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Iggeret ha-Mispar

by Isaac ben Solomon Ibn al-Aḥdab

(Sicily, 14th century)

from *Ilana Wartenberg**

Part I: The Author

Abstract:

Isaac ben Solomon Ibn al-Aḥdab was a prominent medieval astronomer, poet and exegete. He was born in Castile in the middle of the 14th century and died in Aragonite Sicily around 1430. He wrote a treatise on mathematics in Hebrew, *Iggeret ha-Mispar* (The Epistle of the Number), which includes an impeccable translation and adaptation of the Arabic arithmetical text of the 13th century *Talḥīṣ A‘māl al-Hisāb (A Compendium on Operations of Calculation)* by Ibn al-Bannā'. *Iggeret ha-Mispar* has an important role in the medieval Hebrew mathematical corpus since it is the first known extensive textual evidence for Jewish interest in algebra. This article focuses on the life and the *ensemble d'oeuvres* of Isaac.

In 1899, the father of modern Jewish bibliography and one of the founders of modern Jewish scholarship, Moritz Steinschneider (1816-1907), wrote in his seminal work *Mathematik bei den Juden*: “Isak Alchadib hat bisher nicht das verdiente Interesse der Forscher auf dem Gebiete der jüdischen Literatur gefunden, die nur obenhin oder gelegentlich seiner erwähnen”.¹ Fortunately, this statement is no longer true, thanks to the work of several scholars, each one revealing a different facet of Isaac's literary, scientific and exegetical works.² However, the jigsaw puzzle of Ibn al-Aḥdab's life is far from complete, in part due to the fact that not all his tracts have been studied yet.

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¹ MORITZ STEINSCHNEIDER, *Mathematik bei den Juden*, Hildesheim 1964, p. 167.

² See details on the various works in the chapter on Isaac's life and oeuvre in ILANA WARTENBERG, *The Epistle of the Number by Isaac ben Solomon Ibn al-Aḥdab (Sicily, 14th century) – an Episode of Hebrew Algebra*, Ph.D.-Diss. Paris / Tel-Aviv 2007, pp. 25-44.

Presented here are the highlights of Isaac's life and *ensemble d'oeuvres*, as well as his possible reading sources. I also describe Isaac's family members, scholars he knew and those who may have influenced his work. Accompanying the text is a short description of the historical circumstances in Castile and Sicily in the 14th century.

1. Some Biographical Details

Isaac ben Solomon ben Zaddiq Ibn al-Aḥdab Sefaradi (i.e., [the] Spaniard) was born around 1350 in Castile. He passed away some time between 1429 and 1433.³ We know of a poem dating from 1377, addressed to the philosopher Samuel ibn Zarza, in which Isaac refers to himself as "young".⁴ 1429 is the last known year in which it is certain that Isaac was alive. It was also in this year that Isaac's student, Nissim al-Faragi, copied his manuscript, seeking God's blessing for Isaac's continued long life. However, in a manuscript copied in 1433 by the same scribe, Isaac is referred to "in blessed memory" (z"l).⁵

Isaac was trained in Castile by the astronomer Yehudah bar Asher the Second, the grandson of Rabbi Asher ben Yehiel (the RoSH).⁶ At some unknown point in time, probably before the 1391 persecutions, Isaac left Castile. The introduction to the Epistle reveals that Isaac also lived in an Islamic land, either in the Muslim part of the Iberian Peninsula (Granada) or in North Africa. In his astronomical treatise *A Precious Instrument* (כלי חמדה), Isaac states:

In the year 1396 I am in Syracuse, which is in the Island of cold Sicily, and God is in front of me...⁷

³ Rome, Biblioteca Casanatense, MS 3082, fol. 106r.

⁴ DOV SCHWARTZ, *The religious philosophy of Samuel Ibn Zarza* (in Hebrew), Ph.D.-Diss. (Bar-Ilan University), Ramat-Gan 1989, pp. 5-7.

⁵ See Table of the Islamic calendar and their analogues in the Jewish Calendar, Roma, Biblioteca Casanatense, MS 3082/9, fol. 104v, The Intermediate Instrument, Munich, Bayerische Staatsbibliothek, MS 246/9, fol. 67r, A Poem on Esther, Munich, Bayerische Staatsbibliothek, 246/19, fol. 252 and An article on the definition of things, Munich, Bayerische Staatsbibliothek, MS 246/8, fol. 65r.

⁶ See LEOPOLD ZUNZ, *Zur Geschichte und Literatur*, Berlin 1874 [reprint Berlin 1919], p. 423, ALFRED FREIMANN, Die Ascheriden 1267-1391, in: *Jahrbuch der juedisch-literarischen Gesellschaft* 13 (1919), pp. 142-254, pp. 155-156.

