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Paper's Title: *Al-Bīrūnī's Canon Masudicus: Arabic sources for the issue of the Persian intercalations.*

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Abu Rayḥān Muḥammad b. Aḥmad Bīrūnī, as required by the Choresmian pronunciation Bērūnī, or Bayrūnī in Arabic and sometimes called by the *nisba* al-Khwārizmī by certain Arab authors, stands out among scientists of the Golden Age of Islam not only for the number of his contributions but for his attentive modern scientific approach as well. He was an astronomer, astrologer, mathematician, physicist, geographer, chronologist, historian, linguist and an observer of traditions and creeds of other people. Contrariwise other Arab authors, like Avicenna and Averroes, so relevant for their influence on European culture, his writings did not spread in the Spanish *al-Andalus*, so that none of them was translated into Latin and consequently started circulating in the Middle Ages Europe. The knowledge of his writings in Europe dates back to a century and a half ago, thanks to the orientalist Joseph Toussaint Reinaud (1795-1867) and the geographer Alexander Von Humboldt (1769-1859), who were the first to notice the originality and excellence of his contributions¹.

Al-Bīrūnī was born in Kāth in the year 973 A. D. (362 A. H.) in the Choresmian region southern of the Aral Sea, in the independent principality of Khwārizm. For the first part of his life he was under the protection of the Ma'mūnid Khwārizmshāhs, who were originally Samanid vassals who reached independency during the X century. Next he went to the south of the Caspian Sea to the court of the Ziyārid sultan Abu Ḥasan Qābūs b. Woshmjīr Shams al-Ma'ālī, another Iranian prince to which is dedicated *Āthār al-bāqiya 'an al-qurūn al-khāliya* (literally "Remnants of the Past Centuries"), composed around the year 1000. Al-Bīrūnī returned to his country in the year 1009 where he gave his services to the Ma'mūnids until the 1017, year of the Khwārizmshāh murder by the Ghaznavid ruler Maḥmūd b. Subuktakīn. Al-Bīrūnī was held in captivity at the Ghazna court, in the role of official astrologer, by the way this detention was functional for his researches about India: he had the possibility to follow Maḥmūd of Ghazna in his expeditions to the north-west of the country where he learned Sanskrit and several Indian dialects, in

¹ Bausani (1974).

order to compound his writing *Tārīkh al-Hind* (literally History of India) in the year 1030. During the same period, only one year before, he wrote the *Kitāb al-Taḥīm li-Awā'il Ṣinā'at al-Tanjīm* (literally “Book on the Principles of Astrology”) dedicated to Rayḥana. We have not certain and direct information about the dedicatee Rayḥāna but seems plausible that she was part of Maḥmūd’s court in Ghazna, and the dedication is directed to the Khwārizmian daughter of al-Ḥasan².

After that he was under the protection of the sultan Mas'ūd b. Maḥmūn to which is dedicated his masterly *Kitāb al-Qanūn al-Mas'ūdī fī al-Ḥay'a wa al-Nujūm* (literally “The Masudic Canon on Stars and Astronomy”) in the year 1030.

These are his main writings but beside them he wrote more than 100 other works about various matters such as geodesy and mineralogy, pharmacology and natural philosophy; the only field that probably he did not touch was the juridical one. He died in the year 1050 A. D. (442 A. H.) probably in Ghazna³.

The Canon Masudicus

The Birunian *Canon* is the masterpiece and the last scientific and comprehensive effort of the Author. It gathers all his studies about astronomy, astrology mathematics, chronology, geography and more.

It differs from his other works not only because it is the most up-to-date account of his studies but even for his thorough and attentive approach to a scientific method which recalls the modern application to the present day sciences. This was the main reason for the recent attention given to him during the last century: as Bausani reported seems that his works reached the 11th century Europe but he was never translated in Latin, so that they never shared that fortune which is reserved to other Arab philosophers and scientists like the well known Avicenna and Averroes.

His works seemed to follow the same fate as the only translation we possess at the present state of research is a translation in Russian of his last outstanding effort. Has to be pointed out the many difficulties that such *Canon* presents both for translation and critical study of its content: except for the attested philological problems of transmission of the text, and all that concerns the circulation and copy of the manuscripts between different versions in Arabic and Persian, it has to be underlined that the present

² Al-Bīrūnī (1934), p.VII and p. 1.

