Maksim Trpkovič and the Reform of the Julian Calendar

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Abstract

In this essay, we try to express the short history of different Christian calendars, as well as the history of the Julian calendar. Especially, we emphasize Maksim Trpkovič's fundamental role in this reform, who was a professor of natural sciences and originated from Macedonia.

1 Introduction

The calendar has arisen from the desire of humans to determine their coordinates in time, to which they have connected practical, historical, and religious needs. There are a variety of periodical processes used in time measuring and calendar making, such as the change of day and night, the phases of the moon, and the change of yearly seasons.

The main difficulty in calendar making, is based on the fact that the periods of rotation of the earth around the sun, and the moon around the earth, divided by the period of rotation of the earth around its axis, do not give whole numbers. For instance, the synodical period of the moon has 29.530 88 mean solar days, while the tropic year has 365.242199 mean solar days. This problem is solved with the solar calendar by the introduction of the leap year, and by the addition of the thirteenth month with the lunar calendar.

2 Julian and Gregorian Calendar

In the beginning of the Republic, the Roman calendar was lunar. As the centuries passed, the calendar underwent a lot of reforms, but it still stayed very chaotic (often days were added and subtracted for political reasons). It is written that the Romans had many military victories, but nobody really knows when they actually took place.

Many changes occurred in the lives of the Romans, including the calendar change, when Julius Caesar (107-44 B.C.) became a roman dictator. During his campaign for conquering Egypt, in 48 B.C., Caesar met the astronomer Sosingenes, whom he called to come to Rome and make some reformations to the calendar. Basing his knowledge on the Egyptian solar calendar, Sosingenes suggested that the year has 365 and 1/4 days (three simple followed by one leap year), although, probably he was familiar with length of the year that the biggest ancient astronomer Hipparcus determined, which was noticeable shorter. Today, that reformed calendar is known as the Julian calendar.

The Julian calendar was still in use even after the fall of the Roman Empire. The Christian church accepted the calendar, and some Orthodox churches use it even today. With the rise of the Christian church arose the problem of determining the date for Easter celebration. After the decision of the Ecumenical Council in Nicaea 325 AD, Easter is celebrated on the first Sunday following the full moon after the vernal equinox, and which, in the time of the Nicaea's Council, was on March 21st. Because communication in those days was bad, the existence of an algorithm for determination of the Easter date was of great importance. It could make it possible for the local churches to be able to determine when to celebrate Easter. This task was accomplished by Dionysius Exiguus (Dennis the Little), a monk who was born in today's Moldavia at the end of the 5th century, and died in 550 [1]. Dionysius' algorithm was based on the Meton's cycle. In the year 433 B.C., the Athenian Meton, while working on his calendar, noticed that 235 synodic months are equal to 19 tropical years, which is only an approximation. Dionysius introduced a new zero as well, to the Julian calendar. He suggested that the new Christian era should begin from January 1st, the year Christ was born.

The Julian calendar suffers from a serious defect, since by this calendar the length of a year is slightly greater then the length of a tropical year, and after 128 years, this difference adds up to one entire day. The consequence of this is that March 21, according to this calendar (which according to the Council of Nicaea is connected to the determining of the date of Easter) is moving closer to the true summer, so that after 6-7000 years we would be celebrating Easter during the summer. The Catholic Church could not let this happen, so after few unsuccessful attempts, the Pope Gregory XIII announced on February 24, 1582, that 9 days in the Julian calendar are erased, and that October 5, 1582 was going to be October 14 according to the new calendar. The Gregorian reform was made after a proposal of the Italian mathematician Lilio (1510-1576). Besides the removal of the 9 days it was decided that not every forth year was going to be a leap year. Leap years were going to be only those "secular" years (i.e. those ending with two zeroes) if the number of their centuries are divisible by 4. This is so called intercalation rule. Hence, according to the Gregorian calendar, the leap years were 1600 and 2000, and the simple ones were 1700, 1800, and 1900. With this, 3 days within 400 years from the Julian calendar have been removed, so the year length is 365.2425 days. The error per year in this calendar is 26 seconds, which after 3322 years (assuming that the tropical year is fixed) adds up to one day.

