilan cheklanmaydi.

Pedagogik tajriba astronomiyani o'qitishda o'ziga xos jarayon bo'lib, ko'rilayotgan sharoitda pedagogik hodisalarni kuzatish imkonini beradi.

Pedagogik tajribaning mazmunini belgilovchi uchta asosiy xususiyatlar mavjud bo'lib, bu xususiyatlar bilan pedagogik tajriba pedagogik tadqiqotning boshqa xususiyatlaridan farq qiladi. Bular quyidagicha belgilanadi:

a) o'qitish jarayoniga tadqiqotning maqsadi va ilgari surilgan gipotezasiga mos ravishda kerakli o'zgarishlarni kiritish;
b) o'quv jarayonining turli tomonlari o'zaro boђlanishini aks ettiruvchi chuqurroq o'rganuvchi sharoitlarni hosil qilish;
c) o'quv jarayoni va unga kiritilgan o'zgarish natijalarini hisobga olish [17,18,19].

Pedagogik tajribaning maqsadi - o'quv-tarbiya jarayonida qo'llanilayotgan vosita va metodlarni, u yoki bu o'quv materialining berilgan hajmini ko'rsatilgan vaqtda o'rganish imkoniyatlarining samaradorligini hal etishdan iboratdir.

Bu aytilganlarning barchasi astronomiyani o'qitish metodikasi sohasida tajribalarga mos keladi. U astronomiya o'qitishning alohida turini (masalan, laboratoriya ishlarini va ularni bajarishda ishlatiladigan asboblarni, darsdagi muammolarning hal etilishini turli usullarini taklif etishni va h.k.), pedagogik amallarni (astronomik tushunchalarni shakllantirishni, talabalar bilimini nazorat qilishni) qamrab oladi. Pedagogik tajriba bir necha haftalardan (tanlangan mavzuni o'qitish) bir necha yilgacha (kursini o'qitish) davom etishi mumkin.

Pedagogik tajribaning eng tarqalgan shakli – nazorat va tajriba o'tkaziladigan guruh (tajriba guruhi) natijalarni o'zaro taqqoslab o'rganishdan iboratdir.

SHularga asoslangan holda, biz pedagogik tajribani quyidagi bosqichlarda olib bordik:

1. Tajriba sinov ishlarini olib borish uchun guruhlar tanlandi va ular tenglashtirildi.
2. Bu guruhlardagi mavjud bilimlar hamda amaliy ko'nikma darajasi aniqlandi.
3. Tajriba guruhida ishlab chiqilgan metodika bo'yicha, nazorat guruhida esa an'anaviy metodika bo'yicha darslar olib borildi.
4. Ikkala guruhda ham erishilgan bilim ko'rsatgichlari, darajasi aniqlandi.
5. Bilimlar, amaliy ko'nikmalarning o'sish darajasi baholab borildi.
6. Har ikkala guruhda olingan tajriba natijalari taqqoslanib, ishlab chiqilgan metodikaning afzalliklari aniqlandi va natijalar tahlil qilindi.
7. Ishlab chiqilgan metodikaning kamchiliklari tuzatilib, takomillashtirib borildi.

Ishimizning maqsadi – akademik litseylarda astronomiya ta'limi mazmunini axborot kommunikatsiya texnologiyalari muhitida takomillashtirish va uni o'qitish metodikasini ishlab chiqish hamda astronomiya ta'lim jarayoniga qo'llashdan iborat bo'lganligi uchun, biz, tajriba sinov ishlarini tashkil etish uchun Respublika 1-tibbiyot akademik litseyida astronomiya fanini eksperiment maydoncha sifatida tanlab oldik.

Pedagogik tajriba-sinov ishlarini olib borish uchun tanlangan pedagogik ta'lim muassasalarining astronomiya o'qituvchilariga tajriba-sinov o'tkazish uchun tayyorlangan didaktik va tarqatma materiallarning hamda darslar ishlanmalarining kompyuterdan chiqarilgan matnlarini, elektron disklarga yozilgan astronomiyada qo'llash uchun mo'ljallangan dasturiy vositalar, o'quvchilarga beriladigan so'rovnoma savollarini tarqatdik. Tizimli holda o'qituvchi vao'quvchilarning ishlari muntazam nazorat qilib borildi. Mavzuni o'tishdan oldin o'qituvchi bilan mazkur mavzu mazmunini yoritishda qo'proq nimalarga e'tibor berish kerakligi va o'tilgan mavzularning qiziqarli va samarali bo'lishi uchun qanday metodlarni

qo’llash mumkinligi to’ђrisida amaliy ko’rsatma va metodik tavsiyalarni berib bordik.

Pedagogik tajriba-sinov o’tkazish oldidan, astronomiyadan o’tkaziladigan namoyishli tajribalar bajarish haqida suhbat, kuzatish, savol-javob va yozma-nazorat ishlarining tahlili shuni tasdiqladiki:

1) ta’lim muassasalarida kompyuterda namoyishli tajribalar deyarli bajarilmagan;
2) o’qituvchilar kompyuterda namoyishli tajribalarni bajarishlari uchun, nazariy bilim, amaliy ko’nikma va malakaga ega emaslar;
3) barcha tanlangan ob’ektlarda darslar oddiy, oђzaki ma’ruza shaklida, qoђozli plakatlardan foydalanib o’tib kelingan.

Nazorat guruhlarida astronomiya fani bo’yicha dars o’tishda an’anaviy dars o’tish metodlaridan bo’lgan o’quv mavzusini oђzaki bayon qilish, suhbat, darslik bilan ishlash, plakatlar namoyish qilish va amaliy mashђulotlar metodlaridan foydalanildi. Tajriba guruhlarida esa umumiy astronomiya kursi bo’yicha dars o’tishda, noan’anaviy dars o’tish metodlaridan - kompyuter va internet texnologiyalaridan foydalangan holda bahs munozara darslari asosida tashkil qilib, darslar olib borildi. So’ngra, bu guruhlar o’quvchilarining olgan bilimlari tekshirildi. Bunda o’quvchilar bilimini tekshirish va baholash savol-javob, dasturlashtirilgan interfaol test, qisqa yozma ish va mustaqil ish usullaridan foydalanildi.

