

Approaching the 300th anniversary of the birth of Josip Ruđer Bošković

On the occasion of 300th anniversary of the birth of Josip Ruđer Bošković, a Jesuit, versatile scientist, philosopher, diplomat and poet – originally from Dubrovnik, who worked in the 18th century – this paper presents a contribution of his importance. This is a review of one of his first papers which has recently been translated from Latin into Croatian and which explains the appearance of northern lights. Bošković was the first Croatian scientist who dealt with the explanation of this atmospheric phenomenon, and some of his conclusions are close to modern ideas. This paper also presents a recently discovered memorial poem which his younger fellow brother p. Petar Perica wrote on the occasion of the 200th anniversary of Bošković's birth and which was hitherto unknown.

Keywords: J. R. Bošković, J. R. Boscovich, northern lights, aurora, memorial poem by p. Petar Perica

We are approaching the 300th anniversary of the birth of Josip Ruđer Bošković, the greatest Croatian scientist of his time, and we could easily say the greatest Croatian scientist ever. Josip Ruđer Bošković was born in Dubrovnik on 18 May 1711. He got his elementary education there and then attended the Jesuit College in Dubrovnik and Rome. After taking holy orders he stayed in Rome and taught at the Jesuit College there. He was a versatile scientist, physicist, mathematician, astronomer, philosopher, diplomat, and poet. As part of the European humanistic tradition, he was known as Giuseppe Ruggiero Boscovich. He travelled and worked in many countries. He died in Milan on 13 February 1787, aged 76.

Proposed by Ivan Supek (1915–2008), member of the Academy and a respectable Croatian physicist, philosopher and writer, an institute for the research of nuclear physics was founded in Zagreb in May 1950, as part of the Yugoslav Academy for Sciences and Arts. The institute was named the “*Ruđer Bošković Institute*”, also proposed by Prof. Supek who was nominated head of the institute and held the duty until 1958 when he was removed from office, following his opposition to non-peaceful use of nuclear energy.

In 1968, a book “*Ruđer Bošković*” by Željko Marković, Member of the Academy, was published in two volumes, representing by then the most comprehensive presentation of Bošković's life and work in which he always infallibly demonstrated his attachment to his Dubrovnik origins and his permanent



Figure 1. Josip Ruđer Bošković (Dubrovnik, 1711 – Milan, 1783). Oil on canvas, by Celestin Medović (Kuna, Peļješac, 1857 – Sarajevo, 1920), the painting is in the National Museum in Belgrade.

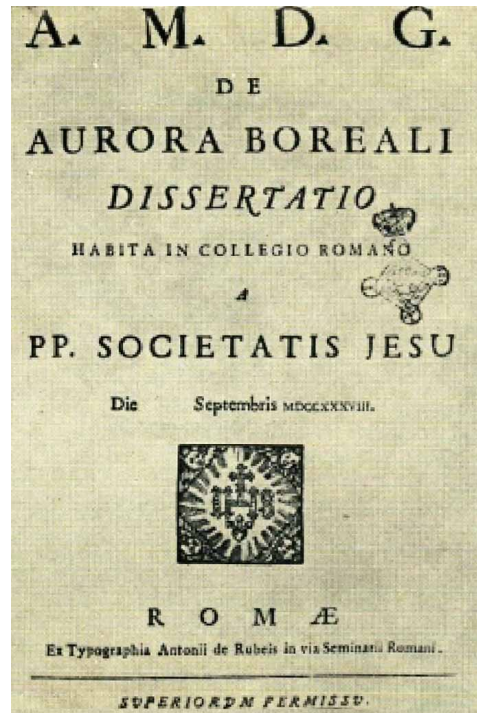
maintenance of his family and friendship links with Dubrovnik. These links of “*our Ruđe*” (as the author often calls him in his book) with his native soil are often stressed in the book which displays the author’s deep respect and love for this great man.

There are numerous papers, studies and books published in Croatia at different times, dealing with presentations and analyses of Bošković’s life and work (e.g., Torbar, 1887/88; Dadić, 1998; and many others).