It is known that the schism of the Christian church occurred in 1054, resulting into the Orthodox and Catholic Church. After the separation the Orthodox Church did not accept the Gregorian reform. In 1593, in Constantinople, it was decided that the Orthodox Church would stay with the Julian calendar. However, the deranged Julian calendar from the astronomical date had been permanent, and interminable problem for the orthodox. Several attempts were made to align the calendar with the timeline of the hystorical past. Consequently, in 19th century, in Russia, the largest orthodox country, a special state committee was created and assiged the task of reforming the calendar. Also many distinguished astronomers in Serbia, such as Djordje Stanojevič (1858-1921), Milan Nedeljkovič (1857-1950), Vojislav Mišković (1892-1976) dealt with the problem of the reforming of Julian calendar. Among them was Maksim Trpkovič too.

3 Maksim Trpković (1864-1924) and his Calendar Reform

Only fragments of the life of Maksim Trpkovič are known, therefore filling the blank pages of his biography is very important task for the history of astronomy.

Figure 1: Kičevo in 1938. The house of Stavra Trpkovič is on the right hand side.

Maksim Trpkovič was born on November 5, 1864, in the village Orlanci by Kičevo. Kičevo was under the Ottoman Empire in the time when Trpkovič was born, and today is a town in the west part of the Republic of Macedonia. The Trpkovič family, in which Maksim was born, was part of a bigger family, Spasenovci, where a lot of eminent people originated. Among them was Stavra Trpković , the member of Parlament of Kingdom of Yugoslavia, built a big house in Kičevo (Fig. 1), in 1892, which is the location for the Western Macedonian Museum today. In the 19th century Orlanci was a big orthodox village with more than 100 houses, but by the end of the 19th century many people had migrated to neighboring Serbia. Over 60 families had moved to Belgrade only, and the village got the nickname "Little Belgrade". During the Ilinden rebellion in 1903, the whole village was on fire, and 45 people were killed by the village church [2]. There were only two houses that were undamaged, one belonging to the Trpkovič family (Fig. 2). The odds are that Maksim was born there.

Following the tradition, Maksim's father, who was a baker, moved to Belgrade, taking his son Maksim with him, a young adult at the time. In Belgrade, although with delay, Maksim enrolled in school. Seeing that Maksim was showing special talent for studying, the father didn't regret the money spent for

Figure 2: Orlanci in 2000. Presumably was birth-house of Maksim Trpkovič

the continuation of his son's education. In 1888 Trpkovič graduated from Real Gymnasium, and in 1892 he got his associate degree. In 1895 Maksim passed the teaching exam in the group for "physics and mechanics with cosmology". As a young professor (Fig. 3) Maksim thought in Pirot first, and later in Belgrade, in the Real Gymnasium, as well as in the King Alexander I Gymnasium. He was teaching mathematics, most often, but also physics, mechanics, cosmography. As a professor he was modest and very respected among his colleagues.They knew about his articles on the calendar reform, and even astronomers from outside the country had commented positively about it.The Maksim's students adored him since he did for them more than it was necessary.

In addition to his regular teaching work Trpković included in the solving of the calendar reform problem. He understood fully its importance for both the Church and the human society. Practically, it becomes his only scientific preoccupation. His first, and most important work is " The Calendar Reform", published in 1900 (Fig. 4) in Belgrade, by the publishing house "Kod prosvete" owned by S. Horovic. In this book of 59 pages Trpković presented concisely his project of the calendar reform. In the first part is presented the history of the Egyptian, Jewish, and Christian calendar, as well as the history of the problem of determination of the date for Easter celebration. In his project of calendar reform Trpkovič notices that when 7 days are taken out of 900 Julian years, the length of the year is 365.242222 mean solar days, or just 2 seconds longer then the true tropical year. The theoretical error (supposing that the length of the tropical year is fixed) is one day on every 43 387 years. Also, Leland in 1782, and Bessel in 1828 had learned about the calendar year of 365.242222 days, but Trpkovič didn't know that.