³ Kennedy, (1981)

state of research for a critical edition - concerning linguistic, philology, history of science and human history- is unfortunately inadequate. The works of many scholars like Nallino, Bausani, Bickerman, Ginzel, Sezgin and Neugebauer among others are solid foundations for a development that such a matter deserves. It certainly requires complementary efforts from different and various fields of research which were brought together two centuries ago - I refer for example to the works of Suter, Sachau, Ideler- to then reach a point of interest from the 50's until the 80's with attentive scientific productions, but isolated and not uniform.

This work does not pretend to fill the mentioned lacks but wants to shed light and gather attention at least on an abridged portion of the Birunian studies about chronology, through a transversal analysis of the Persian intercalation's issue in al-Bīrūnī's main works which precede the *Canon*: the *Tafhim* and the *Chronology of Ancient Nations*, the latter being at the present time re-edited by Professor François De Blois who is providing a translation of the text and a critical comment and on whose I rely for what concerns every aspect of *Āthār al-bāqiya 'an al-qurūn al-khāliya*.

It has to be noticed that difficulties were encountered regarding the translation, both for identification of specific terms and probable typographical errors as well as textual errors. Due to these indicated difficulties I decided, where possible, to keep the literal translation as in the second to last paragraph of the Fourth Chapter - II Maqāla, leaving a more agile description in the commentary section.

I Maqāla, VI Chapter, p. 76.

<p>[...].</p> <p>As for what concerns Copts, people of Egypt, they fixed the five appendage days at the end of their year and called it "small month". After Caesar Augustus' cession to the Byzantines⁴ regulation for the intercalation, the appendage in the year became of seven days and the starting point differed in the ancient regulation and it was newly made. At the same manner Persians fixed the five</p>	<p>[...].</p> <p>اما القبط اهل مصر فانهم وضعوا الايام اللواحق في آخر سنتهم وسموها شهرا صغيرا، وبعد نقل اغسطس اول القياصرة اياهم الى رسم الروم في الكبيسة صارت اللواحق في سنتها سنة ايام واختلف المبدأ في الرسم القديم والمستحدث، وكذلك وضعت الفرس هذه الخمسة المسترفة في آخر السنة ثم نقلتها الى آخر شهر الكبيسة حتى اذا بلغت ابان ماه بقيت فيه باهمال الكبس لتنتت الامر، ولم ينقلها مجوس السغد وما وراء النهر</p>
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⁴ There is no distinction in Arabic between Western and Eastern Romans.

<p>stolen days at the end of the year, then transferred it to the end of the month of the <i>Kabīsa</i> until consequently reached the month of <i>Ābān</i> and stayed in it for the disregard of the intercalation because the instruction has been dispersed. And Magians of Soghdia and Transoxania do not displace it and it remained at the end of their year, then they transferred now in the days of Daylamites⁵ in Persia to the end of the month of <i>Isfandārmudh</i> without intercalating the years of four months⁶ but this did not become well known afterwards, except in their own kingdoms, because many among the Magians of Khorasan refused it and do not accept it.</p>	<p>فبقيت في آخر سنتهم ثم نقلت الآن في أيام الديلم بفارس الى آخر اسفندارمذ ماه من غير ان يكبس السنون باربعة اشهر، ولم يستقض ذلك بعد الا في مما لكهم فقط لان كثيرا من مجوس خراسان ابوه ولم يقبلوه.</p>
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Here the Author is talking about the displacement of the five epagomenal days, or Gatha days, and about an additional intercalation. It is an important matter as, like in Persian, the word for “intercalating” indicates both the intercalation to keep the year fixed and the 5 Gatha Days at the end of every year. For the moment it is necessary to know that the Persian calendar was a lunisolar calendar composed of 12 months of 30 day each with the addition of five days at the end of the year, the before mentioned Gatha Days or *panj rōz*.

As Panaino and De Blois demonstrated the year looked like as it follows in the New Persian form, which I will adapt through over the text even when I am referring to Middle Persian forms:

⁵ Buyids.

⁶ The supposed ninth, tenth, eleventh and twelfth intercalations. See De Blois, 1996.