Since we are approaching the 300th anniversary of Bošković’s birth in 2011, we are going to describe some details of Bošković’s work which have not yet been published in translation. A translation of Bošković’s dissertation on northern lights from 1738 is being prepared and edited (“*De Aurora Boreali Dissertatio habita in Collegio Romano a PP. Societatis Jesu, Die Septembris MDCCXXXVIII. Romae ...*”) The translation is being completed by Prof. I. Martinović, and the comments of the text and drawings are being prepared for printing.

The preparation and the commentaries relate to the comparison with the present physical knowledge about the appearance of northern lights. This translation and the interpretation were initiated in connection with the results of studying the appearance of northern lights in Croatia in the last two

Figure 2. The front cover page: “*De Aurora Boreali Dissertatio habita in Collegio Romano a PP. Societatis Jesu...*”



centuries (Lisac and Marki, 1998), which was previously financed from the research funds of the Department of Geophysics, Faculty of Science, University of Zagreb. The records based on written description on the form and incidence and the colours of northern lights as well as the part of sky involved have served for the preparation of a calendar with the incidence of northern lights in our area, as well as the statistical analysis of the data recorded. Although Croatia is situated in the temperate zone which is not typical for the regular incidence of this atmospheric phenomenon, the results have proved that the frequency records change depending on the intensity of sunlight, with the 11-year period. Until the latest maximum of the Sun's activity with the 11-year period (recorded in 1999-2001), written descriptions prevailed. The observers sometimes attached sketches or drawings to the written description of the phenomenon, which was a valuable contribution to the record.

The first photographs of the northern lights over Croatia were taken in the period of the latest maximum 11-year cycle. There are albums with numerous photographs taken from different places (Mt. Medvednica near Zagreb, Varaždin, Vinkovci, Istria etc.).

The albums with photos of northern lights are kept in the societies of amateur astronomers, consisting mainly of senior secondary school students, uni-



Figure 3. The first photograph of northern lights, observed 7 April 2000 from Eastern Croatia, taken by Milan Karakaš (Cerić nr. Vinkovci, selection of 161 photographs taken between 17:30 and 21:30 CET).



Figure 4. Northern lights photographed from the summit of Mt. Medvednica nr. Zagreb, taken by Hrvoje Horvat and his team (20 November 2003, 21:16 CET).

versity undergraduates and other amateur astronomers, and were published on the Internet. Several photographs have been taken from this source for the report (Lisac and Marki 2003), and selected ones are shown here.



Figure 5. Red and green Aurora in Fairbanks, Alaska, photographed by Mila Zinkova; the image is a scan of an old print, Wikipedia.

The red colour of the sky prevailing in the photographs shown is a regular characteristics of northern lights in the temperate zone. However, the temperate zone is the periphery of the optimum zone for the appearance of northern lights, which is within the 60° to 70° belt of the north and south latitudes. Within this belt, northern lights are practically an everyday occurrence during cloudless nights, and they acquire a richness of colours, forms, dynamics and intensity.

The photographs of northern lights over Croatia were taken during the maximum of the 23rd cycle of the Sun's activity, determined by the number of sunspots. The maximum was reached in April 2000, when the number of sunspots was 120.8 (mean value of modified curve of monthly values). The number was slightly lower than the maximum mean value in the 23rd cycle (159, March 1989). The next, 24th cycle of the Sun's activity is expected to take place

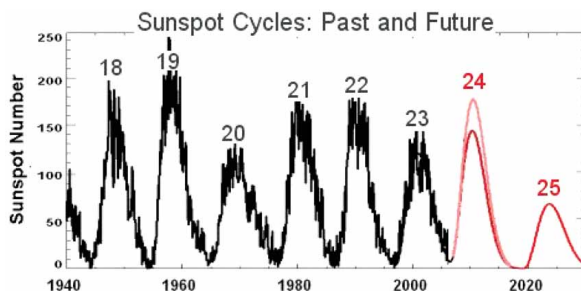


Figure 6. Past and future sunspot cycles according to www.smeter.net/propagation/sunspots/sunspot-cycle-forecast.php (the red curves are those forecast by two forecasters).