⁷ *The Precious Instrument*, London, British Library, MS Or. 2806, Margulioth Catalogue 1013/1, fol. 11r.

Furthermore, in the introduction to *The Epistle of the Number*, one reads about Isaac's arrival in Syracuse:

Then, while I was going through the sea to the Holy Land, may it be built and existent in our days, the waves of the sea were threatening us deep calleth unto deep,⁸ our soul being bowed down to dust. Observing us from His Seat, The Observer of His world in general and in particular, may His name be praised, exalted and raised, calmed the stormy waves and brought us all safe to the glorious town of Syracuse in Sicily [F° 1v: 8-11].

Isaac recounts his journey to the Holy Land, a journey which was interrupted by a vicious storm; thanks to divine intervention, he safely reached Syracuse, Sicily. This story needs to be taken with a pinch of salt since the literary elements of a voyage to the Holy Land, followed by a storm and salvage by God, belong to a literary *topos* typical of Hebrew literature in the Middle Ages.⁹

Isaac further recounts that he first stayed in Syracuse, where he composed *The Epistle of the Number* and the astronomical treatise *A Precious Instrument*. The last evidence of Isaac's location can be found in his astronomical tract *The Intermediate Instrument*, from which we learn that Isaac was in Palermo in 1426, where he probably died.

As for Isaac's knowledge of languages beside Hebrew and Arabic, it is possible to say that he must have known either Latin or a Romance language. This can be inferred from the chapter on fractions in *The Epistle of the Number*, in which Isaac explains the nomenclature of fractions in “other languages”, i.e. a nomenclature which follows a different scheme than the one found in Hebrew or Arabic.¹⁰

2. The Historical Circumstances

I now present the highlights of events and circumstances during Isaac's lifetime. Isaac lived during tumultuous periods in Castile and Aragón.¹¹

⁸ Psalm, 42:7.

⁹ TOVA ROSEN, The Hebrew Mariner and the Beast, in: *Mediterranean Historical Review* 1 (1986), pp. 238-244.

¹⁰ For a denominator greater than ten, neither Hebrew nor Arabic allow an addition of an equivalent fraction marker “-th”, and Isaac tells us that it is indeed possible in some languages. This is a typical feature of Romance languages. See WARTENBERG, *The Epistle*, p. 341.

¹¹ This section presents the relevant highlights in YITZHAK BAER, תולדות היהודים בספרד הנוצית, Tel-Aviv 1959, pp. 179-363

Castile

The 14th century marked the beginning of the destruction of Castilian Jews. Between 1348 and 1350 Jews were accused of causing the Black Plague, and as a consequence, were persecuted. Furthermore, the middle of the 14th century was characterized by a bloody civil war in Castile, which bore tragic consequences for the Jews as well as the wider population. Pedro, the legitimate son of Alfonso the 11th, ruled Castile with the help of Jews, the most famous of whom was Don Shmuel ha-Levi. In 1366, the son of Alfonso's mistress, Enrico the Second, rebelled against his half-brother's reign, denouncing Pedro as the son of a Jew. In 1369, Pedro was killed and Enrico the Second became the supreme authority in Castile. Many Jews were massacred and numerous Talmudic academies were destroyed, as described in a letter by Rabbi Isaac de Lattes. The Jews also had to pay heavy forfeits to the new king, thus creating even greater suffering for them. The humiliation of the Jews was further exacerbated when they were forced to wear a distinctive Jewish mark.

Enrico's son, John the First, ruled between 1379 and 1390. During his reign many anti-Jewish rules were enforced, but at the time several Castilian Jews were holding high ranks in the Royal Courts. John the First of Castile died in 1390, before his heir was old enough to inherit the crown. The custodians appointed by the late king were not strong enough to curb the rebelling forces in Castile. On June 4th, 1391, these forces set fire to Jewish homes in Seville, massacred part of the population, coerced the survivors to convert to Christianity, selling a proportion of them to the Muslims. The persecutions of 1391 were to become the pivotal and most traumatic event for Iberian Jews in the 14th century.

Many Jews committed martyrdom, as can be learned from Hasdai Crescas' letter to Avignon's rabbis, in which he describes the sanctification of Yehudah bar Asher the Second. Synagogues were converted into churches and Jewish neighbourhoods were occupied by Christians, leading to the complete destruction of Jewish communities, such as the one in Valencia.