I Farvardīn
II Ordībehesht
III Khordād
IV Tīr
V Mordād
VI Shahrīvar
VII Mehr
VIII Ābān
IX Ādhar
X Day
XI Bahman
XII Isfandārmudh
Panja

As Egyptians did once they passed under Roman control and administration, they had to add two days to the epagomenal days to keep their calendar aligned with the Julian calendar. At the same manner every calendar in Persia had the appendage days at the end of their year, i.e. *Isfandārmudh*, and after this intercalation imposed from outside of the country they *moved* the 5 Gatha Days to the end of the month during which they decided to apply the foreign intercalation. As indicated by al-Bīrūnī the five epagomenal days laid down between *Ābān* and *Ādhar*, than for the “disregard of the intercalation because the instruction has been dispersed” stayed between the eighth and ninth month because they reached *Ābān* as anyone was caring about not to celebrate the five days but to apply the intercalation of one day every four years. On the other hand not everyone accepted this motion of the five days: the Magians of Soghdia and Transoxania never displaced their Gatha Days, which thus remained always at the end of the year, i.e. *Isfandārmudh*. Thus “now”, that means at the time of the author, Persians replaced the five Gatha Days to their original place but not everyone accepted this days’ motion as Magians of Khorasan kept the transition system.

<p>[...].</p> <p>As for what concerns the second category it is that of the Persians in the Mazdaism and they called the leap year <i>bihīzl</i>⁷ and its reason is that of Zarathustra of <i>Ādhar</i> by accusing their summoner/prophet of having become Magian, lest he does not add to them the intercalation including (what is) below the entire month, changing their glorification of God with the name of the present day's king to the last king, and they instructed to repeat the months' names despite calamities, and the stolen (days) were transferred to the last of the rectified/repeated indication, being wary of the misfortune: for the first <i>Kabīsa</i> there were two <i>Farwardīn</i> and for the second two <i>Ardībihisht</i>, and they do not intercalate after it but eight months, and it is the reasons for the setting in of the stolen (days) in the last month of <i>Ābān</i>. We stated already in tables/the main part⁸ that happened 277 years before Alexander's Era, and that the years that were between it and between Yazdegerd make</p>	<p>[...].</p> <p>واما الطبقة الثانية فهم الفرس من المجوسية وقد سموا سنة الكبيسة بهيزل وسببها ان زرادشت الأذر بييجاني داعهم الى التمجس لم يجوز لهم الكبس بما دون الشهر التام لئلا يتحول تسيبهم باسم ملك اليوم الى ملك آخر وأمرهم بتكرير اسماء الشهور فيها على نوب، ونقل المسترقة الى آخر المكرر علامة تحفظ النوبة، وكانت للكبيسة الاولى فروردينان وللثانية اردبيهستان ولم يكبسوا بعده الاثمانية اشهر هي سبب حصول المسترقة في آخر آبان ماه، وقد قلنا ان بخومه كان قبل تاريخ الاسكندر بمائتين وست وسبعين سنة، وان السنين التي بينه وبين يزدجرد يقتضي عشر كبايس، ولم يكبسوا الا آبان ماه فيبقى من السنين قريب من مائتين وستين، والسبب فيها من وجهين، احدهما ان مدة الاشكنية قريبة من ثلاثمائة وستين سنة تلاصق ملك اردشير بن بابك بارداون اخيرهم وتتأخر عن تاريخ الاسكندر بمائة ونيف وثمانين سنة فيها كان ملك الى ملوك الشام حتى ظهرت الاشكنية ودار الامر بينهم دولاً اربعين سنة الى ان قصرت ايدي ملوك الشام عن العراق فنقردت الاشكنية بالاستيلاء واتبع الفرس قيامهم ايام الاسكندر فضاعت تلك السنون</p>
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⁷ Al-Bīrūnī (1954), Vol I, p. 90, n. 5 and Bacchi (before completion) in which the Feyzullah and the British Library manuscripts report *bihīrk*. The Persian word for intercalation is *wihezag*, with the meaning of moving and progression. See De Blois, 1996.

⁸ See Al-Bīrūnī (1954), Vol. I, p. 90, n. 6 in which *بخومه* and *مجوسيته* are reported. It is probably a scribal error. I suggest it could be *اخونة* "tables", *مجوسية* "Mazdaism" or *حومة* "main part". I lean towards "tables" as Al-Bīrūnī commonly used to put the calendrical data he gathered in tables but employing another term in the *Tafhīm* جدول - جداول *jadwal- jadāwil*, see Al-Bīrūnī (1934), p. 165 and p. 170.