It was only left to come up with the interkalacional rule, or the schema by

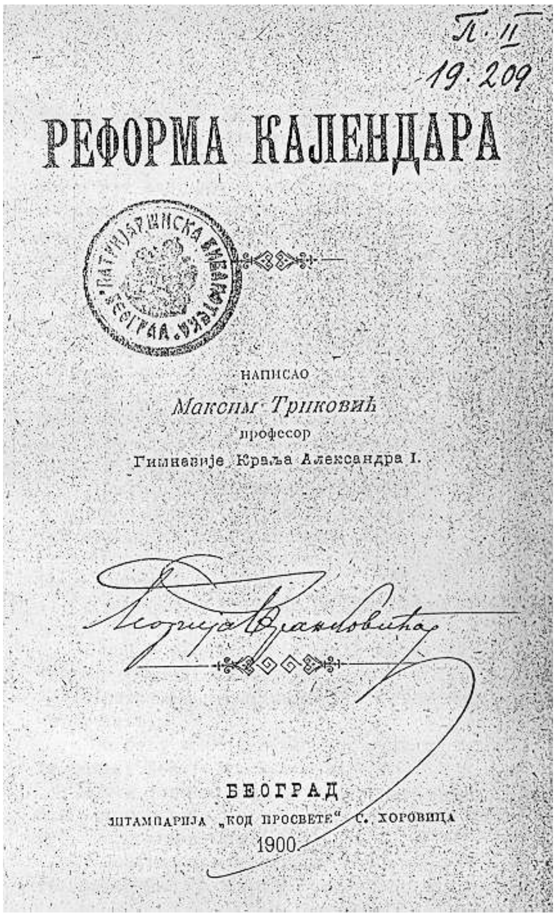
Figure 3: Maksim Trpkovič as a young professor in 1896.

which 7 days will be erased from 9 centuries. Trpkovič suggested: the secular years whose number of the centuries divided with 9 give the remanders 0 or 4, will be leap years. The rest of the secular years are going to be simple years. So, the following were the leap years: 2200, 2700, 3100, 3600, etc.

With this proposal Trpković achieved a high popularity, both in the scientific circles, and the common world. In the same year, 1900, Jelenko Mihailovič wrote a positive commentary article on it the magazine "Brankovo kolo". A positive article was published in France as well, and the Italian Quarenghi said that Trpkovic's proposal was "culmination of the sharp mind, a true masterpiece" [3].

In 1902, the Constantinoples Patriarch Joakim sent a requisite to all of the Orthodox Churches to send him a preposition for reformation of the Julian calendar. The Serbian Orthodox Church, on July 6, 1903, sent Trpkovič's proposal, following it with a letter, where stated: "We considered a professional opinion on this matter, and we believe that the proposal of Mr. Maksim Trpkovič is the most coherent one".

As for the problem with the date for Easter celebration, Trpkovič (using



РЕФОРМА КАЛЕНДАРА

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БЕОГРАД
ШТАМПАРИЈА „КОД ПРОСВЕТЕ" С. ХОРОВИЦА
1900

Figure 4: The title page of the book "The Calendar Reform".

now his new calendar) returned to the decision of the Council of Nicaea, which consisted of modification of the Meton's cycle, an idea that had been abounded with the Gregorian reform.

