

Opazanje i snimanje potpune pomrčine Sunca 15. II. 1961. na otocima Hvar i Brač te na Biokovu*

Observations and recordings of total solar eclipse on February 15, 1961 on the islands of Hvar and Brač and on Mt. Biokovo*

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SAŽETAK

U radu je analiziran rijedak događaj potpune pomrčine Sunca, vidljive u južnom dijelu Hrvatske, posebice na otocima Hvaru i Braču i uključivanje zagrebačke Zvezdarnice u uspješno opazanje i snimanje pomrčine i njezinih različitih efekata.

Brojnim uspješnim predavanjima, koja su pripremili i održali srednjoškolci i studenti sa Zvezdarnice, u 46 mjesta na otocima i priobalju, popularizirali su astronomiju, a time i Zvezdarnicu. Pripremni radovi započeli su još 1960., a mladi predavači upoznati su s pravilnim pristupom održavanju znanstveno-popularnih predavanja laicima svih dobni skupina. Kako je astronomija 1948./1949. izgubila status nastavnog predmeta u srednjim školama, koji je imala dugo

SUMMARY

The paper analyses the infrequent phenomenon of total solar eclipse, observed in southern Croatia, particularly on the islands of Hvar and Brač, as well as the involvement of Zagreb astronomical observatory in successful observation and recordings of the eclipse and its various effects.

Numerous successful lectures, prepared and given by high-school and university students from the Observatory, at 46 locations on the islands and at the coast, popularised astronomy, the Observatory included. Preparations started as early as 1960, when young lecturers got acquainted with the right approach to giving popular science lectures to laymen of all ages. As astronomy lost the position of subject taught in secondary schools in 1948/1949, which it had a long time before, the HPD Observatory was the only place open to astronomy fans.

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vremena, Zvezdarnica HPD-a bila je jedino mjesto otvoreno ljubiteljima astronomije, pa je putem seminara i tečajeva djelovala kao svojevrsna zvezdarnička astronomska škola. Posebno se skrbilo o stručnom radu i obuci s instrumentima za snimanje pomrčine. O tome najbolje govore prekrasne fotografije pomrčine koje su uspjeli snimiti, s puno kreativnosti uz skromne prijenosne teleskope Zvezdarnice. Ta je akcija detaljno opisana u časopisu *Zemlja i svemir* (ZIS) koji je Zvezdarnica osnovala 1957., također s brojnom mladeži zainteresiranom za učenje i promicanje astronomije. Uspješan rad dalje je nastavljen uporabom esperanta te osnivanjem prvoga međunarodnog astronomskog kampa – Esperantsko-astronomskog kampa prijatelja mira te drugih važnih aktivnosti. Zvezdarnicom je u to vrijeme, od 1954. upravljao dr. Gabrijel Divjanović, koji je usmjeravao sve primjerene akcije zvezdarničke mladeži i oduševljavao ih svojim vizijama prijateljstva sa svim narodima zagovaranjem mira. U godini prije potpune pomrčine značajnu je ulogu odigrala knjiga *Drama u svemiru*, svojevrsna znanstveno-popularna drama o mogućoj propasti zemaljske civilizacije uz uporabu atomskog oružja, koju je napisalo 25 mladih zvezdoznana.

KLJUČNE RIJEČI

potpuna pomrčina Sunca u Hrvatskoj

- esperantsko-astronomski Kamp prijatelja mira
- knjiga *Drama u svemiru*
- odabir lokacije
- opažanje i snimanje pomrčine
- otoci Brač i Hvar i tvrđava Španjola
- predavanja zvezdarničke mladeži o pomrčini Sunca
- zagrebačka Zvezdarnica

Through seminars and courses the Observatory acted as a kind of observatory astronomical school, taking special care of professional work and instruction in using the instruments for recording eclipse. This is best illustrated by beautiful photos of the eclipse taken, with much creativity in using modest portable telescopes belonging to the Observatory. This action was described in detail in the periodical *Earth and Space* (*Zemlja i svemir* – ZIS), which the observatory started in 1957, again with a number of young people interested in learning and promoting astronomy. Successful activities were continued by using Esperanto and establishing the first international astronomical camp – Esperanto-astronomical camp for the friends of world piece, as well as by numerous other important activities. The Observatory was at that time, since 1954, managed by dr. Gabrijel Divjaković, who directed all the adequate activities of the Observatory youth and delighted them with his visions of friendship with all the nation and promotion of world peace. The year prior to total eclipse was also marked by an important book – *Drama u svemiru* (*Drama in Space*), a kind of popular science drama dealing with possible downfall of Earth civilisation by the use of nuclear weapons, written by 25 young astronomers.

KEY WORDS

Total solar eclipse in Croatia

- Esperanto-astronomical Camp for friends of world piece
- the book *Drama u svemiru*
- selecting locations
- observing and recording eclipse
- the islands of Brač and Hvar and the fort of Španjola
- lectures by Observatory youth on solar eclipse
- Zagreb Observatory

*Primjer uspješne pripreme mladeži
na zagrebačkoj Zvezdarnici za
popularizaciju pomrčine predavanjima
te za stručni rad opažanja i snimanja
Sunca za vrijeme pomrčine.*

1. Uvod

1.1. Tama usred dana

Nijedna nebeska pojava ne izaziva kod ljudi takav dojam kao pomrčina Sunca. Kada usred bijela dana Sunčeva ploča počinje tamniti, to je nešto više od obične spoznaje da se dobro nam poznati Mjesec nakratko smješta između Zemlje i Sunca. Ta je nebeska predstava još dojmliivije izgledala našim drevnim pretcima, kojima je Sunce bilo božanstvo, a crna sjena što se preko njega prevlačila predstavljala je demona, zmaja koji namjerava prožderati Sunce i ostaviti Zemlju u mraku. Pomrčine Sunca nekoć su stoga sijale užas i strah, a kroz ljudski strah „nagoviještavale“ rat, glad, potres, potop i sve moguće nesreće. Veliku nedoumicu izazivale su i mnoge pojave vezane uz pomrčinu Sunca koje nisu mogli objasniti, od čudnih vatrenih izboja vidljivih tijekom pomrčine, zatim sjajnih planeta i zvijezda na tamnom nebu, pa sve do zatvaranja cvjetova i potpune sablasne tišine bez životinjskih zvukova. Mnogo se toga danas može znanstveno objasniti, ali čudesnost prizora nije ništa manje dojmliiva. I dakako, iz zemaljske perspektive još uvijek se ne može ništa učiniti da se pomrčinu Sunca spriječi, promijeni ili tome slično. Može se samo koristiti sve što nam ona nudi, od nezamjenjive ljepote do novih znanstvenih spoznaja.

*An example of a successful preparation of the
youth at Zagreb Observatory for the purpose of
popularisation of eclipse through lectures and for
professional observation and recording of the Sun
during eclipse.*

1. Introduction

1.1. Darkness in the middle of the day

No other celestial phenomenon can impress people as solar eclipse. When Sun's disk starts to turn dark in the middle of a bright day, it is something more than the mere realisation that a well-known Moon is positioned for a short while between the Earth and the Sun. This celestial show surely looked even more impressive to our ancient ancestors, for whom the Sun was a god, while the dark shadow creeping over it represented a demon, a dragon, whose intention was to swallow the Sun and leave the Earth in darkness. It is no wonder then that Solar eclipses used to sow terror and fear, through this fear „announcing“ war, famine, earthquake, flood and any other possible disaster. Great deal of confusion was also caused by various phenomena associated with solar eclipse that could not be explained, from curious bursts of fire that could be seen during eclipse, bright planets and stars in dark sky, to closing flowers and overwhelming and eery silence, deprived of any animal sounds. All of these phenomena can be scientifically explained today. However, the wonder of the scene is no less impressive. Obviously, from the Earth perspective, we can do exactly nothing to prevent solar eclipse, change it or do anything about it. We can only use everything it offers, from its irreplaceable beauty to some new piece of scientific knowledge. Total solar eclipse could be seen in Croatia, in its southern part, more than sixty years ago, in 1961, while the following one will be seen in as much as 190 years,

Iz Hrvatske, iz njena južnog dijela, potpuna pomrčina Sunca mogla se vidjeti prije više od šezdeset godina, 1961., a sljedeća potpuna, bit će vidljiva tek nakon 190 godina, odnosno 2151. Stoga se pomrčinu iz 1961. s pravom naziva povijesnom potpunom pomrčinom Sunca u Hrvatskoj.

1.2. Zašto dolazi do pomrčine Sunca vidljive sa Zemlje

Put do spoznaje kako nastaju pomrčine i kako ih se može predvidjeti bio je dug i naporan, no pojava je toliko čudesna, prelijepa i zastrašujuća da je od pamtivijeka s razlogom pobuđivala veliko zanimanje. Odgovor na pitanje zašto dolazi do pomrčine Sunca vezan je uz Zemlju, njezin prirodni satelit Mjesec i golemo Sunce, našu zvijezdu, oko koje se gibaju Zemlja i ostali planeti Sunčeva sustava. Sunce i Mjesec nalaze se na različitim udaljenostima od Zemlje. Srednja udaljenost Mjeseca je oko 380 000 kilometara. Srednja udaljenost Zemlje od Sunca ili jedna astronomska jedinica (A.J.) je oko 150 milijuna kilometara. Pritom je Mjesec promjerom oko 400 puta manji od Sunca i na našu sreću i oko 400 puta bliže Zemlji nego Sunce, pa nam stoga Sunce i Mjesec promjerom izgledaju približno jednaki. I tu je najvažnija tajna zašto je uopće moguća potpuna pomrčina Sunca. No, to naravno nije sve. Mjesec obiđe oko Zemlje za oko 29,5 dana, a Zemlja oko Sunca za oko 365,25 dana. Gibanje Zemlje oko Sunca nije jednostavno već zbog same činjenice da Zemljina zamišljena os, koja prolazi polovima nije okomita na ravninu gibanja Zemlje oko Sunca, koju nazivamo ravninom

in 2151. This is why the 1961 eclipse is rightfully called historic total solar eclipse in Croatia.

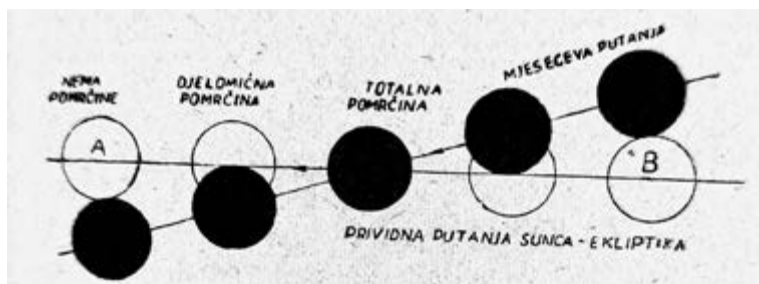
1.2. Why solar eclipses seen from the Earth occur

The road to understanding how eclipses occur and how they can be predicted was long and strenuous, but this phenomenon is so miraculous, beautiful and terrifying that has, with good reason, aroused great interest from the beginning of time. The answer to the question why solar eclipse connected to the Earth occurs is its natural satellite the Moon and huge Sun, our star, around which the Earth and other planets of the Solar system move. The Sun and the Moon are situated at different distances from the Earth. The moon is on average some 380 000 kilometres from the Earth, while the distance of the Earth from the Sun, or one astronomical unit (AU) is around 150 million kilometres. At the same time, the Moon has a diameter about 400 less than the Sun and, fortunately for us, it is about 400 times nearer to the Earth than the sun. As a result, the Sun and the Moon appear to us to be of approximately the same diameter. Here lies the secret of why total solar eclipse is possible at all. Of course, this is not all. The Moon circles the Earth in approximately 29.5 days, while the Earth circles the Sun in 365.25 days. The movement of the Earth around the Sun is not a simple one, if only for the fact that the Earth's imagined axis, which passes through the poles, is not perpendicular to the plan of the Earth's movement around the Sun, called the ecliptic plane, but is tilted, which causes the change of seasons on the Earth. This, of course, is not all as well. If the Moon would also move in the ecliptic plane, we would have, at the time of every new moon, when the Moon is between the Earth and the Sun and cannot be seen in the sky, solar eclipse. However, the plane in which the Moon

ekliptike, nego je nagnuta, pa se stoga na Zemlji izmjenjuju godišnja doba. No, ni to, naravno, nije sve. Kada bi se Mjesec također kretao točno u ravnini ekliptike, za svakoga Mlađaka, kada se Mjesec nađe između Zemlje i Sunca pa ga ne možemo vidjeti na nebu, imali bismo pomrčinu Sunca. Međutim, ravnina u kojoj se Mjesec giba oko Zemlje također je nagnuta prema ravnini ekliptike pa do pomrčine Sunca može doći samo kad se Mjesec nađe u sjecištima tih dviju ravnina, u tzv. čvorovima (slika 1), a Mjesec je u fazi Mlađaka.

travels around the Earth is also tilted to the ecliptic plane and solar eclipse can occur only when the Moon is positioned in the intersection of these two planes, in so called nodes (Figure 1), and the Moon is in the new moon phase.

If the Moon is not exactly in the node, a partial solar eclipse can be seen from the Earth, meaning the Moon passes between the Earth and the Sun in such a way as to overshadow only a part of the Sun's surface. Additionally, the path of the Earth around the Sun and of the Moon around the Earth are not circles but ellipses. When the Earth is nearest to the Sun, the distance between them is around 147 mil-



SLIKA 1. Prikaz čvorova te djelomične i potpune pomrčine Sunca

FIGURE 1. Representation of the nodes, together with partial and total solar eclipse

U slučaju da Mjesec nije točno u čvoru, može sa Zemlje biti vidljiva djelomična pomrčina Sunca, znači Mjesec tako prolazi između Zemlje i Sunca da zasjeni samo dio Sunčeve površine. Osim toga, Zemljina staza oko Sunca i Mjesečeva staza oko Zemlje nisu kružnice nego elipse. Kad je Zemlja najbliže Suncu ta je udaljenost oko 147 milijuna kilometara, a kada je najdalje, ta je udaljenost oko 152 milijuna kilometara. Mjesec u trenutku pomrčine može biti nešto bliže ili nešto dalje od Zemlje. Naime, kada je najbliže Zemlji,

lion kilometres, while the farthest it is 152 million kilometres. The moon, on the other hand, can be, at eclipse, somewhat nearer to or somewhat farther from the Earth. When nearest to the Earth, the distance is around 356 000 kilometres, when farthest, it is around 407 000 kilometres from the Earth. If it is farther, its apparent diameter is somewhat smaller than the Sun's and it does not cover the Sun completely, but a bright edge of the Sun around the dark Moon's disc can be seen from the earth in the area of total eclipse. Annular eclipse can be seen from the Earth in such a situation. Although it is interesting and marvellous, it cannot be compared with

udaljen je oko 356 000 kilometara, a kada je najdalje od Zemlje udaljen je oko 407 000 kilometara. Ako je dalje, njegov prividni promjer je malo manji od Sunčeva pa ne pokrije Sunce u cijelosti, nego se sa Zemlje, u području potpune pomrčine vidi svijetli rub Sunca oko tamne Mjesečeve ploče. Tada se sa Zemlje vidi prstenasta pomrčina Sunca i koliko god je i ona zanimljiva i lijepa, ne može se usporediti s potpunom pomrčinom Sunca, kada je Sunčeva ploča potpuno zakrivljena Mjesečevom, a vidi se samo izbrazdani rub Mjesečeve ploče, okružen veličanstvenom koronom i čudesnim zaigranim plamenovima odnosno prominencijama ili protuberancama. Usred dana tada nastane neobična plavkasto-siva pro hladna noć, praćena vjetroćem, a na nebu se mogu vidjeti najsjajnije zvijezde i planeti.