<p>necessary 10 leap years, and they only intercalate until the month of <i>Ābān</i>, thus from these years is left behind (something) close to 260 years, and the reason comes from two points of view: the first of them is that the Arsacid period is close to 360 years, blending King Ardašīr son of Pāpak with the last Ardavān and it lags behind Alexander's Era of 100 and 80 odd/some 80 years in them, the king assigned to the Shām's Kings until the Arsacids emerged and the site of the authority between them (became) one country (for) 40 years until the hands of the Shām's Kings failed to reach Iraq, thus the Arsacids did the conquest alone and Persians followed their undertaking of Alexander's days, thus these years spread accidentally according to the report of the Shām's Kings.</p> <p>The last point of view is that a report in their annals, according to Zarathustra, was left behind in its days until the completion of the <i>Kabīsa</i> was an amount of years, they do not confirm this and it is less of their era and between Fīrūz⁹, forefather of Anušervān¹⁰, who was in charge of the last intercalation and between Yazdegerd¹¹ there are</p>	<p>بالعراض عن ذكر ملوك الشام. والوجه الآخر انه ذكر ذكر في اخبارهم عن زرادشت انه كان بقي في ايامه الى تمام الكبيسة مقدار من السنين لم يتحققه و لا شك في انه أقل من دورها وبين فيروز جدّ انوشروان الذي تولّى الكبس الآخر وبين يزدجرد قريب من مائة وسبعين سنة، فاذا انضاف اليها من تلك البقية الى الكبيسة تسعون سنة كانت السنين المائتين والستين والله أعلم. واما الطبقة الثالثة فهم القبط قبل اغسطس ولم يتقدر لدينا من اخبارهم ومأخذ حسابهم بالتفصيل شيء يقنع ذكره، وانما حصولنا منهم على الجمل التي أشرنا اليها.</p>
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⁹ Pērōz, Sasanian king from 459 until 484 CE.

¹⁰ Khosrow I, reigned from 531 until 579 CE.

¹¹ Yazdegerd III, the last of Sasanian kings, reigned from 633 until 651 CE. See Al-Bīrūnī (1934), p. 172 and Bacchi (2013): "As for what concerns Persians they reckoned the days of their reign from the days of the reigning king, and kept on reckoning their year until his successor and after the disappearance of their reign they reckon from the year of the king Yazdegerd son of Shahryār son of Khosrow Parviz, the last of their kings, and they do not employ in their

<p>almost 170 years, and if it is added to them, from that remnant to the <i>Kabīsa</i>, 90 years, the years were 260, and God knows best.</p> <p>As for what concerns the third category it is that of the ancient Copts before Augustus and he do not determined, as we know from their annals, and the source of their calculation in detail less satisfies its reputation, and only our acquisition (from them) of the totality is what we recorded.</p>	
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In this passage the Author is talking about the intercalation of an entire month, as he underlines Persians used to repeat the month of intercalation, without giving a name to the introduced month so that there were two *Farvardīn* and then two *Ordībehesht* and so on. Being wary of the difficulties to maintain the tradition of intercalating one month every 120 years remembering what month was intercalated, Persian decided to move the five epagomenal days to the end of the intercalated month, as a sort of bookmark. This is the reason for the settlement of the Gatha Days at the end of *Ābān* and this happened 277 years before the Era of Alexander; there is the possibility that the Author applies the same rule of the Yazdegerd's Era - in other words if he starts counting from the end of his reign, i.e. 323 b.C. - and if we add, as he states, 277 years we reach 600 years to which we have to add the year of the death of Yazdegerd III that happened in 651 A.D. so that we have 1251; if we divide for 120 - the necessary years to reach the addition of one month - we have 10 intercalations in between and a small addition of 260 years. At this point he tries to calculate how many intercalations have been applied through the years that lagged behind and for what reason:

“thus these years spread accidentally according to the report of the Shām's Kings”.

He gives two possibilities, and in the second of them he states that the last intercalation was under Pērōz:

years any intercalation; most of the Magians date from the murder of Yazdegerd and this happens after his reign of 20 years.” It is important to underline that, accordingly to Al-Bīrūnī's *Tafhīm*, Persians started reckoning not from the beginning of his reign but from his death.

“who was in charge of the last intercalation and between Yazdegerd there are almost 170 years, and if it is added to them, from that remnant to the Kabīsa, 90 years, the years were 260, and God knows best.”.

II Maqāla, III Chapter, pp. 131-132.