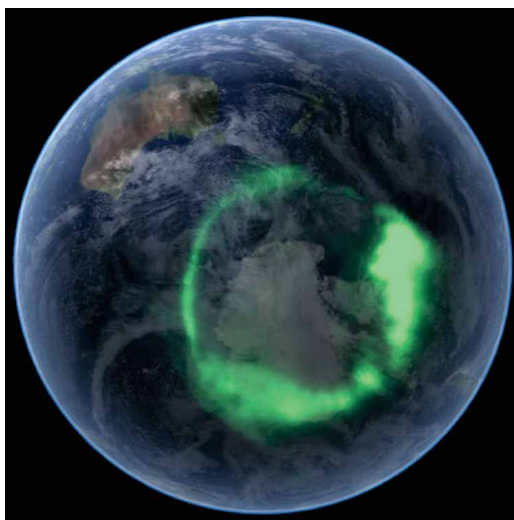


Figure 7. Aurora australis (11 September 2005) as captured by NASA's IMAGE satellite, Wikipedia.

in April or May 2013. This is preliminary information given by the world Space weather forecasting centres.

The 300th anniversary of the birth of Ruder Bošković approximately coincides with the next maximum of the Sun's activity, usually lasting between two to three years. In his explanation of the appearance of this phenomenon, Bošković says it is the result of mixing the upper layers of the Earth's atmosphere with particles of solar origin, which is justifiable even by the modern approach. Moreover, his estimate of the height at which the phenomenon occurs, based only on atmospheric optics, approximately coincides with the present measurement results. He intuitively supposed the circular form of the phenomenon, centred round the geographic pole, by which his idea is close to the present knowledge of the oval ring of northern lights centred round the magnetic poles of both polar regions of the Earth.

Sunspots normally produce a minor effect on solar emissions as a whole, but the magnetic activity, accompanying the appearance of each sunspot, can bring about a dramatic change in the intensity of the Sun's ultraviolet and soft x-radiation, and this part of the solar spectrum has an important impact on the middle and upper Earth's atmosphere (stratosphere, mesosphere and exosphere).

There were numerous celebrations in 1911 to commemorate the 200th anniversary of Bošković's birth, but we are not going to deal with the scope and contents of those celebrations, and would rather draw attention to a special and remarkable contribution to those celebrations, which was later neglected for political reasons.

This contribution is a memorial poem by a much younger member of the order, a renowned Jesuit, preacher, professor, gifted writer and poet, p. Petar Perica. The title of the poem is “*To the glory of Ruđer Bošković, S. J., on the occasion of the 200th anniversary of his birth*”. The poem has 48 lines, and is written in the form of an ode. Due to the complex political circumstances and p. Perica’s modesty, this contribution was unknown and practically hidden from the public. It was brought to light by Prof. Hrvoje Kačić who researched the material on the life of p. Petar Perica, a victim of communist executions on the isle of Daksa near Dubrovnik, in October 1944, shortly before the end of



Figure 8. P. Petar Perica (Kotišina nr. Makarska, 1881 – Daksa nr. Dubrovnik, 1944).

the Second World War¹. Prof. Kačić discovered the manuscript of the poem and published a part of it in his book “*Dubrovačke žrtve*” (“*Dubrovnik Victims*”).

¹ P. Perica, points out Kačić, showed his poetic talent as a young man. In the first decade of the 20th century (or perhaps slightly after that) in the seminary in Travnik he wrote lyrics for the religious songs “*Do nebesa nek se ori*” (in Engl. Let it echo to the heavens) and “*Zdravo djevo svih milosti puna*” (engl. Hail virgin, full of all graces). The music for both of them was composed by the then secondary school teacher in Travnik, Milan Smolka (Miloš, 2001), and both songs became immensely popular, and Croatian believers, especially young ones, have been singing them enthusiastically for a whole century.

This memorial poem, dedicated to the anniversary of the birth of his fellow brother Jesuit, was written by p. Perica in 1911, aged only 30. The poem is especially impressive when read as a whole, and deserves to be reclaimed from obscurity and presented to the scientific and general public.