Već je grčki povjesničar i filozof Plutarh (živio je oko 50. do oko 125. godine) zapazio i opisao Sunčevu koronu, vidljivu prilikom potpune pomrčine Sunca, a to je zapravo vrlo rijetki najviši sloj Sunčeve atmosfere. Korona je jedan od uzročnika blage svjetlosti zbog koje prigodom pomrčine Sunca ne vlada potpuni mrak.¹

1.3. Područje totaliteta ili potpune pomrčine Sunca

Vrh stošca sjene kreće se po Zemljinoj površini i samo na tim područjima je potpuno tamna zona totaliteta. No, Zemlju zahvaća i polusjena, a u tom području je

total solar eclipse, when the Sun's disc is completely concealed by the Moon and only a puckered edge of the Moon's disc can be seen, surrounded by magnificent corona and magic playful flames, or prominences or protuberances. Unusual bluish-grey rather cold night occurs in the middle of the day, accompanied by a slight breeze, while the most brilliant stars and planets can be seen in the sky.

Greek historian and philosopher Plutarch (lived around 50 to around 125) observed and described solar corona, seen at the total solar eclipse, which is, in fact, a very rare highest level of solar atmosphere. Corona is one of the causes of soft light that prevents total darkness during solar eclipse.¹

1.3. The area of totality or total solar eclipse

The tip of the shadow cone travels over the surface of the Earth, resulting in totally dark totality zones only on the spots where it touches the surface. However, the Earth is also affected by a half-shade, where partial solar eclipse can be observed, with the Moon more or less covering the Sun's disc, the coverage expressed in percentages. During the last solar eclipse in the second millennium, in August 1999, a partial eclipse of the big phase could be seen in Croatia, meaning that the Moon covered minimum of 88.9% of the Sun's disc in Lastovo to maximum of 98.8% in Čakovec. Although people in Croatia could experience some unusual effects, such as weird colour of the day and coldness, and see-through protective glasses or some other appliance that only a bright arc remained of the Sun, it cannot even nearly match the impression by a total solar eclipse, which cannot be ignored, even if you try to. Precise calculations have only recently

¹ Koronograf, uređaj kojim se korona može promatrati svakodnevno, izumio je francuski astronom Bernard Ferdinand Lyot (1897. – 1952.) tek u dvadesetom stoljeću, 1930.

¹ Coronagraph, a device used for everyday observation of solar corona, invented by the French astronomer Bernard Ferdinand Lyot (1897–1952) in the twentieth century, 1930.

vidljiva djelomična pomrčina Sunca, pri kojoj Mjesec manje ili više prekriva Sunčevu ploču, što se izražava u postotcima. Tako je prilikom posljednje pomrčine Sunca u drugom tisućljeću, u kolovozu 1999., iz Hrvatske bila vidljiva djelomična pomrčina velike faze, što znači da je Mjesec prekrrio od najmanje 88,9 % Sunčeve ploče na Lastovu, do najviše 98,8 % Sunčeve ploče u Čakovcu. Pa premda su hrvatski građani mogli doživjeti neke neobične efekte kao čudnu boju dana i hladnoću i eventualno kroz zaštitne naočale ili drugo, vidjeti da je od Sunca ostao samo svijetli luk, to ne može ni približiti dojam koji na čovjeka ostavlja potpuno pomračeno Sunce, što čovjek ne može ignorirati čak ni kada bi to htio. Tek je u novije doba usavršeno točno računanje pomrčina Sunca (nakon što su točno izračunate Mjesečeva i Zemljina staza) te se pomrčine mogu precizno izračunati i predvidjeti ne samo za budućnost, nego i za prošlost. Za mnoge događaje iz prošlosti saznalo se vrijeme zbivanja zahvaljujući upravo proračunima pomrčina, a mnoge su i zabilježene u nekoj staroj kronici ili drugom spisu iz vremena kada je ta prirodna pojava bila još dojmljivija.

Potpuna pomrčina Sunca vidljiva je samo s određenog područja na Zemlji. Klizeći po Zemljinoj površini, vršak Mjesečeve sjene crta na njoj liniju potpune pomrčine Sunca, ne širu od 300 kilometara. Trajanje pomrčine je vrlo kratko, ponekad je riječ o jednoj jedinjoj minuti, a najdulje pomrčine mogu trajati oko 7,5 minuta. Zbog te kratkoće trajanja pomrčine, ekipe koje dolaze u zonu totaliteta

been made of solar eclipses (after the Moon's and the Earth's orbits have been precisely calculated), meaning eclipses can now be precisely calculated, not only in the future, but in the past as well. Numerous events in the past could be dated thanks to the calculations of eclipses, as many of them were recorded in an old chronicle or some other document at the time when this natural phenomenon impressed people even more than today.

Total solar eclipse can be seen only from a particular spot on the Earth's surface. Sliding along the surface, the tip of the Moon's shadow draws on it the line of total solar eclipse, not wider than 300 kilometres. Eclipse is of a very short duration, sometimes not more than a minute, while the longest eclipses could last around 7.5 minutes. This is why the teams coming into totality zone to observe, record and study the effects of the eclipse spend a long time preparing and training everything they plan to do during the eclipse. This is necessary not only because the eclipse is so short, but also because it is a „breath-taking“ phenomenon and simulation of the eclipse aims at preparing people who would otherwise, impressed by the unforgettable scene, when the sky is covered with bright stars in the middle of the day, get confused and would not be able to perform the planned tasks in time, and there is no opportunity to repeat it. (1; 2, pp. 127–131, 136–138; 3, pp. 81–125)

2. Observatory at Popov toranj in Zagreb

2.1. *Elitists* and misunderstood role of the Observatory as a burden to the HPD (Croatian Society of Natural Sciences)

Croatian Society of Natural Sciences (Hrvatsko naravoslovno društvo – HND) was founded at the assembly held on December 27th 1885 in the National Museum in Demetrova street 1, Zagreb Up-

da bi opažale, snimale i proučavale efekte pomrčine, dugi vremenski period vježbaju sve što će raditi u tijeku pomrčine. To je potrebno ne samo što totalitet kratko traje, već je to fenomen od kojega „staje dah“ pa se simulacijom pomrčine izbjegava mogućnost da se čovjek, zaokupljen nezaboravnim prizorom, kada se nebo usred dana kratkotrajno ospe sjajnim zvijezdama, ne uspije snaći i na vrijeme izvršiti povjerene zadatke, a prilika za ponavljanje ne postoji. (1) (2, str. 127–131, 136–138) (3, str. 81–125)

2. Zvezdarnica na Popovu tornju u Zagrebu

2.1. *Elitisti* i pogrešno shvaćena uloga Zvezdarnice kao tereta HPD-u

Na skupštini održanoj 27. prosinca 1885. u Narodnom muzeju u Demetrovoj ulici broj 1 na zagrebačkom Gornjem gradu, osnovano je Hrvatsko naravoslovno društvo (HND, od godine 1907. Hrvatsko prirodoslovno društvo – HPD). Osnivač Spiridion Brusina² rekao je tom prilikom da je to „*prvo društvo prirodnjaka u Hrvatskoj i u obće na slavenskom jugu*“. Društvo je imalo dvije sekcije: geografsku i ornitološku, ali je astronomija od samog početka bila zastupljena djelo-

per town. The Society changed its name (Hrvatsko prirodoslovno društvo – HPD) in 1907. The Society founder, Spiridion Brusina² said at the occasion that it was „*the first society of naturalists in Croatia and in Slavic south in general*“. The Society had two sections: geographical and ornithological. However, astronomy was present from the very beginnings through activities of some of the members, especially Oton Kučera.³ It was only seventeen years later, on Kučera's initiative, who was transferred to Real High School on Grič, Zagreb, in 1902, that astronomical section (*astronomska sekcija – AS*), with the main aim „*to organise an astronomical observatory for general public in Zagreb*“. Kučera's book *Naše nebo (Our Sky)*, published by Matica Hrvatska in 1895 (**Figure 2**) became a foundation on which astronomical knowledge was built and spread in Croatian provinces, as well as further into other Slavic regions.

Oton Kučera (4) was the driving force of the newly planned observatory. An interesting cultural circle was created at the beginning of the twentieth century around the idea of creating a public Croatian observatory within the aegis of the HPD, sensing the importance of such an institution. Con-

² Spiridion Brusina (1845. – 1908.), jedan od najpoznatijih hrvatskih prirodoslovaca u 19. st., bio je i utemeljitelj Hrvatskoga narodnog zoološkog muzeja i prvi sveučilišni profesor na katedri za zoologiju Mudroslovnog fakulteta Kraljevskoga sveučilišta Franje Josipa I. Bio je inicijator, suosnivač i prvi predsjednik HPD-a, 1885.

² Spiridion Brusina (1845–1908.), one of the most famous Croatian naturalists of the 19th century. He was the founder of the Croatian National Zoological Museum and the first university professor at the department of zoology of the Faculty of Philosophy, Royal University of Francis Joseph I. He was also the initiator, co-founder and the first president of Croatian Society of Natural Sciences (HPD) in 1885.

³ Dr. Oton Kučera (1857–1931), was an important Croatian naturalist, enlightener, educator, scientist, author of textbooks and popular science books, the president of Matica Hrvatska (1909–1916), co-founder and the first president of Radio club Zagreb, initiator of founding the HPD Observatory in Zagreb and its first head, and occupied numerous other important positions.

vanjem pojedinih članova, posebice Otona Kučere.³ Tek se sedamnaest godina kasnije, na Kučerinu inicijativu, koji je 1892. premješten u Zagreb na Visoku realku na Griču, 1902. tim dvjema sekcijama pridružila i „*astronomička (AS)*“, s glavnim zadatkom: „*urediti društveni opservatorij astronomički u Zagrebu*“. Kučerina knjiga *Naše nebo*, koju je Matica hrvatska tiskala 1895. (slika 2), postala je temelj na kojem se širilo astronomsko znanje u hrvatskim zemljama i dalje na slavenskim područjima.

Pokretačka je snaga osmišljene zvjezdarnice bio Oton Kučera (4). Oko te ideje stvaranja hrvatske građanske zvjezdarnice u okrilju HPD-a stvorio se početkom dvadesetog stoljeća zanimljiv kulturni krug koji je osjetio važnost takve ustanove. Unatoč tome, unutar HPD-a oformila se i snažna struja tzv. elitista, odnosno onih koji su osnivanje zvjezdarnice u siromašnom i malom hrvatskom narodu smatrali ludošću. Međutim, biskup Josip Juraj Strossmayer (1815. – 1905.) donacijom od 200 kruna pokrenuo je val imućnih darovatelja koji su potpomogli izgradnju zvjezdarnice, pa je u tisku objavljeno prikupljanje i skromnih donacija. Za Zvjezdarnicu su dio svojeg prihoda dali prirodoslovci, humanisti, političari, svećenici,

trary to this, a strong group, so called elitists, was formed within the HPD, who considered the foundation of an observatory in small and poor Croatia a folly. However, Croatian bishop Juraj Strossmayer (1815–1905) started a wave of wealthy donors with his donation of 200 krunas, which helped the construction of the observatory and the press announced collection of more modest donations. Naturalists, humanists, politicians, priests, military officers and soldiers, nobility, writers and other artists, craftsmen, people of various professions and of various wealth, as well as institutions and town administration throughout Croatia, all contributed a part of their income to build the Observatory in Zagreb.



SLIKA 2. Naslovnica Kučerine knjige *Naše nebo*

FIGURE 2. *Front page of Kučera's book Naše nebo*

³ Dr. Oton Kučera (1857. – 1931.), hrvatski je značajni prirodoslovac, prosvjetitelj, pedagog, profesor, znanstvenik, pisac udžbenika i popularnih znanstvenih knjiga, predsjednik Matice hrvatske (1909. – 1916.), suosnivač i prvi predsjednik Radio kluba Zagreb, inicijator osnivanja Zvjezdarnice HPD-a u Zagrebu i njezin prvi upravitelj i drugo.

Kučera chose Popov toranj as the site for the Observatory and the city of Zagreb gave it for a free three-year rent. The construction of the Observa-

časnici i vojnici, plemstvo, književnici i drugi umjetnici, obrtnici, ljudi različitih zanimanja i imovnog staleža kao i ustanove i gradski organi diljem Hrvatske.

Kučera je za Zvezdarnicu izabrao Popov toranj, kojega je grad Zagreb na tri godine ustupio na besplatno korištenje. Izgradnja zvezdarnice prikazana je ne samo kao utemeljenje znanstvene i kulturne ustanove, nego i kao rodoljubni čin. Za prvoga predstojnika izabran je dr. Oton Kučera, a sve do 1918. Zvezdarnica je dobivala godišnju vladinu potporu od 500 kruna, pa i više (sluke 3, 4).



SLIKA 3. Zvezdarnica na Popovu tornju 1904. godine

FIGURE 3. *Observatory at Popov toranj in 1904*

Uz stručni rad Zvezdarnica je ozbiljno krenula i s popularizacijom astronomije. Bila je otvorena tri puta tjedno navečer, a nedjeljom prije podne za opažanje Sunca, a posjećivale su je i skupine učenika.

Čini se da je Oton Kučera svojom knjigom *Naše nebo*, koja je izazvala veliko za-

tory was considered not only a foundation of a scientific and cultural institution but a patriotic act as well. The first head of the Observatory was d. Oton Kučera, and the Observatory received an annual support from the government of 500 krunas, and sometimes even more, up until 1918 (Figure 3, 4).



SLIKA 4. Oton Kučera u kupoli Zvezdarnice na Popovu tornju

FIGURE 4. *Oton Kučera in the dome of the Popov toranj Observatory*

Apart from its professional work, the Observatory invested a serious effort in popularising astronomy. It was open three evenings a week, on Sunday mornings to observe the Sun, and was also visited regularly by groups of school pupils.

It is possible that Oton Kučera, with his book *Naše nebo*, which aroused considerable interest

nimanje i popularnost te osnivanjem Zvezdarnice i Astronomijske sekcije u HPD-u 1902. kod nekih svojih moćnih kolega izazvao animozitet, zapravo prikriveni jal i ljubomoru. To je još više došlo do izražaja kad je Kučera na simpoziju u Heidelbergu uspješno inicirao ime *Croatia* asteroidu (**slika 5**) koji je 1906. otkrio njemački astronom August Kopff (1882. – 1960.) sa zvezdarnice u Heidelbergu, a njom je tada upravljao astronom Max Wolf (1863. – 1932.). Ime asteroidu bilo je zapravo odavanje počasti osnivanju Zvezdarnice HPD-a. (4)

Elitisti su i dalje Zvezdarnicu smatrali nepotrebnom velikom investicijom i promašajem, dapače teretom HPD-u. Željeli su društvenu Zvezdarnicu zatvorenog tipa, a Kučeru i njegove tzv. populiste optužili za laicizam. Ravnopravno sudjelovanje laika u HPD-u odredio je osnivač HPD-a Spiridon Brusina iz jednostavnog razloga što je u Hrvatskoj još bilo pre malo prirodoslovaca, a laici različitih struka pokazali su se velikim ljubiteljima astronomije i ostalih prirodoslovnih znanosti. Stoga je Zvezdarnica predavanjima i drugim aktivnostima dala priliku mladeži i građanima da steknu barem osnovna znanja iz astronomije, što bi trebalo biti i pitanje kulture svakoga barem donekle obrazovanog čovjeka.