<p>[...], and about its measurement we calculate that what is between the Hijra and Yazdegerd are 3742 days - then we say in the Yazdegerd's era that the issue of the Magians in their years is its intercalation (<i>kabs</i>) every 120 years of one month repeated successively to the regular months and it came immediately after the stolen appendage, and that comes from 1218 years. It is known that they required the intercalation of 10 months, and it was necessary to the stolen (days) of being in another <i>Day</i> month but its occurrence at the end of the month of <i>Ābān</i> at the time of Yazdegerd is an evidence of them, (and) they do not intercalate nothing but eight times after Zarathustra, if he was in charge of a correction that (happened) before him, then they thought that the last of the <i>Kabīsas</i> occurred in the days of <i>Fīrūz</i> son of Yazdegerd¹² among their kings, and that he intercalated two months: one of them claimed in the past, while the other called to account for a lodging of appeals taken as a precaution because of the king's opinion about the disappearance, and that (was) in front of the decay; the years towards him are close to 1400, and their <i>Kabīsas</i> are 8 and a half, and with the</p>	<p>[...]، وعلى قياسه نحسب ان يكون ما بين الهجرة ويزدجرد من الايام ثلاثة الف وسبع مائة واثنين واربعين - ثم نقول في تاريخ يزدجرد ان موضوع المجوس في سنيهم كبسها في كل مائة وعشرين سنة بشهر مكرر على نوب الشهور الاصلية وردف باللواحق المستترقة، وان من السنين ١٢١٨ ومعلوم انها قد استحققت الكبس بعشرة اشهر، وكان يجب ان تكون المستترقة في آخر دى ماه لكن كونها في آخر آبان ماه في زمان يزدجرد دليل على انهم لم يكبسوا الا ثمان مرّات بعد زرادشت، اذ كان هو تولى تصحيح ما قبله ثم ذكروا ان آخر الكبايس كانت في ايام فيروز بن يزدجرد من ملوكهم، وانه كبس شهرين احدهم استحقاق بالماضي ولآخر استئناف (استسلاف) للمستأنف اخذا بالاحتياط لما رأى الملك الى الزوال والذين بصدد الانحلال والسنون اليه قريبة من الف واربعين وكبايسها ثمان ونصف وباستثناء المستسلفة سبع وسنوها ثمان مائة واربعون (اربع مائة) بنقصان ما يقارب مائتي سنة، وسبب سقوطها من جملة السنين الخمس مائة والسبع والخمسين التي بين مقتل دارا وبين اول ملك الساسانية ان العراق وفارس كانت بعد الاسكندر الى اصحاب الشام النازلين انطكية وكانوا يتناوبونها وخلفاؤهم في هذه السنين وبعد الاسكندر بمدة عصاهم اشك (اشد) صاحب الجبل وكواهم مستقرًا في نواحيه الى ان انقطع هؤلاء، فملك</p>
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¹² See n. 4.

exception of (the one and a half) are seven, and their years are 840 (800 and 400) with an omission of what came close to 200 years. The reason of their lapse comes from the totality of 557 years that are between the slaughter of a land and the first Sasanian king in Iraq, and Persia after Alexander was in charge for the rule of northern residents of Antioch and during these years their Caliphs did it by turns. After Alexander at the time of their revolt the owner of the mountain was stronger and their side of the mountain was firmly established opposite one to another in battle until those desisted, thus the Arsacids dominated their place and Persians do not interfere except for local registration on their side only, and the time of Greeks felt down/dropped, and it is said that Ardashīr compromised intentionally this history to hide in general the time of the ruin that they notified in advance of 1000 years, and these are all corrupted things in the same histories and annals. As for what concerns what has been established from the reckoning after the methods' correction of my fundamentals it is not a result of them (the corrupted things) because it does not come from their alterations with the exception of the substance deprived of the form/essence¹³.

الاشكنية مكانهم ولم يتعرض الفرس الا لاثبات مكان من جهتهم فقط، وسقطت مدة اليونانيين، وقيل ان اردشير تعمّد افساد هذا التاريخ ليخفي على العامة ميقات البوار الذين كانوا أذروا به على رأس الالف السنة، وهذه كلها اشياء قاذحة في نفس التواريخ والابخار.

فاما ما بنى عليها من الحساب بعد تصحيح طرق المبانى فليس بمتأثر عنها لانه لا يتصل من تصاريفها بغير الاسم دون الجسم.

¹³ See Roccato (2004), p. 75, n. 6.

In this passage the Author states that after 1218 years Persians had the necessity to add 10 months for the intercalation and that the stolen days had to stay at the end of the month *Day* so that their presence at the end of *Ābān* in the Yazdegerd Era is a proof of their misplacement. Persian intercalated only eight times after Zarathustra but we cannot make suppositions because, if it is true that it requires 960 years to reach eight intercalations we do not know how they applied them; for example it is possible that for the same intercalation they added more than one month:

“Zarathustra, if he was in charge of a correction that (happened) before him, then they thought that the last of the *Kabīsas* occurred in the days of *Fīrūz* son of Yazdegerd among their kings, and that he intercalated two months: one of them claimed in the past, while the other called to account for a lodging of appeals taken as a precaution because of the king’s opinion about the disappearance, and that (was) in front of the decay”.