Tajriba guruhlari tanlangan didaktik materiallarni o’rgatishda quyidagi metodlardan o’rni bilan foydalanib borildi: suhbat, oђzaki bayon etish, savol-javob, kompyuterda dasturlashtirilgan interfaol testlar, kuzatish, o’lchash, sxema, grafik va jadvallarni namoyish etish, virtual tajribalar ko’rsatish.

III.1. Akademik litseylarda astronomiyani o’qitishda pedagogik tajriba - sinov natijalari

Yuqorida keltirilgan masalalarni hal etish uchun pedagogik tajriba-sinovning izlanish qismi boshlandi.

Astronomiyadan tajribalar bajarish bo’yicha o’quvchilarning nazariy bilimi, amaliy ko’nikmalarini aniqlash maqsadida, tegishli barcha tajriba guruhlarda kompyuterda test-nazorat ishlari olib borildi. Olingan ma’lumotlarni taqqoslab, tahlil qilganimizdan keyin, bunday farq borligi sababini aniqlashga kirishdik. Astronomiya o’qituvchilari bilan olib borilgan suhbat natijasida, tanlab olingan guruhlarda astronomiya mashђulotlarida kompyuter texnologiyalari qo’llanilmasligi ma’lum bo’ldi. Bularning sabablaridan biri kompyuter texnologiyalarining etishmasligida bo’lsa, yana bir sababi, o’qituvchilarning kompyuterda ishlash ko’nikma va malakalarining yetarli emasligi hamda astronomiya o’qitishda qo’llashga doir metodik ishlanmalar va kompyuter dasturiy mahsulotlarining etishmasligi aniqlandi. Astronomiya o’qituvchilari kompyuter va internet texnologiyalarida namoyishli tajribalar bajarishga doir materiallar mazmunini, xususan, ularni bajarishni qo’llay olish ko’nikmasiga ega emaslar. Bunday holat keyingi o’tkazilgan sinov ishlarining natijalarida ham sezildi. Dastlabki tajriba ishimizda tajriba-sinovni tashkil qilishdagi umumiy ilmiy vositalar va innavatsion texnologiyalar metodlari aniqlandi. Tavsiya etilayotgan astronomiyadan kompyuterda bajarishga mo’ljallangan ishlarni bajarishning tushunarli bo’lishi, biz tomonimizdan ishlab chiqilgan tanlash metodlariga asoslanib aniqlandi.

Tajriba va nazorat guruhlarida o’quvchilarning o’zlashtirishini taqqoslash maqsadida, guruhlarda o’zlashtirish bahosining o’rtacha qiymati olindi.

Tajriba guruhida:

Guruhlar	**O’quvchilar soni**	**5 ball**	**4 ball**	**3 ball**	**2 ball**

Nazorat guruhida:

Guruhlar	**O’quvchilar soni**	**5 ball**	**4 ball**	**3 ball**	**2 ball**

Biz bajargan tajriba-sinov ishlari axborot texnologiyalari muhitida olib borilgan darslarda o’quvchilar tomonidan eslab qolgan bilimlar salmoђi an’anaviy usulda olingan bunday natijadan ancha yuqori bo’lishini ko’rsatdi. Bu o’quv jarayonida «ko’rish-eshitish» usuli yuqori samara berishini yana bir bor isbot qildi.

O’tkazilgan tajriba-sinovining ikki jihatiga e’tibor berish lozim deb hisoblaymiz:

- birinchidan, tajriba-sinov natijasida biz o’quvchilarning tajribada o’tilayotgan mavzuni o’zlashtirish darajasi o’zgarganligini, yuqoridagi tajriba-sinov ishlarida ortganligini, ko’rsak,

- ikkinchidan tajriba-sinovda ishtirok etayotgan o’quvchilar dars jarayoni o’zgarganligini ko’radi va bu o’zgarishlar ma’ruza mavzusini to’laroq yoritib berayotganligiga ishonch hosil qiladilar.

XULOSA

1. Bitiruv malakaviy ishimizning tajriba sinov ishlarini umumlashtirish va pedagogik sinov natijalarini tahlil etish asosida quyidagicha xulosa qilishga muyassar bo'ldik. Ta'limni namoyishli tajribalar asosida takomillashtirishning metodologik, didaktik hamda metodik funksiyalarini nazariy va amaliy jihatdan o'rganish natijasida hozirgi zamon astronomiyasini axborot texnologiyalari muhitida o'qitishga o'tish – bu zamon talabi ekanligi aniqlandi. O'quv ma'lumotlar ko'lami keskin ortayotgan davrda bakalavriat bosqichida ta'lim olayotgan talabalar uchun astronomiya fani mazmunining o'ziga hos farqli jihatlari mavjud ekanligi va ularni e'tiborga olish kerakligi aniqlandi. Astronomiya ta'limi mazmunini to'laqonli joriy etilishi uchun astronomiyani o'qitishda zamonaviy axborot texnologiyalaridan keng foydalanish zarurligi aniqlandi.

2. Qayd etib ўtilgan bir qancha muammolar mavjudligini e'tiborga olgan holda, akademik litseylarda astronomiya ta'limi samaradorligini oshirishdagi asosiy masala, o'quvchilarning mustaqil o'quv faoliyatlarini rivojlantirishni ta'minlash zarurligi yana bir bor o'z isbotini topdi.

3."Gigant sayyoralar" mavzusini axborot texnologiyalari imkoniyatlaridan keng foydalanilgan holda o'qitish metodikasini ishlab chiqdik va amalda sinab ko'rdik. Barcha tavsiya etilayotgan metodik ishlanmalar samaradorligi tajribada sinab ko'rildi. Tajriba-sinov ishlari tahlili, tavsiya etilayotgan barcha usul va vositalar astronomik bilimlar berishda hamda o'quvchilarning mustaqil ta'lim olishlarida yuqori samaradorlikka erishilganlikni ko'rsatdi.