Aragón

Historians are of the view that during the 14th century the fate of Jews in Aragón was better than in Castile, though it was not completely devoid of violent acts against them. Sicily, which was part of Aragón's domain, enjoyed an ever greater peace in comparison to the rest of Aragón. Pere

(Pedro) IV ruled Aragón between 1336 and 1387. His reign was relatively calm, and during his time, the Aragonite Jewish community was reconstructed after it had been destroyed in 1328. In general, Pere IV protected the rights of the Jews and allowed their commercial life to flourish. For example, he gave them the permission to import fabrics from England and Flanders. Both Pere IV, and his son Juan I, were interested in astronomy and had Jewish scholars in their court.¹²

Baer claims that despite the existence of Hebrew documents written by Jewish merchants and doctors, some of which are found in archives in Pamplona, it is very difficult to establish a realistic picture of the conditions of the Jews at the time. Some of these documents hint that Jews were secure both financially and socially. Indeed, Pere III aspired much to become an enlightened king. Despite sporadic instances of personal malicious suspicion of the Jews, he was served by Jewish doctors, astronomers, financial advisors and translators. He is also known to have given religious autonomy to the Jews in regard to the application of life and death rulings (דיני נפשות).

Profound hatred against the Jews was deeply rooted both in Castile and Aragón, but its manifestation in Castile was more extensive and overt. Baer explains this hatred by the popular belief among Christians that Jews had stolen the Host (להם הקרבן) and that Jewish religious writings, such as Maimonides' *Mishneh Torah* (משנה תורה) contained anti-Christian sayings.

In 1387, Pere's son, Joan I, assumed power in Aragón until 1396. Once becoming king, he dismissed all libellous stories against the Jews, even though he himself had promulgated similar stories before. Like his father, Juan I maintained good relationships with the Jews of Aragón, in particular with Hasdai Crescas, but he was a weak king. In July 1391, the first rumours of persecutions in Castile reached Aragón and caused uproars. John the First published orders which once again stated that the Jews were considered property of the King and that the clerks must protect them. He even sent chevaliers and soldiers to protect the Jews in various cities but at the same time he did not hesitate to steal the property of the many Jews whose lives had been lost in the persecutions.

¹² JOSÉ CHABÁS & BERNARD R. GOLDSTEIN, Isaac Ibn al-Hadib and Flavius Mithridates: The Diffusion of an Iberian Astronomical Tradition in the Late Middle Ages, in: *Journal for the History of Astronomy* 37 (2006), Part 2, No. 127, pp. 147 - 172, p. 147.

Violence persisted for several years. In 1392, Jews in Sicily were confined to their quarters. There were also persecutions in the summer of that year, which ended shortly after Martin V of Aragón ordered the punishment of the perpetrators. Martin protected the Jewish community in Sicily.

The Jewish Community in Sicily

During the 14th century, Sicily was under Aragonite Christian rule. Jews and Muslims living in Christian Spain were grouped in local *Aljamas* ruled by lay as well as religious leadership. It is well known that Sicily still preserved strong linguistic and cultural Arabic imprints and Arabic was still in large use among Sicilian Jews.¹³ Manuscripts as well as commercial and legal certificates indicate the usage of Hebrew, Arabic, Catalan and Aragonite, although the quality of the Arabic may be poor at times. Arabic culture still influenced Jews in Aragón, as is manifested in poetry and artistic work, songs and even Jewish food of the time. Arabic words were used by Jews, e.g., Sunday was named *al-ahad* and not *domingo*. Commercial documents suggest that transactions between Muslims and Jews were common. In the 13th century, legislation against Jews converting to Islam appeared in Aragón and Castile. This suggests that conversion of Jews to Islam was a common phenomenon. In general, Jews living in Castile and Aragón bore a strong affinity to Islamic culture and religion.¹⁴ This affinity is corroborated in Isaac's writings as well: even though he translated from Arabic into Hebrew, the knowledge of Arabic, at least by some members of the Jewish community in Syracuse, is hinted at in *The Epistle of the Number*. In the introduction to the Epistle, Isaac explicitly said that some Jews who understand Arabic might catch him "red-handed" if they discover that some passages from the Arabic source were missing from his Hebrew translation.¹⁵

3. People in Direct Contact with Isaac

The RiBaSH (Valencia 1326 - Algiers 1408)

Rabbi Isaac bar Sheshet Perfet, or Barfat, the RiBaSH, was a prominent Jewish scholar of noble descent, who was born in Barcelona. In 1372,

¹³ HENRI BRESC, *Arabes de langue, Juifs de religion*, Paris 2001, pp. 46-50.