During the last intercalation under *Pērōz* Persians intercalated two months for precaution, reports the Author.

It is interesting to notice that:

“the Arsacids dominated their place and Persians do not interfere except for local registration on their side only, and the time of Greeks felt down, and it is said that *Ardashīr* compromised intentionally this history to hide in general the time of the ruin that they notified in advance of 1000 years, and these are all corrupted things in the same histories and annals.”.

Than the Author clears that he is only reporting facts and that he applies other methods to calculate eras and chronology, as he wants to take distance from the annals.

II *Maqāla*, IV Chapter about other eras, pp. 142-145.

<p>[...]. As for what concerns the Era of the Magians it is from the King’s year¹⁴ of Yazdegerd disregarding the year¹⁵ of his reign and its length was 20 years.</p>	<p>[...]. واما تاريخ المجوس فانه من سنة ملك يزديجرد دون سنة ملكه وكانت مدته عشرين سنة فاذا نقصت من تاريخ قيامه بقي تاريخ تلفه وكان مقتله بمرور على</p>
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¹⁴ Al-Bīrūnī (1954), p.142 reports مهلك *mahlīk*: it is evidently a typographical error.

¹⁵ See note above.

<p>So if it decreased from the era of its execution, remained the era of its destruction/transfer¹⁶. His murder was in Merv¹⁷ in the nearness of Soghdia, thus the Magians employ (the era) of his time but the Magians of Transoxiana are transgressors in the belief for the Magians of Kurasan and Persia in such a manner that it would not have taken much more to turn spontaneously to the delusion that their Prophet was not the Prophet of those, and the beginning of their years is from the <i>Great Nōrūz</i> occurring later than the <i>Nōrūz of the Kings</i> of five days, and for this reason their months diverge from Persian months to the first of <i>Ādhar's</i> month, then they adjust to the first of <i>Isfandārmudh</i>, and the five days appendix is enclosed in the twelfth among their months, numerable from its (the twelfth month) totality, and for this reason we subtracted from the Era of Yazdegerd, on account of them, 20 years and five days.</p> <p>As for what concerns the <i>Kabīsa</i> of Al-Muṭaḍid¹⁸, that some people called <i>Kabīsa</i> of the Persian with reference to Al-Muṭaḍid I, it is what Persians used to practice in another manner related to their God,</p>	<p>اقتراب من السغد، فاستعمل مجوسها وقته ولكن مجوس ما وراء النهر لمجوس خراسان وفارس في الاعتقاد بحيث يكاد يسبق الى الوهم ان داعيهم غير داعي اولئك، وسنوهم مبتدئة من النوروز الكبير المتأخر عن نوروز الملوك خمسة ايام ولذلك يخالف شهورهم شهور الفرس الى اول آذر ماه ثم يتفق الى اول اسفندارمذ ماه، والخمسة الايام الزائدة ملحقة بالشهر الثاني عشر من شهورهم معدودة من جملة فذلك نقصنا من تاريخ يزدجرد لاجلهم عشرين سنة وخمسة ايام.</p> <p>واما كبيسة المعتضد التي سماها بعض الناس كبيسة الفرس ونسبتها الى المعتضد اولي، فان ما كان الفرس يعملونه منها هو على طريقة اخرى متعلقة بديانتهم وقد كان النوروز واقعا بالقرب من المنقلب الصيفي حين تدرك الغلات، فكانت الاكاسرة يفتتح فيه الخراج، ولما زالت دولتهم اهملت الكبيسة بعدهم فزال النوروز عن موضعه حتى اضر من طولب بخراج، ولما تدرك غلة ارضه وفتن المتوكل لذلك و بحث عن أمره وحرص على اعادة النوروز الى وقته فاخترم اتمامه، ثم اجتهد فيه المعتضد احتسابا وترفيها، وردة الى الموضع الذي كان فيه وقت انقراض الاناسرة وعمله على شهور السريانيين في الحادي عشر أبدا من حازيران ارادة ان ينكس بنفسه ان لم يهتم لتعاوده بعده غيره، وفي تلك السنة كان النوروز المحمول في</p>
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¹⁶ Al-Bīrūnī (1954), p. 142, n. 2 reports نقل *naql* with the meaning of “transfer”. It seems more plausible as a transfer of the days in another period of the year without their sheer disappearance.

¹⁷ The present-day town near Mary, Turkmenistan.