4. Darsga tayyorlanishda internet yangiliklari va resurslaridan keng foydalanildi. Mustaqil ta'lim olish, mustaqil ravishda darslarga tayyorlanish, kompyuter va internet asoslarida ishlay olish ko'nikmalarini shakllantirish maqsadida astronomiyaga oid internet ma'lumotlari va ularning manzillari bilan tanishtirib, ulardan foydalanish yo'llari o'rgatib borildi.

Tajriba-sinov natijalari axborot texnologiyalari muhitida o'tkazilgan astronomiya mashg'ulotlariga o'quvchilarning qiziqishini va unda ishtirok etish

faolligini ortganligi va bu mashg’ulotlar o’quvchilarga rivojlantiruvchi ta'sir etayotganligini ko’rsatdi. Ularning mashg’ulotlarni zamonaviy axborot va telekommunikasiya texnologiyalari vositasida tayyorlash va olib borish metodikasini o’rganishga qiziqishlari va intilishlari ortdi.

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IZOHLI IUG'AT

1.	**Gigant sayyoralar-The Giant Planet** A gas giant (sometimes also known as a Jovian planet after the planet Jupiter, or giant planet) is a large planet that is not primarily composed of rock or other solid matter. There are four gas giants in our Solar System: Jupiter, Saturn, Uranus, and Neptune. Many extrasolar gas giants have been identified orbiting other stars. Planets above 10 Earth masses are termed giant planets. Below 10 Earth masses they are called super earths or, sometimes probably more accurately for the higher mass examples, "Gas Dwarfs" e.g. as suggested by MIT Professor Sara Seager[citation needed] for Gliese 581c using a model where that exoplanet was mostly composed of hydrogen and helium. The term "gas dwarf" was also used previously by others
2.	**Yupiter massasi-Jupiter masses** Jupiter mass (MJ or MJUP), is the unit of mass equal to the total mass of the planet Jupiter (1.8986×1027 kg, 317.83 Earth mass; 1 Earth mass equals 0.00315 Jupiter masses). Jupiter mass is used to describe masses of the gas giants, such as the outer planets and extrasolar planets. It is also used in describing brown dwarfs. The most massive exoplanets are typically described in terms of Jupiter masses as this provides a convenient scale for comparison. A Jupiter-mass planet at an orbital distance of 1 AU from a Sun-like star causes an amplitude shift of 28 m/s, which is detectable with current technology.
3.	**Yupiter magnitosferasi- Magnetosphers of Jupiter**. A magnetosphere is formed when a stream of charged particles, such as the solar wind, interacts with and is deflected by the intrinsic magnetic field of a planet or similar body. Earth is surrounded by a magnetosphere, as are the other planets with intrinsic magnetic fields: Mercury, Jupiter, Saturn, Uranus, and Neptune. Jupiter's moon Ganymede has a small magnetosphere — but it is situated entirely within the magnetosphere of Jupiter, leading to complex interactions. The ionospheres of weakly magnetized planets such as Venus and Mars set up currents that partially deflect the solar wind flow, but do not have magnetospheres, per se.
4.	**Radiatsion belbog'-Radiation belts** When the first scientific satellites were launched in the first half of 1958—Explorers 1 and 3 by the US, Sputnik 3 by the Soviet Union—they observed an intense (and unexpected) radiation belt around Earth, held by its magnetic field. "My God, Space is Radioactive!" exclaimed one of Van Allen's colleagues, when the meaning of those observations was realized. That was the "inner radiation belt" of protons with energies in the range 10-100 MeV (megaelectronvolts), attributed later to "albedo neutron decay," a secondary effect of the interaction of cosmic radiation with the upper atmosphere. It is centered on field lines crossing the equator about 1.5 RE from the Earth's center.

5.	**Saturn- Saturn** Saturn is the sixth planet from the Sun and the second largest planet in the Solar System, after Jupiter. Saturn is named after the Roman god Saturn, equated to the Greek Cronus (the Titan father of Zeus), the Babylonian Ninurta and the Hindu Shani. Saturn's astronomical symbol represents the Roman god's sickle. Saturn, along with Jupiter, Uranus and Neptune, is classified as a gas giant. Together, these four planets are sometimes referred to as the Jovian, meaning "Jupiter-like", planets. Saturn has an average radius about 9 times larger than the Earth's.[12] While only 1/8 the average density of Earth, due to its larger volume, Saturn's mass is just over 95 times greater than Earth's.
6.	**Saturn - Saturn Mass** Mass From Wikipedia, the free encyclopedia This article is about the scientific concept. For the Liturgical Mass, see Mass (liturgy). For other uses, see Mass (disambiguation). Not to be confused with matter.Classical mechanics Newton's Second Law History of classical mechanics · Timeline of classical mechanics [show] v · d · e In physics, mass (from Ancient Greek: μᾶζα) commonly refers to any of following three properties of matter, which have been shown experimentally to be equivalent: inertial mass, active gravitational mass, and passive gravitational mass. Although mass must be distinguished from matter in physics, because matter is a poorly-defined concept, and although all types of agreed-upon matter exhibit mass, it is also the case that many types of energy which are not matter—such as potential energy, kinetic energy, and trapped electromagnetic radiation (photons)—also exhibit mass. Thus, all matter has the property of mass, but not all mass is associated with identifiable matter.
7.	**Quyosh sistemasi-Solar System** he Solar System[a] consists of the Sun and the astronomical objects bound to it by gravity, all of which formed from the collapse of a giant molecular cloud approximately 4.6 billion years ago. Of the many objects that orbit the Sun, most of the mass is contained within eight relatively solitary planets[e] whose orbits are almost circular and lie within a nearly flat disc called the ecliptic plane. The four smaller inner planets, Mercury, Venus, Earth and Mars, also called the terrestrial planets, are primarily composed of rock and metal. The four outer planets, the gas giants, are substantially more massive than the terrestrials. The two largest, Jupiter and Saturn, are composed mainly of hydrogen and helium; the two outermost