Godine 1909. iskazana je Kučeri velika čast izborom za predsjednika Matice hrvatske, a asteroidu *Croatia* službeno je priznato ime. (5) Naredna godina, 1910. bila je za Kučeru izuzetno teška. *Elitisti* su ga na sve načine nastojali ukaljati, a prilika koju su čekali pružila im se kad je Ku-

and was quite popular, as well as with the foundation of the Observatory and the Astronomical section in the HPD in 1902, provoked animosity, better to say concealed envy and jealousy, on the part of some of some of his powerful colleagues. It was even more obvious when Kučera successfully proposed the name *Croatia* for an asteroid at a conference in Heidelberg (**Figure 5**). The asteroid was discovered by the German astronomer August Kopff (1882–1960) in 1906, from the observatory in Heidelberg, headed at that time by the astronomer Max Wolf (1863–1932). Giving the name to the asteroid was, in fact, an honour to the foundation of the HPD Observatory in Zagreb. (4)



SLIKA 5. Fotografiska ploča oznake G4164 na kojoj je A. Kopff otkrio asteroid 589 Croatia; položaj asteroida je obilježen strjelicom i oznakom „10“

FIGURE 5. Photographic plate designated G4164 on which A. Kopff discovered the asteroid 589 Croatia; the position of the asteroid is marked with the arrow and designation „10“

The *elitists* further insisted to consider the Observatory an unnecessary huge investment and a failure, furthermore, a burden on the HPD. They wanted a national Observatory of a closed type, while Kučera was accused of laicism. The founder of the HPD Spiridon Brusina defined equal participation of laymen in HPD, for the simple reason that the number of naturalists in Croatia was too

čera održao predavanje o spektralnoj analizi, koje je potom objavljeno u *Glasniku HPD-a*. Moćna grupa prirodoslovaca optužila ga je za tzv. plagijat. Unatoč ružnim napadima u hrvatskom tisku, pobijedio je na izborima za predsjednika HPD-a, ali zbog cijele nepodobne situacije tu čast nije prihvatio. Osim toga, dao je ostavku na mjesto predstojnika Zvezdarnice te je do 1913. bio v. d. predstojnik, a potom je sav inventar Zvezdarnice predao HPD-u. (3, str. 88–120)

Od važnih astronomskih događanja iz toga razdoblja upečatljivo je bilo opažanje Halleyeva kometa 1910. i brojni popularni članci u hrvatskom tisku posvećeni repaticama, u čemu je Kučera sudjelovao. Predstojnici Zvezdarnice birani nakon Kučere nisu imali prilike pokazati svoje vrline i sposobnosti jer je 1914. počeo Prvi svjetski rat, pa su neki bili i mobilizirani. Unatoč tome izabrani upravitelj Adam pl. Kugler⁴ je 1918. tiskao prvu vrteću kartu zvezdanog neba na hrvatskom području i slavonskom jugu, a u suradnji s Otonom Kučerom priredio je astronomski *Kalendar Bošković*. Rad na Zvezdarnici od 1914. do 1918. nadgledao je predsjednik HPD-a Fran Tučan.⁵ (6)

⁴ Adam pl. Kugler (1888. – 1918.) bio je astronomski motritelj i publicist. Od 1915. do 1918. bio je pročelnik Astronomijske sekcije HPD-a i predstojnik Zvezdarnice.

⁵ Fran Tučan bio je hrvatski mineralog i petrograf, predsjednik Hrvatskoga prirodoslovnog društva (1915. – 1921. i 1945. – 1954.) te predsjednik Matice hrvatske (1918. – 1920.). U njegovu je čast 1987. utemeljena Nagrada „Fran Tučan“ za popularizaciju znanosti.

small, and laymen of various professions proved to be great fans of astronomy and other natural sciences. This is why the Observatory offered an opportunity to the youth and other citizens, through lectures and other activities, to acquire at least basic knowledge in astronomy, which was considered to be an issue important for every at least minimally educated man in the country.

Kučera was greatly honoured in 1909 when he was elected as the president of Matica Hrvatska, and the name of the asteroid Croatia was officially recognised. (5) The following year, 1910, was very hard for Kučera. The *elitists* tried to defile him in any way possible, and the opportunity they were waiting for opened when Kučera had a lecture on spectral analysis, later published in the *HPD Glasnik*. A powerful group of naturalists accused him for plagiarism. Despite ugly attacks in Croatian press, Kučera won the election for the president of the HPD. However, due to the unacceptable situation, he declined the honour. Additionally, he resigned from the position of Observatory head and continued to be acting head until 1913, after which he handed the complete Observatory equipment to the HPD. (3, pp. 88–120)

One of the most important and memorable astronomical events of the time was the observation of Halley's comet in 1910, which resulted in a number of popular articles in Croatian press dedicated to comets, shooting stars, in which Kučera also participated. The heads of the Observatory elected after Kučera did not have the opportunity to show their virtues and abilities, as the World War I started in 1914, and some of them were even mobilised. Despite this, the elected head of the Observatory Adam pl. Kugler⁴ published the first rotating

⁴ Adam pl. Kugler (1888–1918.) was an astronomical observer and a publicist. He was the head of the HPD's

Bolja situacija sa Zvezdarnicom bila je od 1920. do 1925., kada je njome ponovo upravljao dr. Oton Kučera. Studentska mladež počela je obavljati zadatke demonstratora i aktivno volontirati na Zvezdarnici. Uz rad na popularizaciji astronomije zabilježeni su i pokušaji znanstvenog djelovanja. Nakon Kučerina odlaska 1925. počelo je stagniranje aktivnosti što je trajalo sve do završetka Drugoga svjetskog rata.

Na rad Zvezdarnice i dalje su negativno djelovali sukobi „populista“ i „elitista“ glede namjene i važnosti Zvezdarnice, pa je povremeno zabilježena i njena potpuna neaktivnost. Oni koji su imali svu vlast i mogli upravljati Zvezdarnicom, nisu imali ni sposobnosti niti želje da Zvezdarnica okuplja mladež, ali ni ljude svih dobnih skupina. Jedino se na Zvezdarnici sastajalo Hrvatsko prirodoslovno društvo.

Ostaje tek činjenica da je Zvezdarnica najbolje djelovala prvih deset godina od osnivanja, dok je njome upravljao dr. Oton Kučera te u vrijeme njegova drugoga predstojništva od 1920. do 1925.

U uvodnom govoru koji je zabilježen u Tajničkoj knjizi Astronomsko-geofizičke sekcije, prigodom ponovnog otvorenja Zvezdarnice 1945., nakon što je završio Drugi svjetski rat, tadašnji po drugi puta predsjednik HPD-a (1945. – 1954.) dr. Fran Tučan kritički se osvrnuo na cijelo opisano razdoblje, žaleći desetljeća prije rata „kada je Društvo stjecajem tadašnjih prilika i nesposobnosti uprave pošlo poves krivim putem i mjesto sve šireg populariteta, ono se svojim radom ograničava-

chart of the starry sky in Croatia and Slavic south in 1918, and in cooperation with Oton Kučera he prepared the astronomical and *Kalendar Bošković* (*Bošković Calendar*). The work at the Observatory from 1914 to 1918 was supervised by the HPD president Fran Tučan.⁵ (6)

Situation with the Observatory improved in the period from 1920 to 1925, when it was again managed by dr. Oton Kučera. Students started to perform the duties of demonstrator and volunteer actively at the Observatory. Together with the work on popularising astronomy, the first attempts of scientific work were recorded. After Kučera left in 1925, activities stagnated and stagnation lasted until the end of the World War II.

Negative impact on the work of the Observatory was continually exhibited by the conflicts of „populists“ and „elitists“, concerning with the purpose and importance of the Observatory, which resulted in its recorded complete inactivity at times. People with complete power and could manage the Observatory had neither capacity not wish to gather young people at the Observatory, or people of all ages for that matter. Only the Croatian Society for Natural Sciences used to meet at the Observatory.

The fact is that the observatory worked most efficiently during the first ten years from its foundation, when headed by dr. Oton Kučera, as well as during his second term as the head of the Observatory, from 1920 to 1925.

Astronomical section from 1915 to 1918, as well as the manager of the Observatory.

⁵ Fran Tučan was a Croatian mineralogist and petrographer, the president of the Croatian Society for Natural Sciences (HPD) (1915–1921 and 1945–1954), as well as the president of Matica hrvatska (1918–1920). The Award for the Popularisation of Science „Fran Tučan“ was established in his honour.

lo na uski krug učenjaka i par amatera“. (6) Da je postojalo veliko zanimanje za astronomiju i Zvezdarnicu među osobama različitih struka i to dobrim dijelom protivnika „elitističkog“ pristupa dotadašnje uprave, pokazuje i zanos kojim je 1945. obnovljeno HPD, ustrojena Astronomsko-geofizička sekcija, uređena Zvezdarnica i otvorena već 13. kolovoza 1945.

3. Preporod Zvezdarnice pod upravom dr. Gabrijela Divjanovića

Nakon Drugoga svjetskog rata nastaje novi uzlet Zvezdarnice kao ustanove za široku popularizaciju astronomije u svim dobnim skupinama, a vrhunac djelovanja nastupa u razdoblju upravljanja Zvezdarnicom dr. Gabrijela Divjanovića⁶ (slika 6).

Bez obzira na brojne aktivnosti u svezi s astronomijom, predmet astronomija je bez prihvatljiva obrazloženja 1948./1949. isključen iz srednjoškolske nastave, pa se godinama bezuspješno pokušavalo astro-

In his speech, recorded in the Secretary book of the Astronomical-geophysical section, on the occasion of re-opening the Observatory in 1945, after the end of the WW II, the president of the HPD



SLIKA 6. Dr. Gabrijel Divjanović
FIGURE 6. Dr. Gabrijel Divjanović

⁶ Gabrijel Divjanović rođen je 1913. u Našicama, a umro u Zagrebu 1991. Diplomirao je na Pravnom fakultetu u Zagrebu i doktorirao 1937. U Drugom svjetskom ratu se pridružio partizanima zajedno s više članova HPD-a. Iz ratnih dana brojne anegdote opisuju ga kao astronoma koji je u predahu učio o astrognoziji i osnovama astronomije. Tijekom rata napisao je knjižicu *Zemlja i svemir* koja je tiskana 1945. u Splitu te 1946. i 1947. u Zagrebu. U novoj državi unatoč ratnih zasluga završio na Golom otoku jer je bio tvrdoglavo uporan u onom što je smatrao istinom. Zahvaljujući ratnim drugovima na visokim položajima, zaposlio se u HPD-u, a 1954. su mu povjeroili upravljanje Zvezdarnicom.

in the second term (1945-1954) dr. Fran Tučan offered a critical insight of the whole period described above, expressing his regret for the decades before the war „when the Society, due to the circumstances of the time and the incompetence of the people in charge took completely wrong turn and, instead of spreading popularity, it limited through its work the activities to a narrow circle of scientist and a few amateurs“. (6) The fact that there was a great deal of interest for astronomy and the Observatory among the people of various professions, mostly opponents to the „elitistic“ approach of previous administrations, can be clearly seen in the enthusiasm ex-

nomiji vratiti njezin status u hrvatskom srednjoškolskom obrazovanju.

Godine 1954. HPD povjerava upravljanje Zvezdarnicom dr. Gabrijelu Divjanoviću, koji je neočekivano uspješno obilježio gotovo četvrt stoljeća njezina djelovanja. Zvezdarnica se kao primarnom zadatku posvetila radu na popularizaciji astronomije u narodu. Šezdesetih i sedamdesetih godina bilježi se svojevrsni preporod u djelovanju Zvezdarnice, a uz popularizatorski, počeo se jače razvijati i stručni rad, tj. rad na opažanjima i mjerenjima, koja su obavljali mladi sudionici astronomskih tečajeva za učenike srednjih škola. Djelujući uspješno izvan školskoga sustava, Zvezdarnica je koristila sve mogućnosti kako bi nadomjestila taj nedostatak i pomogla učenicima i nastavnicima po školama da steknu potrebna znanja iz astronomije.

Na Zvezdarnici je djelovalo više grupa odnosno sekcija, primjerice grupa za Sunce, za promjenljive zvijezde, za vidljivost, astronautička grupa i druge. Treba spomenuti i napore Grupe za radioastronomiju koja je izradila jednostavni radioteleskop SEA (*Sudden Enhancement of Atmosferics – Iznenadno pobuđivanje atmosfere*). Bio je to prijammnik s radnom frekvencijom od 27 kHz kod kojeg promatrač na osnovu varijacije nivoa izlaznoga signala zaključuje o promjenama u ionosferi, što znači neizravno i o promjenama na Suncu. Rad na SEA započeo je Baldo Jurišić, a nastavili su Robert Nađ, Bruno Šibl, Bojan Štajcar, Zdenko Mikšik, Krešimir Brandt i drugi. (2, str. 137) Zalaganjem G. Divjanovića, HPD-a i brojnih njegovih ratnih prijatelja koji su

hibited in restoring the HPD in 1945, organising the Astronomical-geophysical section, as well as in the activities aimed at re-organising the Observatory, which was opened again as early as August 13th 1945.

3. Revival of the Observatory under the management of dr. Gabrijela Divjanovića

New period of prosperity for the Observatory, as an institution for broad popularisation of astronomy in all age groups, started after the Second World War, while the peak of its activities occurred in the period when dr. Gabrijel Divjaković was leading the Observatory⁶ (Figure 6).

Regardless of numerous activities dealing with astronomy, the subject of astronomy was, with no acceptable explanation, removed from school curricula in 1948/1949, and years were spent in vain to try to return the status of astronomy in Croatian secondary education.

HPD entrusted dr. Gabrijel Divjaković with managing the Observatory in 1954, and his efforts, rather unexpectedly, resulted in successful functioning of the Observatory for almost quarter of a century afterwards. The Observatory defined

⁶ Gabrijel Divjanović was born in Našice in 1913 and died in Zagreb in 1991. He graduated from Law School in Zagreb and earned his doctor's degree in 1937. He joined the partisans in the World War II, together with a number of HPD members. Anecdotes from his war days describe him as an astronomer who taught himself bases of astronomy and astronomy. During the war he wrote a booklet entitled *The Earth and Space*, published in Split in 1945 and in Zagreb in 1946 and 1947. In the newly formed state, despite his war-time merits, he ended in the Goli otok concentration camp, because he was stubbornly consistent in what he saw as a truth. Thanks to his war companions as high positions, he was employed in the HPD, and in 1954 he was entrusted with the position of the head of the Observatory in Zagreb.

ga cijenili, astronomija je dobila svoje mjesto u školskim natjecanjima iz fizike, kemije i drugih predmeta, iako nije bila službeno uključena u nastavni program.

3.1. *Drama u svemiru (Tragedio en la Universo)*

Godine 1960., na 15. obljetnicu tragedije Hirošime i Nagasakija, iz zanimljive književne radionice na Zvezdarnici dovršena je i tiskana znanstveno-fantastična svemirska drama pod naslovom *Drama u svemiru* (slika 7). To je nevelika knjižica (93 stranice), koja je otvoreno progovorila o sudbini našega planeta ako ne pobijedi razum. Knjigu su napisala dvadeset petorica mladih astronoma amatera sa zagrebačke Zvezdarnice, vođena G. Divjanovićem. Premda u knjizi nigdje nije naveden kao duhovni otac i začetnik toga djela, sudionici pisanja knjige potvrdili su atmosferu u kojoj je stvarana *Drama u svemiru*, a označila je početak pohoda miroljubive i čovjekoljubive ideje s hrvatske Zvezdarnice u svijet.

its primary goal as popularisation of astronomy in the nation. During the sixties and seventies of the last century a kind of revival happens in the workings of the Observatory. Together with popularisation efforts, professional work was also encouraged, i.e., the work on observations and measurement, performed by young participants of astronomical courses for secondary school students. The Observatory worked successfully outside of the formal educational system, using all the opportunities do compensate for this disadvantage and help the students and teachers in schools to acquire necessary knowledge in astronomy.