On the subject Julian calendar reform and the date for Easter celebration, Trpković published several articles, wherein he elaborates his original idea. In 1901 he published two books, "Our calendar" published by the printing-house of Markovič and Pavlovič in Belgrade, and "Is it forbidden to celebrate Easter with the Jewish Passover?" published by the State printing-house of the Kingdom of Serbia in Belgrade. From the same printing house, in 1909, another Trpkovič's work was published titled "Celebration of Easter, the day of fool moon". In 1910 the calendar "Rad" in Sremski Karlovci printed an article "About the Christian calendars" written by Trpkovič. Before the end of his life, 1919-1921, Trpkovič published a series of texts on calendars in the church-social paper "Vesnik".

Maksim Trpkovič died in Belgrade, in 1924.

4 The Pan-Orthodox Congress in Constantinople, 1923

After foundation of the Kingdom of Serbs, Croatians, and Slovenians in 1918, the calendar issue became a question of national unity, since in the new country nations, that were Catholic and used the Gregorian calendar, are included. The Kingdom of Serbs, Croatians, and Slovenians accepted the Gregorian calendar for state use, but there was still the dilemma over the dates of the orthodox holidays.

Luckily, in that time the Pan-Orthodox Congress in Constantinople was scheduled for May of 1923, where the Julian calendar reform was on the list of things to be discussed. The Metropolitan Gavrilo Dožič (1881-1950) and the famous astronomer Milutin Milankovič (1879-1958) were appointed to be representatives of the Serbian Patriarchy for the Congress. The Patriarchy had decided that the its official preposition on the Julian calendar reform was going to be Trpkovič's proposal.

Milankovič went through Trpkovič's work and had gained positive attitude towards the idea. However, he had noticed that Trpkovič had assumed the mean value for the length of the tropical year, that is persistent, although it actually its length varies so some corrections in the calculations had to be done. For the Trpkovič's calendar, that correction is the following [4]:

$$\Delta = 0.002575\, t + 0.00000624\, \frac{t^2}{2},$$

where Δ is a correction in days, and t is time in centuries. The difference from one day will come about after 28 800 years, in any case, better than the Gregorian calendar, wherein the difference of one day occurs after 3 280 years.

Another notice that Milankovič made, in reference to Trpkovič's intercalation rule, was a difference of one day in the year 2000 comparing to the Gregorian calendar. The goal of Milankovič was to accommodate the calendar as much as possible so that the unavoidable discrepancy between the two calendars would be postponed as later as possible. He suggested an intercalation rule where all of the secular years are simple with exception to the ones whose number of centuries divided by 9 give remainder 2 or 6. And so, the leap years were 2000, 2400, and 2900. The first difference that will occur between the two calendars is going to be in the year 2800, which by the new calendar is simple, and by the Gregorian is a leap year.

Milanković thought that his intercalation rule is better and he suggested it to adopt. At the Pan-Orthodox Congress, which took place under guidelines of the Patriarch Melety IV, a very complex diplomatic encounter took place, but thanks to Milankovič's skilfulness and persistence, at the end the Congress adopted the proposition of the Serbian Patriarchy, based on the Trpković's proposal (his amodified project). About the date for celebrating Easter, The Holy Synod affirmed the Nicaea's rules, and with that the date (calculated by the local time of the city of Jerusalem) of fool moon will not be calculated by the Meton's cycle, but based on the observations and calculations of modern astronomy. However as written later (Vojislav Mišković, Petar A.Tipa and others) Trpković's solution is more accurate than Milanković's one.

5 Epilogue

With this calendar reform the following has been achieved: a calendar more accurate than the Gregorian has been published, with the removal of the 13 days from the Julian calendar, the orthodox holidays with an unchanging date (ex. Christmas) would be celebrated on the same day as the catholic ones. Easter (and the holidays following Easter), would be celebrated, most of the time, on the same dates as the Catholic one. A different celebration date would show up every 9-10 years, which was sufficient to emphasize the difference of the Orthodox Church.

Unfortunately, enactment did not follow the decisions of the Congress in Constantionple. Up till now, the new calendar has been adopted by the Greek, Bulgarian, and Romanian Orthodox Church. The rest of the orthodox churches (among those the Serbian as well) have postponed this reform for better times.