¹⁴ ELEAZAR GUTWIRTH, Hispano-Jewish Attitudes to the Moors in the fifteenth Century, in: *Sefarad* 49 (1989), pp. 237-262, pp. 245-250.

¹⁵ WARTENBERG, *The Epistle*, p. 161.

he moved to Saragossa, where he was leading the local Jewish community from 1385 until 1391. In regard to foreign sciences, he said:

One must not discuss the Laws of the Bible and its Precepts using the wisdom of Nature and medicine, because if we believed their sayings, then the Bible does not come from Heaven, God forbid... we rely upon our wise men, of blessed memory, even if they tell us that right is left... We should not believe the Greek scholars and the Muslims, who only talk out of [their own] assumptions and experiences.¹⁶

During the persecutions of 1391, the RiBaSH was one of few who escaped from Valencia. The only evidence of a relationship between the RiBaSH and Isaac is found within a *responsum* to Yehudah bar Asher the Second, where the RiBaSH states that he had met Isaac in Castile before the persecutions. He goes on by referring to “three notebooks (קונדריסין שלשה), which your student, al-Ahdab, laid here, may God save him; he wrote them for me to send to you”. The content of these notebooks is unknown.¹⁷

The Rosh’s Family: Yehudah Bar Asher the Second

At the beginning of the 14th century, the RoSH, who was of German origin, was invited to Toledo by the local Jewish community. Despite the fact that he originated from an Ashkenazi religious milieu, the RoSH was highly influential in the life of the Sephardic community of Toledo and his religious rulings were highly respected. After his death he was succeeded by one of his sons, Yehudah the First, and after Yehudah’s death in 1349, the RoSH’s grandson, Yehudah bar Asher the Second from Burgos, who had become a Rabbi in Toledo, wrote a book on astronomy. Yehudah bar Asher the Second was Isaac’s teacher while the latter was still in Castile. During the persecutions of 1391, Yehudah committed martyrdom in Toledo, as did many of his friends and family members.¹⁸

Samuel Ibn Zarza (Valencia, Second Half of the 14th Century)

The Jewish philosopher Samuel ibn Zarza was active in Castile between 1360 and 1380. His writings evolve around various matters such as the theory of God’s attributes, the Creation of the World, morality

¹⁶ BAER, *תולדות היהודים*, p. 271 (the translation of this passage into English was done by Ilana Wartenberg).

¹⁷ *The Responsa project* (in Hebrew), Bar-Ilan-University, Ramat-Gan 1972-2002, *Responsa* 240 (CD ROM).

¹⁸ BAER, *תולדות היהודים*, p. 285.

(based on Maimonidean theories), God's Providence, and the source of the soul. Ibn Zarza wrote two exegetical works: *The Source of Life* (מקור חיים) and *A Perfect Beauty* (מקליל יופי). *The Source of Life* comments on Ibn Ezra's exegesis to the Bible. *A Perfect Beauty* is a commentary on "tales of our Sages of Blessed Memory" (אגדות חז"ל) and their *Midrashim*. Ibn Zarza's period is dominated by Averroistic rationalistic theories, but in many respects, Ibn Zarza's doctrine is neo-Platonic. Ibn Zarza was trying to create a synthesis between rationalism and neo-platonism, interwoven with strong elements of astrology and astral magic, in which Human Beings are endowed with the capacity to change Nature.

Around 1377, after having studied Ibn Zarza's works, Isaac sent the author a letter of admiration written in verse, at the end of which he refers to himself as "Ibn al-Ahdab the young". This letter is the only known correspondence between Isaac and Ibn Zarza and it sheds some light on Isaac's philosophical and exegetical background: in this letter Isaac expresses his profound respect for Ibn Zarza, whose wisdom and splendour had superseded all men of his generation. Isaac prayed for the welfare of Ibn Zarza and hoped God would prolong his days.¹⁹

Zarahia Ibn Danon

Zarahia Ibn Danon was a poet with whom Isaac had a polemic exchange of poems, the last of which Isaac wrote on Ibn Danon's tomb, immediately after the latter's death.²⁰

4. Isaac's Reading Sources

- The main Arabic source of *The Epistle of the Number* is Ibn al-Bannā's (1256 - c. 1321) *Talhīṣ A'māl al-Ḥisāb* and its commentary *Raf' al-Hiġāb*.²¹
- In *The Epistle of the Number*, within the discussion that one is not a number, Isaac refers to Ibn Rushd's commentary on the matter.²²
- Euclid's *Elements*: Isaac must have been familiar with the contents of this book, either with one of its translations or commentaries either in

¹⁹ SCHWARTZ, *The religious philosophy*, pp. 13-18.