Here is the transcript of the poem, translated into English by Ms. Iskra Pavlović:

***Poem to the glory of Ruđer Bošković, S. J.
for the 200th anniversary of his birth***

*In Dubrava paced the lovely May
Watching the star-crowned night,
Enthralled by the beauty of heavenly secrets,
He glorified the Supreme's unattainable might.*

*In the holy rapture he folded his wings,
A new heavenly body's trail twinkled,
In the wreath woven by the Almighty about us,
To burn up the dead darkness in the universe.*

*When the sky was russet, from fir tree to fir tree
The breeze whispered breaking up the dream:
The dawn arrived on the eighteenth of May
The first day arrived for Ruggiero.*

*From Mt. Orjen the May sun sped
To kiss its first offspring dear
And on the infant's brow – like a heavenly pearl,
A radiant trace of the kiss remained.*

*When the sun's darling stretched his wings
And his desire blazed to light the world,
The white fairy from Dubrava took him,
She took the young man to Loyola's fold.*

*From the dark nest the falcon flew,
A flame blazed from its beak,
Rocks can be glimpsed over the eternal city
And before him Peter's temple was built.*

*With his wings, like an arrow, he cuts in the rocks
Of stifling darkness impenetrable sound,
Before him, owls flee irretrievably,
Behind him, the road showered with stars.*

*And many an eye became enraptured
To watch the falcon and the flash of his torch;
From Vienna, Milan, London and Paris
His glory and greatness echoed with singing.*

*Crowned heads bend their foreheads
And wave their sceptres to slow his flight
To hear him, where the source of his life
Flowed clearly into God's world.*

*Answers the falcon: „In the embrace of dawn,
Where the Adriatic kisses the immovable rock,
Where valiant hearts like the sun do burn;
To Europe there rises an impenetrable wall.*

*In this wall, the bulwark to Europe,
Is his ancestral nest and his dearest kin,
Steeping in blood for the glory of Christianity,
While you are celebrating here, carefree.*

*This saying – Ruggiero – flew high
With the flame of knowledge to light the world
And after him turned many an eye
Like a young flower, after sun, at dawn.*

The poem shows the author's good knowledge of the global importance of Ruder Bošković, the joy and respect for the renown that Ruder acquired, as well as his love of his fellow-brother and the person. When reading this ode, we are greatly taken by the depth of feelings which prompted the author to create this beautiful poem.

If Prof. Supek, Prof. Marković and other authors had by any chance known about the ode by p. Perica, dedicated to Ruder Bošković, they would certainly not have been indifferent, but would have accepted it with respect to the awareness of the gifted young priest, excited about the many-sided importance of Bošković's role in international science. This would have increased the renown of this extraordinary priest, Jesuit, martyr, exceedingly intelligent and artistically gifted, as well as the popularity of the great man to whom the poem was dedicated.

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SAŽETAK

Približava se 300. obljetnica rođenja Josipa Ruđera Boškovića

U povodu tristote obljetnice rođenja J. R. Boškovića, isusovca, svestranog znanstvenika, filozofa, diplomata i pjesnika – porijeklom Dubrovčanina, koji je djelovao u 18. stoljeću – daje se prikaz dijela njegova značaja. Dan je osvrt na jednu od njegovih prvih rasprava, koja je nedavno prevedena sa starolatinskog na hrvatski jezik, a kojom se tumači nastanak polarne svjetlosti. Bošković je prvi hrvatski znanstvenik koji je pristupio tumačenju te osobite atmosfere pojave, a neki od njegovih zaključaka pokazuju se bliskim današnjim spoznajama o nastanku polarne svjetlosti. U ovom se radu također objavljuje nedavno otkrivena oda koju je Boškovićev mlađi subrat isusovac, pater Petar Perica spjevao povodom dvjestote obljetnice Boškovićeva rođenja 1911. godine, a koja je do danas ostala nepoznata.

Ključne riječi: J. R. Bošković, polarna svjetlost, aurora, oda p. Petra Perice

Inga Lisac

Corresponding author's address: Inga Lisac, Ph.D., Andrija Mohorovičić Geophysical Institute, Faculty of Science, University of Zagreb, Horvatovac 95, HR-10000 Zagreb, Croatia, e-mail: lisac@irb.hr