	planets, Uranus and Neptune, are composed largely of ices, such as water, ammonia and methane, and are often referred to separately as "ice giants".
8.	**Sayyoralararo gaz-interplanetary dust** Cosmic dust is a type of dust composed of particles in space which are a few molecules to 0.1 μm in size. Cosmic dust can be further distinguished by its astronomical location; for example: intergalactic dust, interstellar dust, interplanetary dust (such as in the zodiacal cloud) and circumplanetary dust (such as in a planetary ring). In our own Solar System, interplanetary dust causes the zodiacal light. Sources include comet dust, asteroidal dust, dust from the Kuiper belt, and interstellar dust passing through our solar system. The terminology has no specific application for describing materials found on the planet Earth, other than in the most general sense that all elements with an atomic number higher than helium are believed to be formed in the core of stars via stellar nucleosynthesis and supernova nucleosynthesis events. As such all elements that exist can be indiscriminately considered to be a form of "cosmic dust".
9.	**Quyosh shamoli- solar wind** The solar wind is a stream of charged particles ejected from the upper atmosphere of the Sun. It mostly consists of electrons and protons with energies usually between 10 and 100 keV. The stream of particles varies in temperature and speed over time. These particles can escape the Sun's gravity because of their high kinetic energy and the high temperature of the corona. The solar wind creates the heliosphere, a vast bubble in the interstellar medium that surrounds the Solar System. Other phenomena include geomagnetic storms that can knock out power grids on Earth, the aurorae (northern and southern lights), and the plasma tails of comets that always point away from the Sun.
10.	**Plazma- plasma** In physics and chemistry, plasma is a state of matter similar to gas in which a certain portion of the particles are ionized. After sufficient heating a gas dissociates its molecular bonds, rendering it into constituent atoms. Further heating leads to ionization (a loss or gain of electrons), thus turning it into a plasma, containing charged particles: positive ions and negative electrons. The presence of a non-negligible number of charge carriers makes the plasma electrically conductive so that it responds strongly to electromagnetic fields. Plasma, therefore, has properties quite unlike those of solids, liquids, or gases and is considered a distinct state of matter. Like gas, plasma does not have a definite shape or a definite volume unless enclosed in a container; unlike gas, under the influence of a magnetic field, it may form structures such as filaments, beams and double layers. Some common plasmas are stars and neon signs. In the universe, plasma is the most common state of matter for ordinary matter, most of which is in the rarefied intergalactic plasma and in stars.

11.	**Gaz-Gas** Gas is one of the three classical states of matter. Near absolute zero, a substance exists as a solid. As heat is added to this substance it melts into a liquid at its melting point (see phase change), boils into a gas at its boiling point, and if heated high enough would enter a plasma state in which the electrons are so energized that they leave their parent atoms from within the gas. A pure gas may be made up of individual atoms (e.g. a noble gas or atomic gas like neon), elemental molecules made from one type of atom (e.g. oxygen), or compound molecules made from a variety of atoms (e.g. carbon dioxide). A gas mixture would contain a variety of pure gases much like the air. What distinguishes a gas from liquids and solids is the vast separation of the individual gas particles. This separation usually makes a colorless gas invisible to the human observer. The interaction of gas particles in the presence of electric and gravitational fields are considered negligible as indicated by the constant velocity vectors in the image.
12.	**Katta qizil dog'- Great Red Spot** The Great Red Spot (GRS) is a persistent anticyclonic storm, 22° south of Jupiter's equator, which has lasted for at least 181 years and possibly longer than 346 years.The storm is large enough to be visible through Earth-based telescopes. An infrared image of GRS (top) showing its warm center, taken by the ground based Very Large Telescope. An image made by the Hubble Space Telescope (bottom) is shown for comparison. The GRS rotates counterclockwise, with a period of about six Earth daysor 14 Jovian days. Its dimensions are 24–40,000 km west–to–east and 12–14,000 km south–to–north. The spot is large enough to contain two or three planets the size of Earth. At the start of 2004, the Great Red Spot had approximately half the longitudinal extent it had a century ago, when it was 40,000 km in diameter. At the present rate of reduction it could potentially become circular by 2040, although this is unlikely because of the distortion effect of the neighboring jet streams. It is not known how long the spot will last, or whether the change is a result of normal fluctuations.]
13.	**Bo'ron va chaqmoqlar- Storms and lightning** The storms on Jupiter are similar to thunderstorms on Earth. They reveal themselves via bright clumpy clouds about 1000 km in size, which appear from time to time in the belts' cyclonic regions, especially within the strong westward (retrograde) jets.] In contrast to vortices, storms are short-lived phenomena; the strongest of them may exist for several months, while the average lifetime is only 3–4 days. They are believed to be due mainly to moist convection within Jupiter's troposphere. Storms are actually tall convective columns (plumes), which bring the wet air from the depths to the upper part of the troposphere, where it condenses in clouds. A typical vertical extent of Jovian storms is about 100 km; as they extend from a pressure level of about 5–7 bar, where the base of a hypothetical water cloud layer is located, to as high as 0.2–0.5 bar.