¹⁸ The Abbasid caliph of Baghdad (857 - 902 CE).

and the *Nōrūz* was occurring already near to the Tropic of Cancer¹⁹ at the time of cereal ripening, thus Persian Kings used to start off the beginning of the tax-paying and because of their dynasty disappearance the leap year was disused after them, thus *Nōrūz* was left on its position until it produced a damage from the tax request, and because of the (time of) its land's cereal ripening. For this reason Al-Mutawakkil²⁰ realized it and examined his decree and he egged on sending back *Nōrūz* to its time, thus he died before its fulfilment, then Al-Mu'taḍid put out for it through the computation and mended it. His attribution to (having put in its) right place - which happened in the time of Persian King's extinction - he applied it to the months of the Syrians on the eleventh starting from *Ḥazīrān*, (with) the will of having intercalated it by himself (in order to) do not be concerned by his institutions afterwards, and on that year this *Nōrūz* was carried to the first day of the month of *Khordād* on the year 264 for Yazdegerd (era) and the year of Syrians, that fell on the month of *Ābān*: this year is the *Kabīsa*, thus has been intercalated with it (as) the first year of this era, and it is known that it occurred on the second year (from it), on the second month of *Khordād* and

اليوم الاوّل من خرداد ماه سنة اربع وستين ومائتين ليزدجرد وسنة السريانيين التي وقع فيه آبان ماه هذه السنة كبيسة فانكبس معها السنة الاولى من هذا التاريخ، ومعلوم انه كان في سنة الثانية منه في ثاني خرداد ماه وثبت على ذلك سنين متواليه.
ثم انتقل بالكبيسة الى ثالث خرداد ماه، فاذا اسقطنا من تاريخ يزدجرد ما بين النوروز في اول سنة من ملكه وبين النوروز المكبوس للمعتضد و هو من السنين التامة مائتان وثلاث وستون ومن الشهور شهران فقد حصلنا على تاريخ هذه الكبيسة بسنين غير مكبوسة، ومنذ ذلك قد تراجع في كل سنة ربع يوم فاذا اخذنا ربعها كان عدد ايام التراجع وانما زدنا عليها ثلاثة لانها سنو تاريخ بالسنة المنكسرة واولاها كبيسة فاذا زدنا عليها ثلاثة انجبرت الارباع في اولها ومتى زدنا ايام التراجع على موقع اليوم المعطى من شهور الفرس عادت الى موضعا الذي رتبته المعتضد.
ولما زدنا على السنين ثلاثة انجبرت في الاولى آبان ماه فيها ستة وثلاثون يوما فصار انجبارها فيها يستأنف علامة لمثله وان شئنا (?) استعملنا نوروز المعتضد في الحادي عشر ابدا من حزيران فتبين لنا من فضل ما بين نوروزنا والنوروز الآتي بعده حال الكبيسة وآبان ماه قال على بن يحي المنجم للمعتضد يوم نيروزك يوم واحد لا يتأخر من حزيران يوافي أبدا في احد عشر.

¹⁹ It means that *Nōrūz* was ongoing already when the sun was approaching the celestial Tropic of Cancer, or rather the 21 of June of the Gregorian calendar.

²⁰ The Abbasid Caliph (821 - 861).

it was stationary successively during these years.

Then the *Kabīsa* shifted to the third month of *Khordād*, and if we subtract from the Yazdegerd era what is between *Nōrūz* on a first year from his reign and between the preserved (intercalated) *Nōrūz* for Al-Muṭaḍid, and it comes from the totality of years, (the result) is 263, and from the months (the result) is two months, and we obtained already a history of this *kabīsa* with years that are not preserved (intercalated). Since this it lagged behind a quarter of a day, thus if we gather its quarter it was the amount of the retrogradation's days, and on the contrary we added to them three (because of them²¹) years of history to the fragmented year and their first *Kabīsa*; thus when we added to them three, the quarters were mended in the beginning, and when we added the retrogradation's days to the date on which the given day falls, among the months of the Persians, it returned to the position that al-Muṭaḍid regulated.

And why we added to the years three? It was mended on the first of the month of *Ābān* of thirty six days²², thus its amendment/union²³ got to the

²¹ Referring to the days.

²² Al-Bīrūnī (1954), p. 143, line 18 reports بوما *bawman*. It is clearly another typographical error. We are going to see further that the whole paragraph is unclear.

²³ I could not find the انفعال form of جبر in any dictionary.