A number of groups, or sections, were active at the Observatory, such as the group for the Sun, for variable stars, for visibility, astronautical group etc. Th efforts of the Group for radioastronomy should be mentioned, which constructed a simple radio-telescope SEA (*Sudden Enhancement of Atmospherics*). It was a receiver with the working frequency of 27 kHz, where the observer concludes, based on the output signal variation,

on the changes in ionosphere, meaning indirectly on the changes in the Sun as well. Baldo Jurišić started the work on SEA, to be continued by Robert Nađ, Bruno Šibl, Bojan Štajcar, Zdenko Mikšik,



SLIKA 7. Naslovnice knjiga *Drama u svemiru* i *Tragedio en la Universo* te *Felicigaj Ferioj* (*Sretni praznici*)

FIGURE 7. *Front pages of the books Drama u svemiru, Tragedio en la Universo and Felicigaj Ferioj (Happy Holidays)*

Knjiga je svojevrsan protest protiv sudbine Hirošime i Nagasakija i svih potencijalnih hirošima koje prijete ljudskome rodu. Godine 1956. zvezdarnička mladež i stariji suradnici te Gabrijel Divjanović pokrenuli su popularno znanstveni časopis *Zemlja i svemir (ZIS)*, gdje bi objavljivali različite članke vezane uz astronomiju i Zvezdarnicu. U njemu je uspješno reklamirana *Drama u svemiru*, a u esperantskom izdanju putovala je u brojne svjetske države i bila dobro prihvaćena. Posebice je apostrofirana poruka iz knjige „Mi hoćemo živjeti!“, upućena svima onima koji se neodgovorno „igraju“ atomskim oružjem koje može uništiti planet Zemlju. Naslov knjige i navedena poruka potaknule su Divjanovića na dokazivanje da planet Zemlja nema granica, osim onih umjetno stvorenih, koje su često kobne za ljude. Bilo je to doba hladnog rata i „željezne zavjese“, a on, kažnjnik s Golog otoka, nije smio imati putovnicu. Dapače, nije smio ni objavljivati članke niti knjige, pa je pisao pod pseudonimima. Tako je oduševljeni esperantist Gabrijel Divjanović i mladež okupljenu na Zvezdarnici inspirirao da uče esperanto, kao odskočnu dasku za druženje s ljudima iz cijeloga svijeta.

Pacifističko-humanističkim opredjeljenjem Zvezdarnice uz *Dramu u svemiru* i učenje esperanta, uspostavljene su brojne veze sa svjetskim esperantistima, što je iznjedrilo zajednički projekt *Kamp prijatelja mira u Primoštenu*, ljetno odredište hrvatske mladeži zagrebačke Zvezdarnice. U kampu se gradivo iz opće astronomije i astrognozije produbljiva-

Krešimir Brandt and others. (2, p. 137) Commitment of G. Divjanović, HPD and a number of his war friends who respected him, astronomy won its place in school competitions in physics, chemistry and other subjects, although it has never been included into secondary school curricula.

3.1. *Drama in Space (Tragedio en la Universo)*

In 1960, on the fifteenth anniversary of the tragedy in Hiroshima and Nagasaki, science-fiction space drama entitled „*Drama in Space*“ was completed and published from the intriguing literature workshop at the Observatory (Figure 7). This small booklet (93 pages) openly spoke of the destiny of our planet if reason did not prevail. Twenty-five young amateur astronomers from the Zagreb Observatory, led by G. Divjanović, authored the book. Although the book made no mention of Divjanović as a spiritual father and begetter of this work, the participants in writing the book clearly confirmed the atmosphere of creating it – the beginning of the idea of peace-loving and philanthropic campaign at the Observatory in Zagreb, and its global opening.

This book was a kind of a protest against the destiny of Hiroshima and Nagasaki, as well as against all the potential hiroshimas threatening humankind. Observatory youth and come older collaborators, together with Gabrijel Divjanović started in 1956 a popular science journal *Earth and Space (Zemlja i svemir, ZIS)*, where they published various articles connected with astronomy and the Observatory. The journal successfully promoted the book *Drama in Space*, which, in its Esperanto version, found readers in a number of countries worldwide and was quite well received. Special attention was paid to the message in the book „We want to live!“, sent to those who „played“ irresponsibly with nuclear weapons that could de-

lo i nastavilo dopisivanjem s esperantistima iz različitih zemalja. To je dovelo do uspješne pripreme za opažanje, snimanje i popularizaciju kasnije potpune pomrčine Sunca vidljive iz Hrvatske. Kad je Divjanović počeo na esperantu tiskati časopis *Zemlja i svemir*, pod naslovom *Homo kaj Kosmo* (*Čovjek i svemir*), doista su poništene zemaljske granice. Tako je *Homo kaj Kosmo* odlazio i u Kinu, otkud je godina-ma stizao kineski časopis *El popola Cinio* (*Kineski narod*).

Osim toga, Divjanović je Zvezdarnicu 1967. učlanio u Hrvatski pagvaški pokret u suradnji s akademikom Ivanom Supekom (1915. – 2007.), koji mu je bio na čelu. Time je Zvezdarnica bila vezana i uz svjetski Pagvaški pokret iz 1962., kada su eminentni svjetski znanstvenici osnovali pokret protiv zlouporabe atomske energije. (7–9)

4. Primjer uspješne pripreme mladeži na Zvezdarnici HPD-a za popularizaciju i stručni rad u astronomiji u povodu potpune pomrčine Sunca vidljive iz Hrvatske 15. II. 1961.

4.1. Područje totaliteta pomrčine od 15. veljače 1961.

U broju 1/61 časopisa *Zemlja i svemir* objavljeni su zanimljivi članci povezani sa Suncem i „događajem stoljeća“, kako je nazivana potpuna pomrčina Sunca u Hrvatskoj. O tome je pisao Jerko Kirigin i prikazao uvjete za odabir najboljeg mjesta za opažanje pomrčine. Pojas potpune pomrčine Sunca 15. veljače 1961. počeo je u

stroy the Earth. The title of the book and this message prompted Divjanović to prove that there are no boundaries on the Earth, apart from those artificially created and often fatal for the people. It was the time of cold war and „iron curtain“ and he, a convict from Goli otok, could not get his passport. Moreover, he was not allowed to publish articles or books and was forced to use alias to publish. This is also why a devoted esperantist Gabrijel Divjanović inspire and prompted the youth gathered at the Observatory to learn Esperanto, as a kind of springboard for the chance to associate with the people worldwide.

Through pacifist and humanistic commitments, *Drama in Space* and learning Esperanto, the Observatory established numerous contacts with world esperantists, which resulted in a joint project *Friends of Piece Camp in Primošten* (*Kamp prijatelja mira u Primoštenu*), a summer destination for Croatian youth from the Observatory in Zagreb. The camp was dedicated to broadening the knowledge of general astronomy and astrogony and continuing correspondence with esperantists from various countries. This enabled successful preparation for the observation, recording and popularisation of the solar eclipse seen from Croatia that was to come later. When Divjanović started publishing in Esperanto the publication *Earth and Space* (*Zemlja i svemir*), under the title *Homo kaj Kosmo* (*Man and Space*), it really meant abolishing borders on the Earth. For example, *Homo kaj Kosmo* went to China, from where a Chinese journal *El popola Cinio* (*Chinese people*) arrived to Zagreb.

Additionally, Divjanović enrolled the Observatory into the Croatian Pugwash movement in 1967, in cooperation with the academician Ivan Supek (1915–2007), who headed the Movement in Croatia. This is how the Observatory was connected with the global Pugwash movement from

Biskajskom zaljevu, oko 500 km zapadno od francuskoga grada Bordeauxa. Prelazio je francuskim područjem, zatim talijanskim gdje je središnja linija prolazila preko Genove i Ancone. U Hrvatskoj je pomrčina počela na jugozapadnom rtu otoka Brača u 8 h i 42 min, na Hvaru i Makarskoj, potom malo južnije od Mostara u Bosni i Hercegovini u 8 h i 44 min. Prešla je preko Pljevlja i Niša u Srbiji u 8 h i 48,5 min, a zatim bugarsku granicu oko 8 h 49 min i 30 s. Iz Bugarske je prešla u Sovjetski Savez, na poluotok Krim, gdje je bio najpogodniji položaj za opažanje. Linija totaliteta potom je zahvatila Sovjetski Savez do poluotoka Tajmira u sjevernom Sibiru. Pojas potpune pomrčine bio je širok oko 240 km pa su u pojasu bili gradovi Marseille, Genova, Rim, Sofija, Rostov, Staljingrad, a također i velika zvjezdarnica Pic du Midi na Pirinejima i jedna od najvećih zvjezdarnica na svijetu na poluotoku Krimu.

J. Kirigin je naveo da je za opažanje sa Zvjezdarnice trebalo izabrati najpogodnija mjesta opažanja, koja se nalaze na samoj liniji totaliteta gdje totalitet traje najdulje i pritom imati na umu meteorološke prilike izabranog mjesta. Najbolje mjesto opažanja bio je Hvar s najmanjim brojem oblačnih dana u godini, zatim Brač, jugoistočni dio Šolte i okolica Makarske. Dogovoreno je stoga nekoliko opažачkih mjesta. (10) U časopisu je osim Kiriginove bilo još zanimljivih tema, pa je svaki čitatelj mogao pronaći najvažnije podatke o Suncu. (11–19) Objavljen je i članak *Pripreme talijanskih opservatorija za promatranje totalne pomrčine*.

1962, when eminent world scientists established a movement opposed to misuse of nuclear energy. (7–9)

4. Examples of successful preparation of youth at the HPB Observatory for popularisation and professional work in astronomy on the occasion of total solar eclipse seen in Croatia on February 15th 1961

4.1. Eclipse totality zone on February 15th 1961

Interesting articles on the Sun and „the event of the century“, as total solar eclipse in Croatia was called, were published in the issue 1/61 of the journal *Earth and Space (Zemlja i svemir)*. Jerko Kirigin also wrote on the topic, describing the conditions for the selection of the best spot to observe the eclipse. The zone of total solar eclipse on February 15th 1961 started in the Bay of Biscay, about 500 km west of the French city of Bordeaux. It passed through the territory of France, and then Italy, where the central line passed over Genoa and Ancona. The eclipse started in Croatia at the southwest headland of the island of Brač at 8 hours 42 minutes a.m., on Hvar and at Makarska, and then then a little bit southern of Mostar in Bosnia and Herzegovina at 8 h 44 min. It moved over Pljevlje and Niš in Serbia at 8 h 48.5 min, and then to Bulgarian border around 8 h 49 min 30 s. From Bulgaria it passed to the Soviet Union, to the peninsula of Crimea, where position was the for observing the phenomenon. The line of totality then reached the Soviet Union all through the Peninsula of Tajmir in the north of Siberia. Total eclipse zone was about 240 km wide and included the cities like Marseille, Genoa, Rome, Sofia, Rostov, Stalingrad, a big observatory Pic du midi on the Pyrenees and one of

4.2. Predavanja iz astronomije i priprema zvjezdarničke mladeži za ulogu predavača

Godina koja je slijedila nakon tiskanja *Drame u svemiru* bila je izrazito plodna u povijesti Zvjezdarnice. U očekivanju potpune pomrčine Sunca, mladi zvjezdarničari na Popovu tornju, puni entuzijazma željeli su iskoristiti rijetku prigodu za popularizaciju astronomije na jugu Hrvatske, posebice na otocima. Osim priprema za stručno opažanje i fotografiranje pomrčine, cilj je im bio putem zanimljivih i svakom čovjeku razumljivih i dostupnih predavanja ukazati mještanima da je riječ o prirodnoj pojavi koja će zahvatiti Hrvatsku tek nakon 190 godina. Te se pojave ne treba bojati nego iskoristiti rijetku privilegiju da je mogu opažati svi ljudi koji ili žive ili će doći u zonu totaliteta odnosno potpune pomrčine Sunca. Također je trebalo pojasniti slušateljima zašto i kako će zaštititi svoje oči. Ostvarenje svih tih ciljeva zahtijevalo je dugotrajnu pripremu koja je na Zvjezdarnici počela još 1960. Osim predavanja o tome kako nastaju pomrčine i što se sve može vidjeti u kratkom vremenu trajanja potpune pomrčine, mjesec dana prije pojave pomrčine obrađene su teme kao građa svemira, uvjeti za život, ima li života na drugim svemirskim tjelesima, što su nam otkrili umjetni sateliti te put u svemir. Osim toga, sudionici izabrani za popularizaciju astronomije predavanjima, morali su upoznati potrebne instrumente te veličine i jedinice mjerenja u astronomiji.

Na Zvjezdarnici su u okviru seminara obrađene sve dogovorene teme, provje-

the largest observatories in the world on the peninsula of Crimea.

J. Kirigin wrote that the observers from the Observatory were supposed to select the most favourable positions for observation, those on the very line of totality, where totality exhibits the longest duration, while at the same time considering meteorological conditions of the location. The most favourable observation location was Hvar, with the fewest cloudy days in a year, then Brač, south-east part of Šolta and the vicinity of Makarska. A number of observation posts were thus agreed upon. (10) Besides Kirigin's, there were some other interesting topics in the magazine, so every reader could find the most important data on the Sun. (11–19) The article *Preparations of Italian observatories for observing total solar eclipse* was also published in the issue.

4.2. Lectures in astronomy and Observatory youth preparations for the role of lecturers

The year that followed publishing *Drama in Space* was an extraordinary fruitful one in the history of the Observatory. Expecting total solar eclipse, young astronomers at the Popov toranj, bursting with enthusiasm, wished to use a rare opportunity to popularise astronomy at the south of Croatia, especially on the islands. Besides preparations for professional observation and photographing the eclipse, their aim was to use interesting, understandable and easily accessible lectures to show the local population that the eclipse was a natural phenomenon that will reach Croatia again only after 190 years. The phenomenon should not be afraid of, it should be used as a rare privilege, as it could be observed by all the people who lived or would come into the totality zone, the zone of total solar eclipse. The public should also be acquainted with the knowledge of why and how to protect their

ravana su ranije stečena i nova znanja kako bi predavači bili spremni ne samo za svoje predavanje nego i za svaku raspravu koja bi mogla uslijediti tijekom i nakon predavanja. Tek kad su predavači bili odlični u stručnom znanju, slijedio je novi pokus kako sve to popularnim i pristupačnim govorom prenijeti slušateljima različite dobi i naobrazbe. Svemirske udaljenosti i slično trebalo je predočiti živim i zanimljivim usporedbama, služiti se slikama, crtežima i modelima Sunčeva sustava. Pritom je valjalo pokazati i kreativnost na samom predavanju, jer nisu uvijek bili dostupni aparati za projekciju slika. Smatralo se korisnim ispričati i kakvu zanimljivu šalu ili anegdodu iz povijesti astronomije, ali se trebalo snaći i za slučaj da nestane struje. Konačno, predavanje ne bi smjelo trajati dulje od 35 do 45 min, a zatim je trebalo i potaknuti raspravu. Predavači su morali naučiti i rukovati s tehničkim pomagalima na predavanjima i znati se obratiti svakom pojedincu i prilagoditi se publici.

Nakon svega rečenoga izabrani predavači, njih 16, bili su svjesni da ne predstavljaju samo sebe nego i Zvezdarnicu. Na izabrana mjesta poslani su dopisi za držanje predavanja. Odziv je bio izvrstan te su predavači upućeni u 46 mjesta. Bojazan da zbog mladosti kao astronomi amateri ne će biti ozbiljno shvaćeni od starije publike, ubrzo se rasplinula. Ipak, najzahvalnija publika bila su školska djeca koja su postavljala brojna raznovrsna pitanja. Starija publika pokazala je veliku bojazan od mogućnosti gubitka vida. Bilo je potrebno uvjeriti ih da se to ne može dogoditi

eyes. Long-time preparations were required to realise all of this, and the preparations started at the Observatory as early as 1960. Apart from the lectures explaining how eclipses are created and what can be seen in the short duration of total eclipse, a month prior to the eclipse some other topics were presented, such as the structure of the universe, conditions for developing life, whether there is life on other bodies in space, what was discovered by artificial satellites and travel to space. Additionally, the participants selected to popularise astronomy through lectures had to get familiar with the measuring instrument, values and units in astronomy.

All the topics agreed upon were elaborated in the seminary at the Observatory, previous and new knowledge was checked again, so that the lecturers were not only ready for their assigned lecture, but also for any possible discussion that could start during and after the lecture. Only when the lecturers were excellent in their professional knowledge, could they be instructed, in a new trial, in how to transfer their knowledge to their listeners of various age and education in a popular and understandable words. Distances in space and similar notions should be presented by vivid and interesting comparisons and pictures, drawings and models of the Solar system were supposed to be used. Creativity was expected at giving the lecture itself as the devices for projecting pictures were not available everywhere. It was considered useful to tell an interesting joke or anecdote from the history of astronomy, and being ready for power failure was also one of the skills. Finally, the lecture was supposed not to last longer than 35 to 45 minutes, then discussion was to be encouraged. The lecturers were obliged to learn handling technical aids and device to be used in lectures, they should know how to address each individual and adapt their way to particular public.

ako slijede dane im upute. Unatoč tome, neki su izjavljivali da će se zatvoriti u kuću, zaključati vrata i staviti pokrivače na prozore. Teško ih je bilo uvjeriti da im se ništa loše ne može dogoditi jer se u svemirskom prostoru Mjesec nalazi na pravcu Zemlja – Sunce i njegova sjena uvjetuje pomrčini.