Apendix: The definitive decision about the reform of the calendar

Pan-Ortodox Congress held in Constantinople, in the month of May, the year 1923, under the guidelines of His Holiness, the Ecumenical Patriarch Lord Melety IV, on his session from May 30 of the same year, discussing the issue of correction of the calendar, finally made a decision written below.

Admitting that there is an inevitable need for removal of the diference between the church and the civil calendars, and that there is no any canonic obstacle for corrections of the church calendar in use according to the data of the astronomy science, there is an unanimous decision about correction of the Julian calendar in the following:

1) Thirteen days from the Julian calendar are omitted, those which make difference against the solar year counting from the First Ecumenical Synod in Nicaea. So, October 1st, 1923 shall be considered as October 14th, 1923.

2) The holydays of the omitted days shall be celebrated all together on October 14th, 1923, or as determined by the archprist of the eparchy.

3) All the months in the year shall retain the same number of days which they have also today. In the leap years, February shall have the same as it had so far, 29 days.

4) There will be, as so far, two kinds of years: simple years of 365 days and leap years of 366 days. The leap years will be those years which be divided to 4 without a remainder, as it was so far. There is an exception only in the secular years, for which refers the rule given in the following paragraph.

5) The secular years will only be leap years if the number of their centuries, divided to 9, gives the remainers 2 or 6. All other secular years will be simple ones. Consequently, among the following years only those underlined on the table below will be leap years

<u>2000</u>	2100	2200	2300	<u>2400</u>	2500	2600	2700	2800
<u>2900</u>	3000	3100	3200	<u>3300</u>	3400	3500	3600	3700

According to this scedule, the medium length of a civil year will be 365 days 5 hours 48 minutes and 48 seconds, in complete accordance with the length of the solar year.

6) The fixed holidays shall have the same dates which they had so far.

7) The movable holidays shall be determined according to the Easter holiday. In accordance with the canonical provisions which remaind untouched, Easter shell be celebrated on the Sunday coming behind the first full moon after the vernal equinax.

8) The passover full moon will be determined on the basis of the astronomic calculations, taking into account the achieved progress of the science. The date of Easter shall always be determined by the local time of holy city of Jerusalem.

9) The Ecumenical Patriarchy shall ask the observatories and departments of the celestial mechanics at the Universities in Athens, Belgrade, Bucharest and Petrograd (Pulkovo) to make long-term passover tables, and shall advise to all Ortodox Churches.

10) The reform of the Julian Calendar can not be an obstracle to its later alteration which would be received by all Christian churches.

Remarks

to paragraph 5) The new calendar is more precise than the Gregorian calendar whose mean length of year differs for 24 to 25 seconds then the mean lenth of the solar year. The difference between the lengths of the civil year of the new calendar and the Gregorian one is so small that the change in the dates appears after 877 years. In fact, from the following secular years the Gregorian leap years are given on the table below

<u>2000</u>	2100	2200	2300	<u>2400</u>	2500	2600	2700	<u>2800</u>

Deviation shall appears only in the year 2800.

to paragraph 8) Concerning day from the midnight to midnight, there will be determined the civil date of the first oposition of the moon after the vernal equinax based on the time of the meridian passing through the Temple of Holy Tomb. The first Sunday after this date is the Easter day, i.e. if this date falls on Sunday, Easter shall be celebrated the next Sunday.

In the Patriarchy, 5th June, 1923.

Patriarch od Constantinople Melety

Metropolitan Cysic Kalnik
Archbishop of North America Aleksandar
Metropolitan of Montenegro and Coast region Gavrilo
Metropolitan of Nicaea Vasilije
Metropolitan of Drach Jakub
Archimandrite Julie Skriban
V. Antonijadis
M. Milankovič, professor of the University in Belgrade
Secretary of Holy Synod
Archimandrite German

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