	Storms on Jupiter are always associated with lightning. The imaging of the night–side hemisphere of Jupiter by Galileo and Cassini spacecraft revealed regular light flashes in Jovian belts and near the locations of the westward jets, particularly at 51°N, 56°S and 14°S latitudes. The lightning strikes on Jupiter are on average more powerful than those on Earth. However, they are less frequent; the light power emitted from a given area is similar to that on Earth. A few flashes have been detected in polar regions, making Jupiter the second planet after Earth to exhibit polar lightning.
14.	**Yupiter atmosferasi-**New Latin atmosphaera, created in the 17th century from Greek ἀτμός [atmos] "vapor" and σφαῖρα [sphaira] "sphere") is a layer of gases that may surround a material body of sufficient mass,and that is held in place by the gravity of the body. An atmosphere may be retained for a longer duration, if the gravity is high and the atmosphere's temperature is low. Some planets consist mainly of various gases, but only their outer layer is their atmosphere (see gas giants). The term stellar atmosphere describes the outer region of a star, and typically includes the portion starting from the opaque photosphere outwards. Relatively low-temperature stars may form compound molecules in their outer atmosphere. Earth's atmosphere, which contains oxygen used by most organisms for respiration and carbon dioxide used by plants, algae and cyanobacteria for
15.	**Yupiter atmosferasi bosimi - Atmospheric pressure** Atmospheric pressure is the force of per unit area that is applied perpendicularly to a surface by the surrounding gas. It is determined by a planet's gravitational force in combination with the total mass of a column of air above a location. Units of air pressure are based on the internationally-recognized standard atmosphere (atm), which is defined as 101,325 Pa (or 1,013,250 dynes per cm^2). The pressure of an atmospheric gas decreases with altitude due to the diminishing mass of gas above each location. The height at which the pressure from an atmosphere declines by a factor of e (an irrational number with a value of 2.71828..) is called the scale height and is denoted by H. For an atmosphere with a uniform temperature, the scale height is proportional to the temperature and inversely proportional to the mean molecular mass of dry air times the planet's gravitational acceleration. For such a model atmosphere, the pressure declines exponentially with increasing altitude. However, atmospheres are not uniform in temperature, so the exact determination of the atmospheric pressure at any particular altitude is more complex.
16.	**Yupiter tuzilishi-Composition** Atmospheric gases scatter blue light more than other wavelengths, giving the Earth a blue halo when seen from space. Initial atmospheric makeup is generally related to the chemistry and temperature of the local solar nebula during planetary formation and the subsequent escape of interior gases. These original atmospheres underwent

	much evolution over time, with the varying properties of each planet resulting in very different outcomes. The atmospheres of the planets Venus and Mars are primarily composed of carbon dioxide, with small quantities of nitrogen, argon, oxygen and traces of other gases. The atmospheric composition on Earth is largely governed by the by-products of the very life that it sustains. Earth's atmosphere
17.	**Gallileo Galliley- Galileo Galilei .** Galileo Galilei (Italian pronunciation: 15 February 1564 – 8 January commonly known as Galileo, was an Italian physicist, mathematician, astronomer and philosopher who played a major role in the Scientific Revolution. His achievements include improvements to the telescope and consequent astronomical observations, and support for Copernicanism. Galileo has been called the "father of modern observational astronomy", the "father of modern physics", the "father of science", and "the Father of Modern Science". Stephen Hawking says, "Galileo, perhaps more than any other single person, was responsible for the birth of modern science."
18.	**Titan-(Saturn yo'ldishi)- Titan (Saturn moon)** Titan (/' taɪtən/, Ancient Greek: Τῑτάν), or Saturn VI, is the largest moon of Saturn, the only natural satellite known to have a dense atmosphere,[8] and the only object other than Earth for which clear evidence of stable bodies of surface liquid has been found. Titan is the sixth ellipsoidal moon from Saturn. Frequently described as a planet-like moon, Titan has a diameter roughly 50% larger than Earth's moon and is 80% more massive. It is the second-largest moon in the Solar System, after Jupiter's moon Ganymede, and it is larger by volume than the smallest planet, Mercury, although only half as massive. Titan was the first known moon of Saturn, discovered in 1655 by the Dutch astronomer Christiaan Huygens.
19.	**Uran xalqasi- Rings of Uranus** The scheme of Uranus's ring-moon system. Solid lines denote rings; dashed lines denote orbits of moons. The planet Uranus has a system of rings intermediate in complexity between the more extensive set around Saturn and the simpler systems around Jupiter and Neptune. The rings of Uranus were discovered on March 10, 1977, by James L. Elliot, Edward W. Dunham, and Douglas J. Mink. More than 200 years ago, William Herschel also reported observing rings, but modern astronomers are skeptical that he could have actually seen them, as they are very dark and faint. Two additional rings were discovered in 1986 in images taken by the Voyager 2 spacecraft, and two outer rings were found in 2003–2005 in Hubble Space Telescope photos. As of 2008 the Uranian ring system is known to consist of 13 distinct rings. In the order of increasing distance from the planet they are designated 1986U2R/ζ, 6, 5, 4, α, β, η, γ, δ, λ, ε, ν and μ. Their radii range from about

	38,000 km for the 1986U2R/ζ ring to about 98,000 km for the μ ring. Additional faint dust bands and incomplete arcs may exist between the main rings. The rings are extremely dark—the Bond albedo of the rings' particles does not exceed 2%. They are probably composed of water ice with the addition of some dark radiation-processed organics.
20.	**Yupiter xalqasi- Rings of Jupiter** A schema of Jupiter's ring system showing the four main components The planet Jupiter has a system of rings, known as the rings of Jupiter or the Jovian ring system. It was the third ring system to be discovered in the Solar System, after those of Saturn and Uranus. It was first observed in 1979 by the Voyager 1 space probe and thoroughly investigated in the 1990s by the Galileo orbiter. It has also been observed by the Hubble Space Telescope and from Earth for the past 23 years. Ground-based observations of the rings require the largest available telescopes The Jovian ring system is faint and consists mainly of dustIt has four main components: a thick inner torus of particles known as the "halo ring"; a relatively bright, exceptionally thin "main ring"; and two wide, thick and faint outer "gossamer rings", named for the moons of whose material they are composed: Amalthea and Thebe.[
21.	**Yupiter yo'ldoshi- Amalthea; Greek: Αμάλθεια) is the third moon of Jupiter** in order of distance from the planet. It was discovered on September 9, 1892, by Edward Emerson Barnard and named after Amalthea, a nymph in Greek mythology.[8] It is also known as Jupiter V. Amalthea is in a close orbit around Jupiter and is within the outer edge of the Amalthea Gossamer Ring, which is formed from dust ejected from its surface. From its surface, Jupiter would be an astonishing sight in its sky, appearing 46.5 degrees in diameter. Amalthea is the largest of the inner satellites of Jupiter. Irregularly shaped and reddish in color, it is thought to consist of porous water ice with unknown amounts of other materials. Its surface features include large craters and high mountains.Amalthea was photographed in 1979 and 1980 by the Voyager 1 and 2 spacecraft, and later, in more detail, by the Galileo orbiter in the 1990s.
22.	**Yupiter orbitasi- Orbit Jupiter** Amalthea circles Jupiter at a distance of 181 000 km (2.54 Jupiter radii). The orbit of Amalthea has an eccentricity of 0.003 and an inclination of 0.37° relative to the equator of Jupiter. Such appreciably nonzero values of inclination and eccentricity, though still small, are unusual for an inner satellite and can be explained by the influence of the innermost Galilean satellite, Io: in the past Amalthea will have passed through several mean motion resonances with Io that will have excited its inclination and eccentricity (in a mean motion resonance the ratio of orbital periods of two bodies is a rational number like m:n). Amalthea's orbit lies near the outer edge of the Amalthea Gossamer Ring, which is composed of the dust ejected from the satellite.