Tablica objavljena u navedenom članku najbolje govori o uspješnosti akcije popularizacije astronomije. Predavanja su održana u 46 mjesta, od jednog predavanja pa do rekordnih 16 predavanja u 6 dana u Visu, a na cijelom otoku Visu bilo je čak 26 predavanja. Pokazalo se da su osmišljena predavanja bila puni pogodak, uspješna i višestruko korisna, održana su od 5. do 11. veljače, u 7 dana 16 mladih predavača održalo je 111 predavanja za 30 940 slušatelja različitih dobi (slike 8, 9).

Bio je to veliki uspjeh Zvezdarnice na Popovu tornju i temelj na kojem je kasnije inicirano stvaranje astronomskih grupa u hrvatskim školama, a dio grupa je prerašao u astronomska društva u pojedinim mjestima. Svi su oni imali otvorenu mogućnost suradnje sa Zvezdarnicom bilo putem posjeta, čitanja uspješnog časopisa *Zemlja i svemir*, pisanja na adresu Zvezdarnice te uputa za osnivanje astronomskih grupa i pravih društava. Time je učinjen znatan korak u popularizaciji i razvoju astronomije u Hrvatskoj, a Zvezdarnica je tada bila jedina ustanova takve vrste.

Povremeno bi čitatelji u časopisu mogli naći obavijest o knjizi *Drama u svemiru* i kako je nabaviti. U br. 1/2 šk. god.

After all of the above, the selected lecturers, sixteen of them, well aware that they not only represented themselves but the observatory as well. Official memos were sent about planned lectures to the places to be held. The response was excellent and the lecturers were sent to 46 locations. The fear that, due to their youth and the fact they were amateur astronomers, they would not be taken serious by older listeners, proved to be unfounded. However, the most appreciative audience were school children who asked a number of questions of all kinds. The older audience exhibited considerable fear of the possibility of losing their eyesight. It was necessary to convince them it could not happen if they followed the instructions given. Despite all, some of them claimed they would close in their homes, lock the doors and put blankets on the windows. It was really difficult to convince them that nothing bad could happen as the Moon was situated directly on the direction the Earth – the Sun and its shadow caused the eclipse itself.

The table published in the article mentioned above is the best illustration of the successful astronomy popularisation action. Lectures were held in 46 places, from a single lecture to record 16 lectures in 6 days on the town of Vis, with as much as 26 lectures on the whole island of Vis. Obviously, planned lectures hit the spot, they were successful and useful in a multiple ways. They were held from February 5th to 11th. Sixteen young lecturers gave 111 lectures in 7 days, for 30 940 audience of various age groups (Figure 8, 9).

It was a great success of the Observatory at Popov toranj and the foundation upon which astronomical groups were initiated in Croatian schools, while some of these groups grew into astronomical societies in some towns. All of them had an open possibility of cooperating with the Observatory, through visits, reading the successful *Earth and*

Tema predavanja	Broj predavanja	Prisutno slušalaca		
		građana	učenika	vojnika
Pomrčina Sunca	90	18.680	5.340	1.950
Put u svemir	9	580	1.300	—
Što su nam otkrili Zemljini umjetni sateliti?	7	1.390	—	300
Ima li života na drugim svemirskim svjetovima?	3	800	—	—
Grada svemira	2	600	—	—
		22.050	6.640	2.250
SVEGA	111		30.940	

SLIKA 8. Teme predavanja i prisutno slušateljstvo
 FIGURE 8. Lecture topics and the audience present

Mjesto	Broj predavanja	Prisutno		
		građana	učenika	vojnika
1. Biograd na moru	1	200	—	—
2. Brijuni na Korčuli	1	250	—	—
3. Bol (na Braču)	1	50	—	—
4. Budva	1	100	—	—
5. Crnica kod Šibenika (Tvornica ferolegura)	1	300	—	—
6. Dubrovnik	5	300	570	—
7. Dugopolje (kraj Solina)	1	200	—	—
8. Gračac	6	1800	270	—
9. Herceg Novi	1	600	—	—
10. Imotski	3	800	240	—
11. Kaštel Kambelovac	1	350	—	—
12. Klis	1	300	—	—
13. Knin	1	600	—	—
14. Kornik (otok Vis)	6	1500	1000	200
15. Korčula	2	650	—	—
16. Kotar	2	250	—	—
17. Krivodol	2	350	120	—
18. Lečevica	1	70	—	—
19. Lozovac (kod Šibenika) Tvornica aluminija	1	400	—	—
20. Malo Lošinj	1	150	—	—
21. Makarska	4	2000	—	—
22. Maringe Zemlje (otok Vis)	1	100	—	—
23. Milna (otok Brač)	1	400	—	—
24. Nikšić	3	1200	200	—
25. Petrovac na moru	1	100	—	—
26. Ploče	6	380	900	850
27. Podalje (otok Vis)	1	50	—	—
28. Postire (otok Brač)	1	150	—	—
29. Potstranje (otok Vis)	1	100	—	—
30. Potpišlje (otok Vis)	1	400	—	—
31. Proložac	2	250	120	—
32. Pušćica (otok Brač)	1	300	—	—
33. Ražine (kod Šibenika) Tvornica aluminija »Bois Kidrič«	1	500	—	—
34. Runovići	2	500	120	—
35. Selca (otok Brač)	2	400	—	—
36. Sinj	1	1000	—	—
37. Solin	1	400	—	—
38. Split	8	500	1500	—
39. Supetar (na Braču)	2	200	300	—
40. Šibenik	7	2.250	1050	—
41. Titograd	1	700	—	—
42. Třebinje	2	600	400	—
43. Vis (otok Vis)	16	1280	300	600
44. Vranjic	1	200	—	—
45. Zadar	4	700	—	600
46. Žrnovnica	1	200	—	—
Svega	111	22050	6640	2250
			30940	

SLIKA 9. Mjesta održanih predavanja i prisutno slušateljstvo
 FIGURE 9. Location where lecture was given and audience present

1967./1968. dana je obavijest o drugom, znatno dopunjenom izdanju poznate knjige *Drama u svemiru*. Upućena je poruka roditeljima i nastavnicima da nagrade dobre učenike tom knjigom te da je preporuča prijateljima i znancima i time učine nešto „za našu zajedničku stvar“.

Astronomska društva i školske grupe mogli su se obratiti Zvezdarnici kako bi dobili ogledni primjerak knjige. Saznajemo da je u SFRJ⁷ prvo izdanje prodano u nakladi većoj od 10 000 primjeraka, čime je postala jedna od najčitanijih knjiga u državi.

Akademik Žarko Dadić je o važnosti Zvezdarnice napisao: *Zvezdarnica Hrvatskoga prirodoslovnog društva je po početnoj zamisli trebala biti ustanova za popularizaciju astronomije i za znanstveno-istraživački rad. Istraživački rad na njoj nije uspio, ali je ipak njezina uloga za razvoj astronomije u Hrvatskoj bila znatna. Naime, ona je odigrala važnu ulogu popularizacije, a svojim izdanjima je širila astronomska znanja u narodu. Osim toga ona je bila jedina astronomska ustanova u Hrvatskoj prvih 20 godina 20. stoljeća, budući da nije uspjelo osnivanje katedre za astronomiju na Zagrebačkom sveučilištu. Zato se mora priznati njezina važna uloga u hrvatskom društvu i bez obzira što nije preasla u znanstveno-istraživačku ustanovu.* (20)

⁷ Pod imenom Federativna Narodna Republika Jugoslavija trajala je od 1945. do 1963., a nadalje do 1991. bila je Socijalistička Federativna Republika Jugoslavija.

Space journal, writing to the Observatory and using instructions on how to establish astronomical groups and true societies. It was an important step in popularisation and development of astronomy in Croatia, at the time when the Observatory was the only institution of the kind in the country.

Readers could occasionally find the information on the book *Drama in Space* in the journal, as well as the instructions how to purchase it. The issue 1/2 academic year 1967/1968 offered an information of the second, significantly supplemented edition of the well-known book *Drama in Space*. A message was sent to parents and teachers to award good students with the book and to recommend it to their friends and acquaintances and in this was do something for „out common goal“.

Astronomical societies and school groups could contact the Observatory to get a sample copy of the book. Reports say that the first edition of the book was sold in Yugoslavia (SFRJ)⁷ in more than 10 000 copies, which made it one of the most widely read books in the country.

The academician Žarko Dadić wrote about the importance of the Observatory: *The Observatory of the Croatian Society of Natural Sciences was by initial intention supposed to be an institution aimed at popularising astronomy and organising scientific research in the field. Scientific research did not succeed, but its role in the development of astronomy in Croatia was still considerable. It played an important role in popularising, and their editions spread astronomic knowledge throughout the nation. Additionally, it was the only astronomic institution in Croatia during the first 20 years of the twentieth century, as the*

⁷ The country functioned under the name of Federal People's Republic of Yugoslavia from 1945 until 1963, to continue until 1991 under the name of Socialist Federal Republic of Yugoslavia.

4.3. Priprema zvjezdarničke mladeži za opažanje i snimanje potpune pomrčine Sunca 15. veljače 1961. i ekipe za opažanje i snimanje s Hvara, Brača i planine Biokovo kraj Makarske

Nakon održanih predavanja svi su predavači krenuli u Split, ugovoreno mjesto sastanka te su zajedno pošli na Hvar pripremiti sve potrebno za opažanje pomrčine.

Da bi opažanje i snimanje Sunca tijekom potpune pomrčine bilo uspješno, bilo je potrebno mlade astronome amateure upoznati s izazovima toga zadatka i na Zvjezdarnici uvježbati sve ključne momente da bi se u kratkih dvije minute totaliteta uspješno obavilo sve predviđeno. Najstručniji u tom pogledu da im prenesu svoja znanja bio je djelatnik Zvjezdarnice Zlatko Britvić, dipl. inž. geodezije (1928. – 1989.), i oni koji su imali iskustva s pravom pomrčinom, makar i djelomičnom.

Ekipa mladih opažaca morala je izvršiti svestrane pripreme i naučiti rukovati s instrumentima koji su postojali na Zvjezdarnici. U posljednjim mjesecima 1960. već su imali gotov opći plan opažanja, određen broj opažaca i raspoloživih instrumenata (slika 10). Zatim se prišlo sređivanju i uređivanju instrumentnog inventara. Namjera je bila opažati pomrčinu u više vidova. Grupe od po četiri opažaca bile su predviđene za crtanje korone odnosno vanjskoga plašta Sunca. Svaki je član trebao nacrtati jedan kvadrant korone te bi sva četvorica zabilježila njenu konačnu sliku, a potpuna pomrčina za koju su se pripremali trajala je samo dvije minute i u tom kratkom vremenu opažaci su morali nacrtati svoj kvadrant korone.

efforts to establish a department of astronomy at the University of Zagreb failed. This is why its important role in Croatian society should be recognised, regardless of the fact that it did not grow into a scientific research institution. (20)



SLIKA 10. Članovi ekipe zagrebačke Zvjezdarnice koji su promatrali totalnu pomrčinu Sunca 15. veljače 1961. u Hvaru
FIGURE 10. Members of the Zagreb Observatory team in charge of observing total solar eclipse on February 15th 1961 at Hvar

4.3. Preparation of the Observatory youth for observing and recording total solar eclipse on February 15th 1961 and preparation of the team in charge of recording from Hvar, Brač and Mt. Biokovo near Makarska

After having given their lectures, all the lecturers went to Split, meeting place previously arranged, and then went together to Hvar, to prepare everything necessary to observe the eclipse.

To ensure a successful observation and recording of the Sun during total eclipse, it was necessary to acquaint young amateur astronomers with all the challenges of this project and to practice at the Observatory all the key moments, so as to be able to do everything planned during the short two minutes

Vježbalo se s projekcijama na platno fotografija korone iz prijašnjih pomrčina. Značajnu ulogu u crtanju korone imao je suradnik Zvezdarnice Zlatko Berić, dobar poznavatelj boja i njihovih nijansi, koji je središao crteže i ukazivao na moguće nedostatke pri crtanju. Važan zadatak bilo je i određivanje doticaja između Mjesečeva i Sunčeva diska, a za tu kvalitetnu izvedbu trebalo je sedam dalekozora i to pet malih s povećanjem šest puta, koji su inače služili za opažanje i praćenje satelita, i dva Zeissova instrumenta s povećanjem od maksimalno 100 puta. U tu svrhu pripremljena su tamna stakla, s filterima od foto-ploče radi zaštite očiju opažачa. Zeissovi instrumenti rabljeni su na dva načina, jedan s filtrom, a drugi projekcijom slike Sunca na bijeli papir (metoda projekcije). Zeissovi instrumenti bili su predviđeni i za motrenje protuberanci ili prominencija odnosno velikih plamenova vidljivih za vrijeme potpune pomrčine.

Opažачi su dobili štoperice kojima su određene korekcije prema kronometru odnosno preciznom satu koji je bio u inventaru Zvezdarnice. Vremenska služba određivala je i korekcije kronometra prema signalu Geofizičkog instituta u Zagrebu.

Od najatraktivnijih fotografija pomrčine očekivalo se najviše rezultata. Sredstvima koja je Zvezdarnica dobila za praćenje pomrčine uređen je sav fotomaterijal i opremljeni svi fotoaparati. Tri su fotoaparata bila zadužena tijekom pomrčine bilježiti različite promjene kao što su osvjetljenje, faze pomrčine i drugo. U središtu pozornosti bila je teleskop-kamera za sni-

of totality. Zlatko Britvić (1928-1989), graduated engineer of geodesy and an employee of the Observatory, was most proficient and professional in order to transfer his knowledge, together with some other people who had any previous experience with real eclipse, partial at least if not total.

A teal of young observers was in charge of organising comprehensive preparation and learn to use the instrument at their disposal at the Observatory. They had a general plan of observation completed during the last months of 1960, number of observers defined and assortment of available instruments (**Figure 10**). The following step was listing and preparing the instruments to be used in the project. Their intention was to observe the eclipse by various means. Groups of four observers each were supposed to make drawings of the corona or outer mantle of the Sun. Each member had to draw a single quadrant of the corona, which meant the four of them would record its final picture. Total eclipse for which they prepared lasted only two short minutes and, in this time, and each observer had to draw precisely his own quadrant of the corona.

Practice was done using projecting corona photos from previous eclipses on screen. Collaborator of the Observatory, Zlatko Berić, expert on colours and their hues, played an important role in drawing the corona. He sorted out the drawings and pointed out possible imperfections in drawing. Important task was also to determine contacts between the Moon and Sun discs. To do it as perfectly as possible they needed seven binoculars, five of them small, with the magnification of six, usually used to observe and monitor satellites, and two Zeiss instruments with the magnification of maximum one hundred. Darkened pieces of glass were prepared for the purpose, with photo-plate filters to protect the observers' eyes. Zeiss instruments were used in

manje pomrčine, nabavljena neposredno prije pomrčine.