<p>point in it where recommenced a separation for its equivalent, and we gradually²⁴ applied Al-Mu'taḍid's) Nōrūz on the eleventh starting from Ḥazīrān, thus it became distinct, as though separate from the others, and thus it became plain for us from a surplus that was between our Nōrūz and the Nōrūz when the Kabīsa shifted (after it), and (it is?) the month of Ābān, 'Alī bin Yaḥyā al-Munajjim²⁵ said that for al-Mu'taḍid the day of (your) Nōrūz²⁶ is one day that is not in late from Ḥazīrān(, and) the beginning appears on the eleven.</p>	
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Here the Author states that Magians adopt the Yazdegerd era starting from his death. He explains why when calculating Yazdegerd Era is necessary to include five days after his reign of twenty years. Moreover he points out that not every Magian adopt the same era: the ones from Transoxiana begin their years from the *Great Nōrūz* that occurs later than the *Nōrūz of the Kings* - i.e. the *Nōrūz* of the Magians from Khorasan and Persia- of five days; moreover their year starts from *Ādhar* and only later they adjusted the calendar in order to have *Isfandārmudh* as first month, moving the appendix to the last month of the year.

The Author passes now to al-Mutawakkil adjustment of the calendar starting from the 11th of *Ḥazīrān*:

“Persian Kings used to start off the beginning of the tax-paying and because of their dynasty disappearance the leap year was disused after them, thus Nōrūz was left on its position until it produced a damage from the tax request”.

And this was the first intercalation of their era, i.e. the era of the Author.

²⁴ I suggest شينا instead of شئنا as the conjugation of the perfective for شياء (شاء) does not present such form.

²⁵ Astronomer of the Munajjim family.

²⁶ Here we find another typographical error: نيروزك.

Conclusion

As a thorough analysis of François De Blois demonstrated in 1996, the account of al-Bīrūnī reports different traditions about the intercalation of the Persian calendar in its history, gathering them altogether. As pointed out by the scholar through a keen and transversal philological analysis, the data that the author reports in his *Canon* come from different Muslim sources in Persian and Arabic, respectively the *Bundahišn* and the account of the historian al-Mas‘ūdī among others. As a result the “legend” of the intercalation of one month every 120 years starts circulating in the 10th century in Muslim sources and, surprisingly, is attested even in later Zoroastrian sources during the 11th and 12th century²⁷.

Still in Zoroastrian sources, precisely in the 25th chapter of the *Bundahišn*, is presented a theoretic coexistence of a secular calendar and another with special or notional months that are necessary to explain the cycles of seasons despite the issues of missed (or supposed) intercalations of one day every four years or, as stated by al-Bīrūnī, of one month every 120 years that is highly improbable. It looks like there is an open polemic regarding the lunar Muslim calendar which does not apply the intercalation as commanded by the Prophet Muhammad, an important matter that brought al-Mu‘taḍid and al-Mutawakkil to adjust the calendar because the period for the tax collection came before the harvest and fruit ripening. Trying to avoid the problem with the land holders they made this reform even pushed by the institutions as well:

“His attribution to (having put in its) right place - which happened in the time of Persian King’s extinction - he applied it to the months of the Syrians on the eleventh starting from Ḥazīrān (with) the will of having intercalated it by himself (in order to) do not be concerned by his institutions afterwards”.

Furthermore al-Bīrūnī presents an analysis trying to demonstrate the exactness of computations comparing different calendars and eras, as the one of Yazdegerd and the Muslim calendar with its start at the beginning of Hijra.

The matter itself is still far away from being unravelled, as we have seen that at a certain point interpolated sources made their entrance in the issue of the Persian intercalation, the same sources al-Bīrūnī relied on. On the other hand he recognizes that the same annals and histories he possesses are not trustful in a way he takes distances from what he is writing, though reporting facts as he read them.

²⁷ De Blois, 1996.

On the other hand, integrating the data from the *Canon* with the other known sources brings the possibility to shed light on intercalations. As opinion of the present writer this makes necessary further deepening about the matter, connecting different fields of research such as computational astronomy, linguistic and history of science.

As for what concerns the field of Arabistic, the need of a proper glossary about astronomical terms is urgent as we are not in possess of a comprehensive edition able to fill the heavy lack of textual instruments necessary for an attentive and thorough carrying out of such a wide and unfortunately unexplored field for linguistic.

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تذكار زوجة محبوبة كتاب التفهيم لاوائل صناعة التنجيم تصنيف ابي الريحان محمد بن احمد البيروني المكتوب في غزنة سنة ٤٢٠-١٠٢٩ م قد التزم طبعه وترجمه الى اللغة الانكليزية في اكسفر د سنة ١٣٥٢-١٩٣٣.

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