23.	**Fizik xarakteristikasi (Yupiter) - Physical characteristics** The surface of Amalthea is very red (that is, its reflectivity increases with the wavelength from the green to near-infrared). The reddish color may be due to sulfur originating from Io or some other non-ice material. Bright patches of green appear on the major slopes of Amalthea, but the nature of this color is currently unknown.] The surface of Amalthea is slightly brighter than surfaces of other inner satellites of Jupiter. There is also a substantial asymmetry between leading and trailing hemispheres: the leading hemisphere is 1.3 times brighter than the trailing one. The asymmetry is probably caused by the higher velocity and frequency of impacts on the leading hemisphere, which excavate a bright material—presumably ice—from the interior of the moon.)
24.	**Yupiter xalqalari- Relationship with Jupiter's rings** ue to its low density and irregular shape, the escape velocity at the surface points of Amalthea closest to and furthest from Jupiter is no more than 1 m/s and dust can easily escape from it after e.g. micrometeorite impacts; this dust forms the Amalthea Gossamer Ring. During its flyby of Amalthea, the Galileo orbiter's star scanner detected nine flashes which appear to be small moonlets near the orbit of Amalthea. Since they were sighted only from one location, their true distances could not be measured. The moonlets may be anywhere in size from gravel to stadium-sized. Their origins are unknown, but they may be gravitationally captured into current orbit or they may be ejecta from meteor impacts on the moon. On the next and final orbit, Galileo detected more of these moonlets. However, this time Amalthea was on the other side of the planet, so it is probable that the particles form a ring around the planet near Amalthea's orbit.
25.	**Xalqaning kelib chiqishi va yoshi- Origin and age of rings** The dust is constantly being removed from the main ring by a combination of Poynting–Robertson drag and electromagnetic forces from the Jovian magnetosphere. Volatile materials, for example ices, evaporate quickly. The lifetime of dust particles in the ring is from 100 to 1000 years, so the dust must be continuously replenished in the collisions between large bodies with sizes from 1 cm to 0.5 km and between the same large bodies and high velocity particles coming from outside the Jovian system. This parent body population is confined to the narrow—about 1000 km—and bright outer part of the main ring, and includes Metis and Adrastea. The largest parent bodies must be less than 0.5 km in size. The upper limit on their size was obtained by New Horizons spacecraft. The previous upper limit, obtained from HST. and Cassiniobservations, was near 4 km. The dust produced in collisions retains approximately the same orbital elements as the parent bodies and slowly spirals in the direction of Jupiter forming the faint (in back-scattered light) innermost part of the main ring and halo ring. The age of the main ring is currently unknown, but it may be the last remnant of a past population of small bodies near Jupiter.

26.	**Teleskop- A telescope** A telescope is an instrument that aids in the observation of remote objects by collecting electromagnetic radiation (such as visible light). The first known practical telescopes were invented in the Netherlands at the beginning of the 17th century. The word telescope can refer to a wide range of instruments detecting different regions of the electromagnetic spectrum. The word "telescope" (from the Greek τῆλε, tele "far" and σκοπεῖν, skopein "to look or see"; τηλεσκόπος, teleskopos "far-seeing") was coined in 1611 by the Greek mathematician Giovanni Demisiani for one of Galileo Galilei's instruments presented at a banquet at the Accademia dei Lincei. In the Starry Messenger Galileo had used the term "perspicillum".
27.	**Yulduz shamoli- Solar wind.** The ejection of gas off the surface of a star. Many different types of stars, including our Sun, have stellar winds; however, a star's wind is strongest near the end of its life when it has consumed most of its fuel.
28.	**Rentgen observatoriyasi- X-ray Observatory** International X-ray Observatory (IXO) A joint mission by NASA, the European Space Agency (ESA), and Japenese Aeropsace Exploration Agency (JAXA), which will combine a large X-ray mirror with new instrumentation. IXO will study the formation of structure in the universe, matter under extreme conditions in black holes and neutron stars, and the life cycles of matter and energy in the universe. Launch is planned for the 2020's.
29.	**Pedagogika- Pedagogics** Pedagogy (pronounced) is the study of being a teacher or the process of teaching. The term generally refers to strategies of instruction, or a style of instruction. Pedagogy is also occasionally referred to as the correct use of instructive strategies (see instructional theory). For example, Paulo Freire referred to his method of teaching adult humans as "critical pedagogy". In correlation with those instructive strategies the instructor's own philosophical beliefs of instruction are harbored and governed by the pupil's background knowledge and experience, situation, and environment, as well as learning goals set by the student and teacher. One example would be the Socratic schools of thought.
30	**Shaxs - The Person** Trespass to the person, historically involved six separate trespasses: threats, assault, battery, wounding, mayhem, and maiming. Through the evolution of the common law in various jurisdictions, and the codification of common law torts, most jurisdictions now broadly recognize three trespasses to the person: assault, which is "any act of such a nature as to excite an apprehension of battery"; battery, "any intentional and unpermitted contact with the plaintiff's person or anything attached to it and practically identified with it"; and false imprisonment, the "unlaw[ful] obstruct[ion] or depriv[ation] of freedom from restraint of movement.