Mjesto gdje će opažači snimati pomrčinu izabrano je prema općim meteorološkim prilikama u zoni totaliteta u bivšoj Jugoslaviji. Izbor je pao na Hvar i staru tvrđavu Španjola (**slika 11**) zbog pogodnog smještaja nad okolinom i brojnih terasa koje su poslužile kao izvrstan teren za postavljanje instrumenata. Na Hvaru su



SLIKA 11. Jedno od promatračkih mjesta na tvrđavi Španjola u Hvaru

FIGURE 11. One of the observation posts at the fortress of Španjola in Hvar

poslovi raspoređeni po skupinama. Još su jednom prije pomrčine očišćeni i montirani instrumenti, obavljeno sve potrebno te izvršene korekcije satova. U ponedjeljak 13. veljače svi su instrumenti preneseni na Španjolu i postavljeni na predviđena mjesta. Opažači su obavili i pokusne vježbe s rukovanjem instrumentima. Idućeg dana posjećena su opažačka mjesta ostalih astronomskih skupina, smještenih u neposrednoj blizini Hvara. Disciplina je svugdje bila na visini, jer je bila riječ o pojavi koju se imalo sreću vidjeti jednom u životu.

two manners, one with a filter and the other with a projection of the Sun on white paper (projection method). Zeiss instruments were also intended for observing protuberances or prominences, huge bursts of fire that could be seen during total eclipse.

Observers were also given stop-watches, used to make corrections according to a chronometer, a highly precise clock possessed by the Observatory. Observatory time service also determined chronometer corrections following the signal emitted by the Institute of Geophysics in Zagreb.

The best results were expected from most attractive eclipse photos. All the photographic material and cameras were bought and equipped by the finances acquired for the purpose of monitoring the eclipse. The task of three cameras was to record various changes occurring during the eclipse, such as luminous intensity, eclipse phases etc. A telescopic camera used to record the eclipse, purchased immediately before it, was in the centre of attention.

Exact location where the observers would record the eclipse was selected following the meteorological conditions in the totality zone in former Yugoslavia. The island of Hvar was selected and its old fortress of Španjola (**Figure 11**), primarily due to its favourable location above the immediate environment and numerous terraces that were used as an excellent ground to mount various instruments. Tasks were divided by groups on Hvar. The instruments were once again cleaned and mounted prior to the eclipse, everything necessary was done and clocks corrected. All the instruments were transported to Španjola on Monday, February 13th and mounted the predetermined spots. Observers also organised a trial exercise regarding necessary work with the instruments. Observing posts of the other astronomical groups were visited the following day, situated in the vicinity of the town of Hvar. Disci-

Opažači su fotografirali faze pomrčine i njene različite efekte. Crtanje korone i protuberanci bilo je veoma važno, trebalo ih je crtati na posebnim karticama s kvadrantima označenim rimskim brojem, imenom opažača u gornjem desnom kutu. Kartice je trebalo položiti tako da je njezin donji rub paralelan s obzorom. U crtanje korone bili su uključeni Emil Babić, Jadranka Gomerčić, Jasmina Hadžibaščajušević, Sonja Jermaniš, Marko Kuprešanin, Branka Mihelčić, Nada Mihelčić, Ratko Roušal, Marijan Ručević, Nikola Sabioncello, Blanka Šranc i Jurica Vuković. S pomoću ruskih dalekozora za promatranje satelita finiju strukturu korone zabilježili su Stjepan Malović, Zdenko Marković, Neven Megušar i Miro Pećnik.

Opažanje protuberanci obavljeno je s dva Zeissova teleskopa, povećanja 100 puta. Protuberance su crtali Ernest Mihalek i Petar Römer. Nacrtano je 40 kartica na Hvaru, a na Biokovu 10. Iz svih crteža bilo je moguće rekonstruirati potpuni prikaz korone.

5. Događaj stoljeća: Potpuna pomrčina Sunca vidljiva iz Hrvatske 15. veljače 1961.

U br. 3/60 časopisa *Zemlja i svemir*, u rubrici *Naša Zvezdarnica* čitatelji su upoznati s pripremama za opažanje potpune pomrčine Sunca 15. veljače 1961., „koja će se osobito dobro vidjeti u našoj zemlji, a naročito na području našeg Jadrana“. Za broj 1/61 najavljeno je da će biti posvećen isključivo pomrčini, a „ *cjelokupan rad oko*

pline was high everywhere, as it was a phenomenon one could be lucky to see during his lifetime.

The observers took photos of eclipse phases and its various effects. Drawing corona and protuberances was of extreme importance, they were drawn on special cards with squares marked with Roman numerals and name of the observer in the upper right corner. The card was supposed to be positioned so that its lower edge was parallel with horizon. The following people were included in drawing the corona: Emil Babić, Jadranka Gomerčić, Jasmina Hadžibaščajušević, Sonja Jermaniš, Marko Kuprešanin, Branka Mihelčić, Nada Mihelčić, Ratko Roušal, Marijan Ručević, Nikola Sabioncello, Blanka Šranc and Jurica Vuković. Stjepan Malović, Zdenko Marković, Neven Megušar and Miro Pećnik used Russian-made binoculars, intended for observation of satellites, to observe fine structure of the corona.

Protuberances were observed using two Zeiss telescopes with the magnification of one hundred. Ernest Mihalek and Petar Römer were in charge of drawing protuberances. Forty cards were drawn on Hvar and ten on Mt. Biokovo. Using all of these drawings enabled reconstructing complete representation of the corona.

5. Event of the century: Total solar eclipse seen from Croatia on February 15th 1961

The issue 3/60 of the journal *Earth and Space*, in its column *Our Observatory*, tried to prepare the readers for the observation of total solar eclipse on February 15th 1961 „which will be particularly well seen in our country, and especially at the region of our Adriatic“. It was announced that the issue 1/61 will be dedicated to the eclipse only, and „*complete work on the organisation of observation by foreign and national scientific teams and tourists,*

organizacije promatranja stranih i domaćih naučnih ekipa i turista, boravak i djelatnost na terenu kao i rezultati radova, popraćeno mnogobrojnim ilustracijama, bit će prikazano u drugom posebnom izdanju br. 2. našeg časopisa“.

5.1. Originalna kamera za snimanje korone

U broju 2/61 Ranko Gradečak je u članku *Fotografiranje korone* opisao nastojanje mladih entuzijasta da se i kamerom najbolje moguće pripreme za snimanje korone. Gradečak piše da se kvalitetnu fotografiju korone može dobiti samo ako je slika korone odnosno diska Mjeseca na negativu dovoljno velika. Zbog toga astronomi za snimanje korone rabe objektivne s veoma velikom žarišnom daljinom, čak do 10 metara. Međutim, kod takve je kamere slika korone na negativu slaba sjaja. Da bi se to izbjeglo potrebno je uzeti duge ekspozicije, čak po nekoliko desetaka sekundi, a u tom je slučaju neophodno potrebno tzv. praćenje Sunca. Uređaji koji automatski slijede dnevni put Sunca moraju biti precizno izrađeni i različitih su konstrukcija. Za snimanje korone čak je prema vlastitim nacrtima izrađena kamera za snimanje korone. Geofizički institut u Zagrebu imao je mehaničku radionicu pa je njima povjerena kompletna izrada kamere. Kamera je postavljena na ekvatorijalnu montažu jednog od dalekozora, a sve zajedno je postavljeno na specijalno napravljen drveni stalak. Snimatelji korone bili su Vesna Kolarić, Maja Grgić, Stanko Vidmar i Ranko Gradečak. Snimljene

their stay and activities on the field, as well as the results achieved, accompanied by numerous illustrations, will be presented in the second and special edition of issue 2 of our journal“.

5.1. Original camera for recording the corona

Ranko Gradečak described in the issue 2/61, in the article entitled *Taking photos of the corona*, the efforts of young enthusiasts to prepare in the best possible way for recording the corona with their camera. Gradečak claimed that a high-quality photo of a corona could be obtained only if its picture, or picture of the disc of the Moon, was large enough. This is why astronomers when recording a corona use camera lenses with highly increased focal length, up to 10 metres. However, the picture of a corona is of considerably lower brightness when such a camera is used. To avoid this disadvantage, it is necessary to use long exposures, as long as a few dozens of seconds sometimes, which means observers have to the procedure of so called following the Sun. Devices that automatically follow daily path of the Sun should be extremely precise and can be of various constructions. A camera for recording corona was constructed by original blueprints for this occasion. Institute for Geophysics in Zagreb had a mechanical workshop and they were entrusted to construct complete camera for the purpose. The camera was assembled on the equatorial mounting of one of the binoculars, while the whole structure was mounted on a specially constructed wooden stand. Corona was recorded by Vesna Kolarić, Maja Grgić, Stanko Vidmar and Ranko Gradečak. The photos taken exceeded all expectations (**Figure 12**).

Gradečak described how the HPD Observatory team had a very much efficient camera made for the purpose of recording corona. The lens had 12.5 cm diameter, focal length was 65 cm and shorter expo-

fotografije premašile su očekivanja (slika 12).

Gradečak opisuje kako je ekipa Zvezdarnice HPD-a prema vlastitim nacrtima dala izraditi vrlo uspješnu kameru za snimanje korone. Objektiv je bio promjera 12,5 cm, žarišna daljina 65 cm te je bilo moguće koristiti kraće ekspozicije. Objektiv je bio montiran u prstenu s tri para vijaka kako bi se lako pratio smjer optičke osi objektiva. Pred objektiv je stavljen iris zastor odnosno blenda te je bilo moguće re-

gulirati količinu svjetlosti koja dolazi na objektiv. Prije snimanja korone izravno, s pomoću slike Sunca na mutnom staklu, orijentira se dio kamere u smjer istok – zapad koji služi kao vodilica za umetanje kazeta s fotoografskim pločama. Cijev kamere je izrađena od lakoga

i čvrstog metala svinutog u široku cijev, u koju ulazi jedna manja cijev, kojom se cijeli stražnji dio kamere može vijcima uvlačiti i izvlačiti. Time je omogućeno točno fokusiranje. Zapor jedne stare velike kamere s veoma širokim objektivom poslužio je kao zapor kamere, a bio je smješten neposredno uz fotografsku ploču. Na vanjskoj strani bio je montiran mali pomoćni dalekozor kojim se namještala čitava kamera u smjeru Sunca. U vidnom polju pomoć-

situations could be used. The lens was mounted on a ring with three pairs of screws so as to make it easier to follow the lens optical axis direction. An iris curtain, or shutter, was mounted in front of the lens making it possible to regulate the amount of light to come onto the lens. A part of the camera used as a guide for inserting cartridges with photographic plates was oriented in the direction east-west prior to direct recording of corona, using the image of the sun on frosted glass. Camera barrel was made of a light and strong metal, bent into a broad tube, into which a smaller tube is inserted. This is used to



SLIKA 12. Korona snimljena specijalnom kamerom

FIGURE 12. Corona recorded using a special camera

retract and draw out the whole back assembly of the camera, employing special screws. This action allows for precise focusing. A shutter of another old big camera with a very wide lens was used as the diaphragm for the new one and was positioned immediately with the photographic plate. A small auxiliary binocular was mounted on the outer

side and used to set the whole of the came in the direction of the Sun. A cross of thin threads was situated in the field of view of the auxiliary binoculars. The picture of the Sun was supposed to be brought at the crossing of the threads, meaning exactly in the centre of the field of view. One of the binoculars of equatorial mounting owned by the Observatory was carrying the camera described above, and the whole assembly was mounted on a specially constructed wooden stand. Camera movement was controlled with screws for fine adjustment, po-

nog dalekozora nalazio se križ od tankih niti. Slika Sunca trebala se dovesti na presjek niti, kad je točno u središtu vidnog polja. Jedan od dalekozora ekvatorijalne montaže u posjedu Zvezdarnice, nosio je opisanu kameru, a sve zajedno stavljeno je na specijalno napravljen drveni stalak. Kretanje kamere obavljalo se vijcima za fino pomicanje koji se nalaze na ekvatorijalno montiranim osima te je kamera mogla biti točno usmjerena u bilo kojem smjeru neba.

Gradečak je potanko opisao rad na pripremanju i snimanju korone. Nakon što su stativ i osovine ekvatorijalne montaže smještene u točno određeni položaj, montirana je kamera sa svim dijelovima. S pomoću blende pred objektivom smanjen je sjaj slike Sunca, a da bi sjaj bio još više smanjen pred objektiv je postavljena jedna srednje zacrnjena fotografska ploča. Smjer sjevera na ploči dobiven je izravnim slikom Sunca hvatanom na mutno staklo kamere. Na njemu je ucrtan križ. Čitavo ležište mutnog stakla moglo se okretati oko osi okomite na mutnu ploču. Sunce je praćeno okretanjem ležišta mutne ploče u smjeru istok-zapad. Izabrano je da slika Sunca pri nepokretnoj kameri stalno prolazi uz jednu crtu križa, što je fiksiralo ležište mutnog stakla. Tim je načinom osigurana i orijentacija svih fotografskih ploča. Moralo se paziti pri umećanju foto-ploča u kazete da njihova ivica dobro priljege uz rub kazete.

Za uspješno snimanje korone zaslužno je četvero ljudi: Vesna Kolarić, Maja Grgić, Stanko Vidmar i Ranko Gradečak. Stanko Vidmar je vijcima za fino pomica-

sitioned on the equatorially mounted axes, which made possible for the camera to be precisely directed in any required direction in the sky.

Gradečak described in detail the work on preparations and recording the corona. After the stand and the axes of equatorial mounting were fixed in a precisely defined position, the camera and all of its parts were mounted. Brightness of the picture of the Sun was reduced using a diaphragm in front of the camera lens, and to reduce it even further, a medium darkened photographic plate was positioned in front of the lens. Northern direction on the plate was obtained through a direct picture of the Sun caught onto the dimmed camera glass. It has a cross drawn on it. The whole frosted glass bearing could be rotated around the axis perpendicular to the dimmed plate. The sun was followed by rotating the dimmed plate bearing in the direction east-west. Construction required that the picture of the Sun with stationary camera passes constantly by one line of the cross, which fixed the bearing of frosted glass. Orientation of all the photographic plates was also ensured in this way. Operators had to take care that the edge of the plate had to fit tightly with the edge of the cartridge when inserting the photographic plates into cartridges.

Four people should be given credit for successful recording of the corona: Vesna Kolarić, Maja Grgić, Stanko Vidmar and Ranko Gradečak. Stanko Vidmar used the screws for fine adjustment to keep continuously the picture of the Sun at the crossing of the threads, with the help of a binoculars. Vesna Kolarić adjusted exposition times, wound the shutter and exposed. Maja Grgić and Ranko Gradečak inserted cartridges into the camera, opened and closed their covers and extracted cartridges with exposed plates. It could be seen how important were the exercises and practice done at the Observatory, aimed at coordination of the movements and high-

nje neprekidno držao sliku Sunca u presjeku nitnog križa u pomoćnom dalekozoru. Vesna Kolarić je namještala vremena ekspozicije, napinjala zapor i eksponirala. Maja Grgić i Ranko Gradečak stavljali su kazete u kameru, otvarali i zatvarali njihove poklopce i vadili kazete s eksponiranim pločama. Pokazalo se koliko su važne bile na Zvezdarnici odrađene vježbe usklađivanja pokreta i što veće brzine snimanja. Snimanje je izvršeno na osam fotografskih ploča. Dvije ploče bile su s ekspozicijom jedne sekunde, dvije ploče s pola sekunde te po jedna ploča s ekspozicijom 1/5, 1/10, 1/25 i 1/50 sekunde. Ploče su bile odlične kvalitete, a razvijач je bio Atomal F. Ekipa je bila potpuno zadovoljna rezultatom snimanja jer su fotografije nadmašile njihova očekivanja. Skromna vlastita konstrukcija izvrsno je obavila svoj zadatak s dobro uhodanim četvero snimatelja.

5.2. Precizni opisi u časopisu *Zemlja i svemir*

Kao što je i najavljeno, brojevi 1/61 i 2/61 časopisa *Zemlja i svemir* u cijelosti su posvećeni pomrčini 15. II. 1961. Ukazana prilika izvrsno je iskorištena za popularizaciju astronomije i promociju AS HPD-a i Zvezdarnice HPD-a i izvan Hrvatske i SFRJ. Pomrčina je ocijenjena kao događaj stoljeća, s napomenom da se iz „naše zemlje“ može vidjeti samo tri puta u tisuću godina. U prvom broju dani su teorijski članci o kojima je pisano ranije. U br. 2 prikazana je totalna pomrčina Sunca 15. II. 1961. u iznimno zanimljivim člancima: B. Damjanić: *Astronomске večeri u zoni totaliteta*, E. Mihalek: *Organizacija*

est possible recording speed. Recording was done on eight photographic plates. Two of them were exposed for one second, two for half a second and one had the exposition of 1/5, 1/10, 1/25 and 1/50 seconds. The plates were of top quality, and the developer used was Atomal F. The team was completely satisfied with the results of recording as the photos surpassed all of their expectations. Their modest self-made construction performed the task in an excellent way, with the help of four trained and coordinated cameramen.

5.2. Precise descriptions in the *Earth and Space journal*

As had been announced, the issue 1/61 and 2/61 of the *Earth and Space journal* were completely dedicated to the eclipse of February 15th 1961. The opportunity was perfectly used to popularise astronomy and to promote the AS HPD and the HPD Observatory outside Croatia and Yugoslavia. The eclipse was rated as the event of the century, with a special note that „from our country“ it could be seen only three times in thousand years. The first issue contained theoretical article mentioned before. The issue 2 presented total solar eclipse of February 15th 1961 in the following very interesting articles: B. Damjanić: *Astronomical evening in the totality zone*, E. Mihalek: *Organisation of eclipse observation*, Z. Klobučar: *Taking photos of eclipse phases*, R. Gradečak: *Taking corona photos*, P. Römer: *Drawing corona and protuberances*, Z. Klobučar: *Corona*, T. Breider: *Measuring contacts and Flying shadows*, dr. B. Makjanić: *Geophysical measurement during eclipse*.

Branka Damjanić, the author of the text on astronomical evenings in totality zone, reported that the Observatory sent three specially trained and equipped teams into totality zone: one team of 16 lecturers that visited all the important towns in to-

promatranja pomrčine, Z. Klobučar: Fotografiranje faza pomrčine, R. Gradečak: Fotografiranje korone, P. Römer: *Crtanje korone i protuberanaca*, Z. Klobučar: *Korona*, T. Breider: *Mjerenje kontakata i Leteće sjene*, dr. B. Makjanić: *Geofizička mjerenja za vrijeme pomrčine*.

Od Branke Damjanić, autorice teksta o astronomskim večerima u zoni totaliteta, saznajemo da je Zvezdarnica u zonu totaliteta uputila tri specijalno izučene i opremljene ekipe: jednu ekipu predavača (16 članova), koja je obišla sva važnija mjesta u zoni totaliteta, od Malog Lošinja do Titograda u Crnoj Gori (ukupno 46 mjesta); drugu ekipu od 40 promatrača na otok Hvar, na tvrđavu Španjola; i treću od šest promatrača na planinu Biokovo kraj Makarske, na koti od 1 700 m nadmorske visine. Predavači, većinom studenti i srednjoškolci koji su za predavanja i rasprave pripremljeni na seminarima na Zvezdarnici prije pomrčine, od 111 održanih predavanja, 90 se odnosilo na pomrčinu, a ostale teme bile su: *Put u svemir*, *Što su otkrili Zemljini umjetni sateliti*, *Ima li života na drugim svemirskim svjetovima* i *Grada svemira*. Predavanja o pomrčini Sunca slušalo je 18 680 građana, od toga 5 340 učenika i 1 950 vojnika (slika 8).

Slično kao s predavačima bilo je i s odabranim opažačima, koji su prošli stručne pripreme. Već krajem 1960. napravljen je opći plan opažanja s brojem opažača i brojem iskoristivih instrumenata. U pripreme radove ubraja se i odabiranje mjesta opažanja. Kao najpogodnije mjesto izabran je otok Hvar i stara tvrđava Španjola.

tality zone, from Mali Lošinj to Titograd in Monte Negro (46 towns totally); the other team of 40 observers sent to the island of Hvar, Španjol fortress; and finally the third team of six observers to the Mt. Biokovo near Makarska, at the elevation of 1700 m above the sea level. The lecturers were mostly university or high-school students prepared prior to the eclipse for the lectures and discussions at seminars organised by the Observatory. Exactly 111 lectures were given, 90 concerned with the eclipse, while the other topics were: *Travel to space*, *What have Earth's artificial satellites discovered*, *Is there life on other celestial bodies* and *The structure of the Universe*. The lectures on eclipse were attended by 18 680 people, 5340 pupils and 1950 soldiers (Figure 8).

Just like the lecturers, selected observers also passed professional training. As early as the end of 1960, a general plan of observation was made, including the number of observers and the number of instruments to be used. Preparations also included selecting the location for observation. The island of Hvar was selected as the most favourable one, with its fortress of Španjola. All the instruments were transported to the fortress and mounted to be tested at their predetermined points. The observers performed the last training and tests in working with the instruments.

The entire team was highly successful and the Croatian Society of Natural Sciences published an interesting booklet entitled *ABC Solar Eclipse on February 15th 1961*. The author was Milan Butorac. The expedition to Hvar was evaluated as successful (Figure 13, 14), while the Observatory published a nicely furnished booklet *Total Solar Eclipse on February 15th 1961 (Totala suneklipso 15. 02. 1961)* written in Croatian, Esperanto, English and German (Figure 15). Prof. dr. Leo Randić was the editor. The booklet was also used to send

U ponedjeljak 13. veljače 1961. svi su instrumenti preneseni na tvrđavu i postavljeni za probu na svoja predviđena mjesta. Opažači su obavljali zadnje vježbe u rukovanju instrumentima.

Uspjeh cjelokupne ekipe bio je izvrstan te je Hrvatsko prirodoslovno društvo objavilo zanimljivu knjižicu *ABC Pomrčina Sunca 15. veljače 1961.* Autor je bio Milan Butorac. Ekspedicija na Hvar ocijenjena je uspješnom (slike 13, 14), a Zvezdarnica je tiskala lijepo opremljenu knjižicu *Potpuna pomrčina Sunca 15. II. 1961. (Totala suneklipso 15. II. 1961.)* napisanu na hrvatskom, esperantu te engleskom i njemačkom jeziku (slika 15). Urednik je bio prof. dr. Leo Randić. Knjižica je iskorištena i za slanje u svijet informacija o prijevodu na esperanto *Drame u svemiru (Tragedio en la Universo)*, ljepota Hrvatske i Međunarodnoga kampa prijatelja mira u Primoštenu te astronomske esperantske radiostanice. Naime, nešto više od mjesec dana nakon pomrčine Sunca, nastupanje proljeća 1961. godine obilježeno je u noći s 20. na 21. ožujka uključivanjem s Popova tornja astronomske esperantske radiostanice, članice Radio-kluba Zagreb, jedine takve vrste na svijetu.

Publikacija *Totala suneklipso 15. II. 1961.* slana je esperantskim organizacijama diljem svijeta. Navedeno je da svim radovima oko organizacije promatranja te svemirske pojave rukovodi Koordinacioni odbor astronomskih društava i opservatorija FNRJ, u koji su učlanjene sve astronomske organizacije u državi.

Dr. Zlatan Sremec, predsjednik Republičkoga vijeća Sabora Narodne Re-

information globally on the Esperanto translation of *Drama in Space (Tragedio en la Universo)*, of the natural beauties of Croatia and of the International camp for the friends of world piece in Primošten as



SLIKA 13. Pojava dijamantnog prstena prigodom potpune pomrčine Sunca na Hvaru

FIGURE 13. Diamond ring appearing during the total solar eclipse on Hvar



SLIKA 14. Kromosfera i protuberance na zapadnom rubu Sunca

FIGURE 14. Chromosphere and protuberance at the western edge of the Sun

well as of the astronomical Esperanto radio station. Namely, the astronomical Esperanto radio station, a member of the Zagreb radio club and the only one at that time in the world, started broadcasting

publike Hrvatske, također i predsjednik HPD-a, u sklopu ekipe sa Zvezdarnice također je promatrao otpunu pomrčinu Sunca na Hvaru.

Posebna ekipa, koja je pomrčinu opažala s Biokova, također je dala svoj opsežan opis opažanja pomrčine s vrha Vošac na Biokovu (**slika 16**), u snježnim uvjetima mjeseca veljače. I oni su uspješno obavili postavljene zadatke, kao i stručna ekipa koja je pomrčinu opažala iz Vrboske, s terase tvrđave.

U toj su ekipi bili stručnjaci Astronomskog zavoda Tehničkog fakulteta iz Zagreba: prof. dr. Leo Randić, prof. ing. Predrag Terzić, tehničar Slavko Marof, Zlatko Britvić, dipl. ing. i skupina mladih astronoma amatera. Grčka ekipa je također mjerila kontakte te je zanimljiva bila usporedba najboljih rezultata izmjenog vremena kontakata obiju ekipa. Za vrijeme I. kontakta grčka je ekipa dobila rezultat 7 h 33 min i 55,5 s, a hrvatska 7 h 33 min i 49 s. Za IV. kontakt grčka je ekipa dobila vrijeme 9 h 54 min 39,6 s, a hrvatska ekipa izmjerila je vrijeme IV. kontakta u 9 h 54 min 39,9 s.

S terase tvrđave iz Vrboske mjerena je i temperatura tijekom pomrčine.

in the night between March 20th and 21st 1961, a month after the solar eclipse.

The publication *Totala suneklipso 15. 02 1961* was sent to Esperanto organisations worldwide. It stressed that all the activities on the organisation of observing the phenomenon were directed by the Coordination Committee of the astronomical societies and observatories in Yugoslavia, a body the

members of which were all the astronomical organisations in the country.

Dr. Zlatan Sremec, the president of the Sabor's (Parliament's) Republic Council of the People's Republic of Croatia, also the president of the HPD, was also a member of the Observatory team observing the total solar eclipse on Hvar.

Special team that observed the eclipse from Mt. Biokovo contributed considerably to the description of the observations from the peak of Vošac on Mt. Biokovo (**Figure 16**), under heavy snow conditions in February. They also successfully

performed all of their planned tasks, as did the expert team that observed the eclipse from the fortress terrace at Vrboska.

The team included the experts from the Astronomical Department, Technical Faculty in Zagreb: Prof. dr. Leo Randić, Prof. ing. Predrag Terzić, technician Slavko Marof, Zlatko Britvić, graduated ing. Together with a group of young amateur astronomers. A team from Greece was also involved in measuring contacts and it was interesting to compare the best



SLIKA 15. Naslovnica knjižice *Totala Suneklipso 15. II 1961.*

FIGURE 15. *Front page of the booklet Totala Suneklipso 15 02 1961*



SLIKA 16. Posebna ekipa zagrebačke Zvezdarnice koja je opažala i snimala pomrčinu Sunca na planini Biokovo kraj Makarske

FIGURE 16. *Special team from Zagreb Observatory that monitored and recorded solar eclipse at Mt. Biokovo, near Makarska*

5.3. Događanja s Vidove gore na otoku Braču

Na Vidovoj gori na otoku Braču bilo je organizirano opažanje različitih ekipa iz Hrvatske i inozemstva. Sudjelovala je i Astronomska grupa Narodne osmogodišnje škole iz Selske ceste II uz profesora Branka Margetića (?), a utisci učenika objavljeni su u časopisu. Jedna od zanimljivih epizoda vezanih uz pomrčinu Sunca je i ona s astronomom don Nikom Miličevićem, s otoka. U *Prirodoslovlju* je objavljen članak (21) o njemu te su

results of the contact time measured for both teams. For the time of the first contact, the Greek team reached the result of 7 h 33 min and 55,5 s, while the Croatian team recorded 7 h 33 min and 49 s. For the fourth contact, the Greek team recorded the time of 9 h 54 min 39,6 s, while the Croatian team measured the time of 9 h 54 min 39,9 s for the same contact.

Temperature during the eclipse was also measured from the terrace of Vrboska fortress.

5.3. Events at Vidova gora on the island of Brač

Observation for various teams, both from Croatia and abroad, was also organised at Vidova go-

prikazani život i djelo don Nike Miličevića, ml. (1877. –1963.), svjetski poznatog astronoma iz Pustinje Blaca na otoku Braču. Nikola Miličević rođen je 1887. u Zvečanju, u Poljicama. Kao dječak došao je u Pustinju Blaca gdje je upravitelj bio njegov stric Nikola Miličević, st. (1869. –1923.). Pod njegovim je patronatom odgajan za svećenika i njegova nasljednika. Zareden je 1910. i postao župskim pomoćnikom na Braču. Tijekom školovanja oduševio se astronomijom te je stric ishodio dozvolu od hvarskog biskupa za njegov studij astronomije u Beču. Nakon završenog studija i preuzimanja 1923. uprave nad Pustinjom Blaca, godine 1926. uspio je kupiti veliki Brennerov teleskop iz bivše privatne zvjezdarnice Manora na Malom Lošinju te osnovao Zvjezdarnicu Blaca. Bavio se znanstvenim radom iz nebeske mehanike, praktične primjene na izračun pojedinih putanja nebeskih tijela te teorije i prakse raznih astronomskih instrumenata i drugo. (21)

Godine 1961. nalazimo starog i boleznog don Niku kojeg su svi htjeli upoznati, a on unatoč bolesti nije želio propustiti potpunu pomrčinu Sunca koja je za hrvatske i druge astronome i ljubitelje astronomije bila najvažniji astronomski događaj, a vidljiva iz južnog dijela Hrvatske. Linija totaliteta prelazila je otocima Hvar, Brač i Vis. U svom dnevniku don Niko opisuje svoj doživljaj potpune pomrčina Sunca. Imao je tada 74 godine i bio u dosta lošem zdravstvenom stanju, stacioniran u bolnici. Uoči pomrčine 11. 2. 1961. posjetili su ga Željko Polanšćak sa zagrebačke Radio-televizije i Virgil Kurbel, urednik Večer-

ra on the island of Brač. One of the participants was the Astronomical group from the elementary school (Narodna osmogodišnja škola) II in Zagreb, with their teacher Branko Margetić (?), and the pupils' impressions were published in a journal. An interesting episode connected with solar eclipse and an astronomer from the island, don Niko Miličević was recorded. An article (21) was published about him in the magazine *Natural History (Prirodoslovlje)*, presenting his life and work. Niko Miličević jr. (1877-1963), globally known astronomer from Pustinja Blaca on the island of Brač was born in Zvečanj, Poljice. As a boy he came to Pustinja Blaca, to live with his uncle Nikola Miličević, sr. (1869-1923), who was the administrator there. Under his protection, he was educated to become a priest and his uncle's heir there. He was ordained in 1910 and became parish assistant on Brač. During his education he was fascinated by astronomy and his uncle got the permission from the Brač bishop for him to study astronomy in Wien. After graduating and taking over the administration of Pustinja Blaca in 1923, he managed to purchase a big Brenner telescope from the former private observatory Manora at Mali Lošinj in 1926, and establish the Blaca Observatory. He was involved in the scientific work in the field of celestial mechanics, practical application of the theory on the calculation of the orbits of individual celestial bodies, as well as in theory and practice of various astronomical instruments and in other relate topics. (21)

In 1961, don Niko was old and ill, but everybody wanted to meet him. Despite his illness he did not want to miss the total solar eclipse, which was the most important astronomical event for Croatian and other astronomers and fans of astronomy, and which could be seen from the southern part of Croatia. The totality line passed over the islands of Hvar, Brač and Vis. Don Niko described in his di-

njeg lista te su s njim obavili zanimljiv razgovor zabilježen na magnetofonu. (21)

Nakon smrti Otona Kučere (1931.), kojeg je don Niko veoma cijenio, kasnije je bio u doticaju s njegovim sinom Vlahom Kučerom⁸ te je postao i članom Astronomskog društva Oton Kučera⁹ (2, str. 210–213) Članovi toga društva bili su u dogovoru s grupom ljubitelja astronomije iz Austrije te su zajedno stigli 13. 2. 1961. u Supetar. Don Niko ih je dočekao, navodi da je u ekipi stiglo 78 ljudi i da su se svi smjestili u hotel Jadran, a za mjesto opažanja bila je odabrana Vidova gora. Srijeda, 15. veljače 1961. bila je Pepelnica. Pomrčina je počinjala u 7.34 i trajala do 9.50 te je trebalo na vrijeme stići na Vidovu goru. Don Niko je ustao u pet i trideset te su on, domaćica Katica, i još neki Bračani stigli na Vidovu goru bolničkim automobilom u 7 h 15 min. Zabilježio je da je temperatura bila 8°. U dnevniku je don Niko zapisao: „*Gore je hladno i ima još ostataka starog snijega, a i mraza. Već je gore dosta svijeta i velika navala na specijalne marke. U 7.34 prvi kontakt i već polako napred, u 8.41 drugi kontakt, počeo*

⁸ Vlaho Kučera (1898. – 1983.) bio je astronom amater i bavio se izumima. Suradnik Zvezdarnice HPD-a, a 1954. suosnivač Astronomskog društva Hrvatske „Oton Kučera“. Objavio je knjigu *Praktični astronom* (1959.).