31	**Astronomiya- Astronomy**. Astronomy is a natural science that deals with the study of celestial objects (such as stars, planets, comets, nebulae, star clusters and galaxies) and phenomena that originate outside the Earth's atmosphere (such as the cosmic background radiation). It is concerned with the evolution, physics, chemistry, meteorology, and motion of celestial objects, as well as the formation and development of the universe. Astronomy is one of the oldest sciences. Prehistoric cultures left behind astronomical artifacts such as the Egyptian monuments, Nubian monuments and Stonehenge, and early civilizations such as the Babylonians, Greeks, Chinese, Indians, and Maya performed methodical observations of the night sky. However, the invention of the telescope was required before astronomy was able to develop into a modern science. Historically, astronomy has included disciplines as diverse as astrometry, celestial navigation, observational astronomy, the making of calendars, and even astrology, but professional astronomy is nowadays often considered to be synonymous with astrophysics.
32	**Ta'lim– Education** Education in the largest sense is any act or experience that has a formative effect on the mind, character or physical ability of an individual. In its technical sense, education is the process by which society deliberately transmits its accumulated knowledge, skills, and values from one generation to another. Etymologically, the word education is derived from educare (Latin) "bring up", which is related to educere "bring out", "bring forth what is within", "bring out potential" and ducere, "to lead".
33	**Maktab- School** A school is an institution designed for the teaching of students (or "pupils") under the supervision of teachers. Most countries have systems of formal education, which is commonly compulsory. In these systems, students

	progress through a series of schools. The names for these schools vary by country (discussed in the Regional section below), but generally include primary school for young children and secondary school for teenagers who have completed primary education. An institution where higher education is taught, is commonly called a university college or university. In addition to these core schools, students in a given country may also attend schools before and after primary and secondary education. Kindergarten or pre-school provide some schooling to very young children (typically ages 3–5). University, vocational school, college or seminary may be available after secondary school. A school may also be dedicated to one particular field, such as a school of economics or a school of dance. Alternative schools may provide nontraditional curriculum and methods.
34	**Integratsiya – integration** Special education is the education of students with special needs in a way that addresses the students' individual differences and needs. Ideally, this process involves the individually planned and systematically monitored arrangement of teaching procedures, adapted equipment and materials, accessible settings, and other interventions designed to help learners with special needs achieve a higher level of personal self-sufficiency and success in school and community than would be available if the student were only given access to a typical classroom education.
35	**Kommunikativ texnologiya- Communicative technologies** The use of communicative and other new technologies as a supplement to mainstream therapies for mental disorders is an emerging mental health treatment field which, it is argued, could improve the accessibility, effectiveness and affordability of mental health care. Mental health technologies used by professionals as an adjunct to mainstream clinical practices include email, SMS, virtual reality, computer programmes, blogs, social networks, the telephone, video conferencing, computer games, instant

	messaging and podcasts.
36	**Ta'lim mazmuni- The contents of education** Contest mobility refers to system of social mobility in which all individuals are seen as participants in a race where elite status is the end goal and the contest is an open one. The idea is also sometimes referred to as tournament mobility. This serves in opposition to sponsored mobility, in which controlled selection is prevalent. The definitive research article on the subject was published in 1960 by Ralph H. Turner. Turner compared the American and British systems of secondary education and found the two to be markedly different. He identifies the American system as one in which contest mobility is the norm.
37	**Axborot - The information** The Information is the tenth (and seventh major-label) studio album by American alternative rock musician Beck, released in October 2006 on Interscope Records. It was produced and mixed by longtime Beck collaborator Nigel Godrich. Recording began in 2003 concurrently with Guero, but the album was not completed until 2006. Rolling Stone magazine has named it the 24th best album of 2006, while Spin magazine ranked it number 10 on their 40 Best Albums of 2006. The album reached #7 on the US's Billboard 200, #6 in Canada and #31 on Australia's ARIA Chart. As of July 2008, The Information has sold 434,000 copies in the United States.
38	**Spektr-spectr** Astronomical spectroscopy is the technique of spectroscopy used in astronomy. The object of study is the spectrum of electromagnetic radiation, including visible light, which radiates from stars and other celestial objects. Spectroscopy can be used to derive many properties of distant stars and galaxies, such as their chemical composition, but also their motion by Doppler shift measurements.

39	**Osmon-THE SKY** he sky is the part of the atmosphere or outer space visible from the surface of any astronomical object. It is difficult to define precisely for several reasons. During daylight, the sky of Earth has the appearance of a pale blue surface because the air scatters the sunlight. The sky is sometimes defined as the denser gaseous zone of a planet's atmosphere. At night the sky has the appearance of a black surface or region scattered with stars.
40	**Quyosh- SUN** The Sun is the star at the center of the Solar System. It is almost perfectly spherical and consists of hot plasma interwoven with magnetic fields. It has a diameter of about 1,392,000 km, about 109 times that of Earth, and its mass (about 2×1030 kilograms, 330,000 times that of Earth) accounts for about 99.86% of the total mass of the Solar System. Chemically, about three quarters of the Sun's mass consists of hydrogen, while the rest is mostly helium. Less than 2% consists of heavier elements, including oxygen, carbon, neon, iron, and others.
41	**Atom- ATOMS** Atomic spectroscopy was the first application of spectroscopy developed. Atomic absorption spectroscopy (AAS) and atomic emission spectroscopy (AES) involve visible and ultraviolet light. These absorptions and emissions, often referred to as atomic spectral lines, are due to electronic transitions of an outer shell electron to an excited state. Atoms also have distinct x-ray spectra that are attributable to the excitation of inner shell electrons to excited states.
42	**Temperatura- TEMPERATURE** Temperature is a physical property of matter that quantitatively expresses the common notions of hot and cold. Objects of low temperature are cold, while various degrees of higher temperatures are referred to as warm or hot. Quantitatively, temperature is measured with thermometers, which may be calibrated to a variety of temperature scales.

	Much of the world uses the Celsius scale (°C) for most temperature measurements. It has the same incremental scaling as the Kelvin scale used by scientists, but fixes its null point, at 0°C = 273.15K, the freezing point of water.[note 1] A few countries, most notably the United States, use the Fahrenheit scale for common purposes, a historical scale on which water freezes at 32 °F and boils at 212 °F. For practical purposes of scientific temperature measurement, the International System of Units (SI) defines a scale and unit for the thermodynamic temperature by using the easily reproducible temperature of the triple point of water as a second reference point. For historical reasons, the triple point is fixed at 273.16 units of the measurement increment, which has been named the kelvin in honor of the Scottish physicist who first defined the scale. The unit symbol of the kelvin is K.
43	**Qora jism- A BLACK BODY** A black body is an idealized physical body that absorbs all incident electromagnetic radiation. Because of this perfect absorptivity at all wavelengths, a black body is also the best possible emitter of thermal radiation, which it radiates incandescently in a characteristic, continuous spectrum that depends on the body's temperature. At Earth-ambient temperatures this emission is in the infrared region of the electromagnetic spectrum and is not visible. The object appears black, since it does not reflect or emit any visible light.
44	**Massa- WEIGHT** In most physics textbooks, weight is the name given to the force on an object due to gravity. However, some books use an operational definition, defining the weight of an object as the force measured by the operation of weighing it (that is, the force required to support it). Both definitions imply that weight is a force and that its value depends on the local gravitational field. For example, an object with a mass of one kilogram will have a weight of 9.8 newtons on the surface of the Earth, about one-sixth as much on the

	Moon, and zero when floating freely far out in space away from all gravitational influence. The differences between the two definitions are discussed below. For example, they differ over the weight of an object in free fall, such as a falling apple or an astronaut in an orbiting spacecraft. In these cases, the operational definition implies the weight is zero, whereas the gravitational definition does not.
45	**Magnit maydon- MAGNETIC FIELD** magnetic field of a star is generated within regions of the interior where convective circulation occurs. This movement of conductive plasma functions like a dynamo, generating magnetic fields that extend throughout the star. The strength of the magnetic field varies with the mass and composition of the star, and the amount of magnetic surface activity depends upon the star's rate of rotation. This surface activity produces starspots, which are regions of strong magnetic fields and lower than normal surface temperatures. Coronal loops are arching magnetic fields that reach out into the corona from active regions. Stellar flares are bursts of high-energy particles that are emitted due to the same magnetic activity.
46	**Teleskop- TELESCOPE** A telescope is an instrument that aids in the observation of remote objects by collecting electromagnetic radiation (such as visible light). The first known practical telescopes were invented in the Netherlands at the beginning of the 17th century. The word telescope can refer to a wide range of instruments detecting different regions of the electromagnetic spectrum. The word "telescope" (from the Greek τῆ λε, tele "far" and σκοπεῖ ν, skopein "to look or see"; τηλεσκόπος, teleskopos "far-seeing") was coined in 1611 by the Greek mathematician Giovanni Demisiani for one of Galileo Galilei's instruments presented at a banquet at the Accademia dei Lincei. In the Starry Messenger Galileo had used the term "perspicillum".
47	**Nuriy tezlik- LIGHT SPEED** The speed of light (meaning speed of light in vacuum), usually denoted

	by c, is a physical constant important in many areas of physics. Its value is 299,792,458 metres per second, a figure that is exact since the length of the metre is defined from this constant and the international standard for time. This speed is approximately 186,282 miles per second. It is the maximum speed at which all energy, matter, and information in the universe can travel. It is the speed of all massless particles and associated fields—including electromagnetic radiation such as light—in vacuum, and it is predicted by the current theory to be the speed of gravity (that is, gravitational waves). Such particles and waves travel at c regardless of the motion of the source or the inertial frame of reference of the observer. In the theory of relativity, c interrelates space and time, and appears in the famous equation of mass–energy equivalence E = mc2.
48	**Optik teleskop- OPTICAL TELESCOPES** Big Bear Solar Observatory - Located in Big Bear Lake, California (USA) and operated by the New Jersey Institute of Technology is a solar dedicated observatory with different instruments, and has a huge data bank of full disk Hα images. Swedish 1-m Solar Telescope Operated by the Institute for Solar Physics (Sweden), is located in the Observatorio del Roque de los Muchachos on the island of La Palma (Spain).
49	РАДИО ТЕЛЕСКОП - RADIO TELESCOPES Nançay Radioheliographe is an interferometer composed of 48 antennas observing at meter-decimeter wavelengths. The radioheliographe is installed at the Nançay Radio Observatory (France). Owens Valley Solar Array is a radio interferometer operated by New Jersey Institute of Technology consisting of 7 antenas observing from 1 to 18 GHz in both left and right circular polarization. OVSA is located in Owens Valley, California, (USA), now is under reform, increasing to 15 the total number of antennas and upgrading its control system.

50	КОСМИК ТЕЛЕСКОП - SPACE TELESCOPES Space Telescopes The following spacecraft missions have flares as their main observation target. Yohkoh - The Yohkoh (originally Solar A) spacecraft observed the Sun with a variety of instruments from its launch in 1991 until its failure in 2001. The observations spanned a period from one solar maximum to the next. Two instruments of particular use for flare observations were the Soft X-ray Telescope (SXT), a glancing incidence low energy X-ray telescope for photon energies of order 1 keV, and the Hard X-ray Telescope (HXT), a collimation counting instrument which produced images in higher energy X-rays (15-92 keV) by image synthesis.