⁹ Astronomsko društvo „Oton Kučera“, osnovano 1954., bilo je samostalno astronomsko društvo koje je imalo svoju izdavačku djelatnost, predavanja i druge aktivnosti. Među članovima Društva bili su Stjepan Mohorovičić, don Niko Miličević, Juraj Golubić, Slavko Rozgaj, Zlatko Britvić, Dragan Bach, Mladen Hegedušić i drugi.

ary his impressions of total solar eclipse. He was 74 at the time and his health was deteriorating, spending most of his time in a hospital. On the eve of the eclipse, on February 11th 1961, he was visited by Željko Polanšćak from Zagreb Radio-Television and Virgil Kurbel, the editor of *Večernji list*, and they had an interesting conversation with him, recorded on a tape-recorder. (21)

After Oton Kučera died (1931), and don Niko appreciated him very much, don Niko was in contact with his son, Vlaho Kučera⁸ and became a member of the Astronomical Society Oton Kučera⁹ (2, pp. 210–213) The members of this society had an arrangement with a group of astronomy fans from Austria, and came to Supetar on Brač on February 13th 1961. Don Niko welcomed them, said in his diary that the team consisted of 78 people and they were all accommodated in the hotel Jadran, selecting Vidova gora as the observation site. Wednesday, February 15th 1961 was Ash Wednesday. The eclipse began at 7.34 and lasted until 9.50 and it was necessary to come to Vidova gora on time. Don Niko got up at 5.30 and he, together with his housekeeper Katica and some other people from Brač, arrived at Vidova gora by an ambulance at 7 h 15 min. He noted that the temperature was 8°. In his diary don Niko wrote: „*It*

⁸ Vlaho Kučera (1898– 1983) was an amateur astronomer and inventor. He was a collaborator of the HPB Observatory and co-founder of the Astronomical Societa of Croatia „Oton Kučera“ in 1954. He published the book *Practical astronomer* (1959.).

⁹ Astronomical Society „Oton Kučera“, founded in 1954, was an independent astronomical society with its own publishing activities, organised lectures and other activities. Members of the Society were, among others, Stjepan Mohorovičić, don Niko Miličević, Juraj Golubić, Slavko Rozgaj, Zlatko Britvić, Dragan Bach, Mladen Hegedušić and others.

tak totaliteta. Veoma lijepo se vidi fotosfera pak jasna moćna kromosfera i lijepo razvijena korona sa nekoliko lijepih pramenova i dvije jake crvene protuberance lijevo i desno. Nastup crne mjesечеve sjene na moru, i poslije odstup, lijepo se vide planeti Jupiter i Saturn u konjunkciji prema zapadu, a prema istoku Merkur i Venera, i još nekoliko zvijezda oko zenita. Nakon 2 ¼ minute III. Kontakt i Sunce se pomalja. – Idemo zatim u Dom, crnu kavu, pak dijelim čitavo vrijeme autogramе. Vlaho Kučera upravi mi javni pozdrav, a ja mu odgovorim. Prof. Dr. Eisner, Dr. Haupt, Dr. Pyrhinger, Dr. Esih, ing. Hegedušić itd. Već je pomrčina davno svršila, pak idemo k našem autu, i u 11 krećemo natrag. Katica se iskrca i ostane u Nerežišću, a ja i Tomislava u bolnicu. Šoferu Stevi 500. D. (...).“ U rujnu je u Supetru boravio Vlaho Kučera te mu je donio naručene fotografije pomrčine, za koje je don Niko platio 1 000 dinara. (21)

Astronomska sekcija Prirodoslovnog društva iz Ljubljane poslala je na Brač 25 promatrača. U članku profesora Pavla Kunavera koji je organizirao i vodio slovensku ekspediciju razvidno je da su bili u doticaju s don Nikom Miličevićem i od njega su tražili savjet o mjestu promatranja na Braču. Preporučio im je Bol ili Selce. Izabrali su Selce i uspješno obavili opažanja za vrijeme pomrčine. Don Niko i prof. Kunaver bili su u vezi niz godina. Pavel Kunaver (1889. – 1988.), bio je slovenski profesor zemljopisa. Osnovao je 1929. školsku zvezdarnicu na terasi škole u Zgornjoj Šiški. Imao je jednostavan reflektor objektiva 11 cm vlastite izrade. Desetljećima je pratio Sunčevu aktivnost

was cold up there, there were residues of old snow, and frost as well. There were a lot of people up there and a great rush for special stamps. The first contact was at 7.34, then slowly forwards, the second contact at 8.41, the beginning of totality. Photosphere could be nicely seen, together with clear and powerful chromosphere and well-developed corona, with a few beautiful strands and two strong red protuberances left and right. Black lunar shadow advanced at the sea, then retreated. The planets Jupiter and Saturn could be clearly seen in conjunction westward, Mercure and Venus eastward, and some other stars around the zenith. After 2 ¼ minutes third contact occurred and the Sun appeared – We went to the Mountain Hut, black coffee, then autographs for a long time. Vlaho Kučera greeted me in front of the public and I greeted him back. Prof. dr. Eisner, dr. Haupt, dr. Pyrhinger, dr. Esih, ing. Hegedušić and some others were there. The eclipse had long ended, we went for our car and started back at 11 o'clock. Katica went out and stayed in Nerežišće, Tomislav and me went to the hospital. Gave 500 D to driver Stevo (...).“ Vlaho Kučera stayed in Supetar in September and brought the photos of the eclipse don Niko had asked for and paid 1000 dinars for them. (21)

Astronomical section of the Society of Natural Sciences from Ljubljana sent 25 observers to Brač. Prof. Pavel Kunavera, who organised and led the Slovenian expedition, notes in his article that they were in contact with don Niko Miličević and asked for his advice regarding the location on Brač favourable for the observation. He recommended Bol or Selce and they choose Selce, successfully accomplishing observation during the eclipse. Don Niko and Prof. Kunaver had contacts for a number of years. Pavel Kunaver (1889– 1988) was a Slovenian professor of geography. He established a school observatory at the school terrace in Zgornja Šiška in 1929. He had a simple reflector of his

i slao svoja opažanja u Centar za opažanje Sunca u Zürichu. Napisao je nekoliko knjiga iz astronomije i tiskao vrteću kartu neba. Suradivao je i sa Zvezdarnicom na Popovu tornju.

6. Zaključak

Moto članka *Primjer uspješne pripreme mladeži na zagrebačkoj Zvezdarnici za popularizaciju pomrčine predavanjima te za stručni rad opažanja i snimanja Sunca za vrijeme pomrčine*, nije slučajna. Moguće ga je iščitati i u različitim drugim djelovanjima Zvezdarnice na Popovu tornju. Izuzevši nekoliko neplodnih razdoblja, kada vrsni hrvatski intelektualci i znanstvenici nisu shvaćali kakvu priliku imaju da pospješe razvitak hrvatske astronomije, sve ostalo vrvi aktivnošću i velikim rezultatima, o kojima će više biti rečeno sljedeće godine na 120. obljetnici osnivanja Zvezdarnice na Popovu tornju.

Oton Kučera je začetnik Zvezdarnice u koju je nesebično uložio svoje vrijeme i svoju zamisao, imajući viziju zvezdarnice za popularizaciju astronomije, ali i za stručni i znanstveni rad. Drugi velikan s osebujnim načinom rada, Gabrijel Divjanović, svoju je energiju također nesebično dijelio usmjeravajući brojnu mladež na različite vidove popularizacije astronomije te preko njih pridonio razvitku profesionalne astronomije u Hrvatskoj. Uspio je biti i „drugi otac“ i prijatelj učenicima i studentima koji su dolazili i družili se na Zvezdarnici. Bilo je tu i pjesama i sviranja violine i sličnih manifestacija obiteljsko-

own design with the lens of 11 cm and monitored solar activity for years, sending his observations to the Centre for solar observations in Zürich. He also wrote a few books in astronomy and published a rotating map of the sky. He also collaborated with the Observatory at Popov toranj.

6. Conclusion

The motif of the article *An example of a successful preparation of the youth at Zagreb Observatory for the purpose of popularisation of eclipse through lectures and for professional observation and recording of the Sun during eclipse*, is not random or haphazard one. It can also be seen in various other activities of the Observatory at Popov toranj. Barring a few unfruitful periods, when prominent Croatian intellectuals and scientists did not comprehend the opportunity to advance the development of Croatian astronomy, the rest of the history of the Observatory abounds in activity and high results, which will be discussed in more detail next year, at the 120 anniversary of the Observatory at Popov toranj.

Oton Kučera was the founder of the Observatory and he invested selflessly his time and his ideas, having the vision of an observatory with the purpose of popularising astronomy, but also as a place of professional and scientific work. Another great man with a peculiar style of work, Gabrijel Divjanović, also shared his energy selflessly, directing a number of young people to various modes of popularising astronomy, thus contributing to the development of professional astronomy in Croatia. He also managed to be a „second father“ and a friend to pupils and students who came to the Observatory and hanged out there. There was a lot of songs and playing violins there, as well as many other similar manifestations of family unity. However, as-

ga zajedništva, ali uvijek je na pijedestalu bila astronomija i što se još može učiniti za njenu dobrobit kad već nije nastavni predmet u školama. Gledamo li s odmakom vremena, čini se da je što narod kaže „svako zlo za neko dobro“ pa je i ta apsurdna odluka pridonijela ubrzanom razvitku amaterske i profesionalne astronomije u Hrvatskoj s ishodištem na Zvezdarnici HPD-a, a potom samostalnoj Zvezdarnici koja je prolazila kroz različite „Scile i Haribde“¹⁰ i uspješno odolijevala ugrozama.

tronomy was always at the pedestal, as was the question what else could be done for its benefit, when it never made it as a subject to school curricula. If we consider it from contemporary perspective, with a time delay, it seems that the proverbial „every cloud has a silver lining“ could be applied here, meaning this absurd decision has contributed to the accelerated development of amateur and professional astronomy in Croatia, with the starting point in the HPD Observaory, and later completely independent Observatory, which has passed through various „Scyllas and Charibdes“¹⁰ and has successfully resisted various menaces and threats.

LITERATURA I IZVORI / REFERENCES AND SOURCES

1. Branka Damjanić i Petar Römer: *O pomrčinama Sunca i Mjeseca*, Zemlja i svemir (ZIS) **IV**(1) (1961) 2–11.
2. Tatjana Kren: *Astronomijski vremeplov. Crtice iz prošlosti hrvatskoga zvezdoznanstva*, HKD Sv. Jeronima, Zagreb, 2002., str. 127–131, 136–138.
3. Tatjana Kren i Branko Hanžek: *Oton Kučera (1857. – 1931.), Per aspera ad astra* (Kroz trnje do zvijezda), Gimnazija Matije Antuna Reljkovića, Vinkovci, 2013., str 81–125., 88–116).
4. Tatjana Kren: *Temeljni kamen za Zvezdarnicu – Naše nebo Otona Kučere*, u. *Spomenica Zvezdarnice Zagreb 1903. – 2003. Povodom stote obljetnice* (T. Kren i D. Roša, ur.), Zagrebački astronomski savez – Zvezdarnica Zagreb, Zagreb, 2003., str. 36–40.
5. Tatjana Kren i Zlatko Kovačević: *Snimanja asteroida 589 Croatia iz Hrvatske*, Čovjek i svemir (ČIS) **LXIV**(4) (2021–2022) 16–20.
6. Tatjana Kren: *Članovi astronomske sekcije i astronomskeg društva te ostali suradnici Zvezdarnice od 1903. do 2003. godine* (G. Kren, ur.), *Bolid XXX*(1-2) (2003) 94–95.

¹⁰ Scila i Haribda (grč. *Σκύλλα*, *Skýlla* i *Χάρυβδις*, *Khárybdis*), po antičkome vjerovanju dvije opasne nemani koje su pomorci morali izbjeći ako su se htjeli spasiti za plovidbe kroz Messinski tjesnac (između Italije i Sicilije).

¹⁰ Scyllas and Charibdis (Greek *Σκύλλα*, *Skýlla* and *Χάρυβδις*, *Khárybdis*), according to the ancient Greek belief were two dangerous monsters that sailors had to avoid if they wished to sail through the strait of Messina successfully (between Italy and Sicily).

7. Tatjana Kren i Kruno Poljak: *Velika ideja prijateljstva i mira – Pacifizam i esperanto na zagrebačkoj Zvezdarnici*, u: *Spomenica Zvezdarnice Zagreb 1903. –2003., Povodom stote obljetnice*, Zagrebački astronomski savez – Zvezdarnica Zagreb, 2003., str. 92–98).
8. Tatjana Kren: *Drama u svemiru hrvatskih zvezdoznanaca – Književna radionica na zagrebačkoj Zvezdarnici*, u: *Nebesa se osuše zvijezdama*, Hrvatska književnost i astronomija, HKD Sv. Jeronima, Zagreb 2005., str. 67–77).
9. Ernst Mihalek: *Zvezdarnica na Popovu tornju u Zagrebu – kolijevka znanosti i mirotvorstva*, u: *Povijest i filozofija tehnike – 7. simpozij PIFT 2018.* (Z. Benčić, ur.) Kiklos – Krug knjige, Zagreb, 2018., str. 151–168)
10. Žarko Dadić: *Povijest egzaktnih znanosti u Hrvata*, Druga knjiga, SNL, Zagreb, 1982., str. 283.
11. Jerko Kirigin: *Vidljivost pomrčine Sunca 15. II. 1961. iz naših krajeva*, Zemlja i svemir (ZIS) **IV**(1) (1961) 12–14.
12. Toni Breider (Brajder): *Pomrčina Sunca u historiji*, *ibid.*, 14–22.
13. Damir Mikuličić: *Sunce – zvijezda u svemiru*, *ibid.*, 22–25.
14. Zoran Klobučar: *Istraživanje kemijskog sastava Sunca*, *ibid.*, 26–27.
15. Damir Mikuličić: *Fizički procesi na Suncu*, *ibid.*, 28–33.
16. Ernst (Ernest) Mihalek: *Svrha promatranja Sunčevih pomrčina*, *ibid.*, 34–35.
17. Ratko Roušal: *Opći pogled na Sunce*, *ibid.*, 36–37.
18. Branka Mihelčić: *Školska promatranja pomrčine Sunca*, *ibid.*, 37–44.
19. Marko Kuprešanin: *Budućnost Sunca*, *ibid.*, 46–47.
20. Ranko Gradečak: *Fotografiranje korone*, ZIS **IV**(2) (1961) 59–61.
21. Tatjana Kren i Željko Andreić: *Don Niko Miličević mladi, svećenik i astronom*, *Prirodoslovlje* **10**(1-2) (2010) 3–34.
22. Tatjana Kren: *Analiza važnosti časopisa Zemlja i svemir (1956. – 1970.) za hrvatsku astronomiju*, u: *Povijest i filozofija tehnike – 8. simpozij PIFT 2019.* (Z. Benčić, ur.), Biblioteka Elektrotehničkog društva Zagreb, Knjiga 15, Kiklos – Krug knjige, Zagreb, 2019., str. 427–442.