²⁰ ORA RAANAN, *שירי יצחק בן שלמה לאחדב* (Poems of Rabbi Ishak ben Shlomo ben Zaddiq al-Ahdab), Lod 1988, p. 26.

²¹ As was discovered by Tony Lévy, see WARTENBERG, *The Epistle*, pp. 4-5.

²² WARTENBERG, *The Epistle*, pp. 162-163.

Arabic or Hebrew, since he cites two common notions from *The Elements*. However, the linguistic discrepancy between the Hebrew version given in *The Epistle of the Number* and the other Hebrew translations which are known to us strongly hints that Isaac had not read the Hebrew translations of *The Elements*. He probably studied one of the Arabic translations during his stay in a Muslim country.²³

- Abraham ibn Ezra's (Tudela, c. 1089 - c. 1167) work(s): Isaac discusses Ibn Ezra's biblical exegesis in *Leshon ha-Zahav* (לשון הזהב), a book on weights and measures in the Bible, which I will describe later on in part on Isaac's exegetical work.²⁴ It is possible that Isaac also knew Ibn Ezra's mathematical work, such as, *Book on the One* (ספר אחד) and *Book on the Number* (ספר המספר), since these books were in wide circulation at the time. Also, in *The Epistle of the Number*, Isaac mentions the "well known" definition of multiplication in the Holy language, which probably refers to Ibn Ezra's definition.²⁵
- Ibn Sinā's (980-1037) *Canon of Medicine*: Isaac refers to the (ספר הרפואה) when comparing a series of four numbers and the four humours.²⁶
- Aristotle's (384-322) *Physics*, or a commentary thereof: Isaac explicitly mentions the four causes. Also, Isaac must have read the *Organon* or one of its commentaries since he discussed the division of *discrete* and *continuous* quantities.²⁷

Isaac wrote a commentary to the Passover *Haggadah*²⁸ and in it one finds the following sources:

- Maimonides' (1138-1204) *Guide of the Perplexed* (מורה נבוכים).
- RaSHi's (1040-1105) exegesis of the Bible.

²³ WARTENBERG, *The Epistle*, p. 470.

²⁴ ISAAC BEN SOLOMON IBN AL-AHDAB, *לשון הזהב* (*A Wedge of Gold*), London, The British Library, MS Or. 10660, fol. 113v, and ELEAZAR GUTWIRTH, Fourteenth Century Supercommentaries on Abraham Ibn Ezra, in: Fernando Díaz Esteban (ed.), *Abraham Ibn Ezra y Su Tiempo: Actas del Simposio Internacional*, Madrid 1990, pp. 149-150.

²⁵ WARTENBERG, *The Epistle*, p. 258.

²⁶ WARTENBERG, *The Epistle*, p. 180.

²⁷ WARTENBERG, *The Epistle*, p. 301.

²⁸ הגדה של פסח, פסח דורות, דיניليل הסדר ופירוש על הגהה לרבינו יצחק בן שלומה אלאחדב מהכמי ספרד וסיציליה במאה השניה לאלף החמישי (YOSEF S. SPIEGEL, *The Passover Haggadah commentated by al-Ahdab*), Jerusalem 2000, pp. 24-25.

Scholars have pointed to the following medieval astronomers whose work may have been a source of inspiration to Isaac:

- Immanuel Bonfils ben Jacob (ca. 1350, active in Tarascon): In 1365 Bonfils wrote an astronomical work *Six Wings* (שש כנפיהם). It became a popular treatise, and it was translated into Latin in 1406.
- Ibn al-Raqqām (d. 1315), who was the authoritative astronomer in Tunis during Isaac's time, was a source for Isaac's astronomical works, as well as al-Battānī (d. 929) and Ibn al-Kammād (d. 1312).²⁹

5. Isaac's Family

The origin of Isaac ben Solomon Ibn al-Āhdab's surname, al-Āhdab, is not known. Literally, his name means in Arabic *the hunchback* (or *convex*). Isaac's surname appears in various manuscripts under several forms: al-Āhdab, al-Āhadib, al-Āhadab, and al-Āhadib. It is known that Isaac had three sons: Abraham, Zaddik and Yaakov.

Yaakov

Yaakov was Isaac's youngest son. He wrote: "I am the youngest at my father's home".³⁰ Yaakov copied some of his father's poems and wrote commentaries on *Orah Selulah* (סלוליה אורחה). He also elaborated on his father's astronomical tables, in response to a friend's request.³¹ Yaakov is also known to have predicted the sun eclipse of 1463. In a commentary on *Orah Selulah*, Yaakov writes:

Since in these times our brain is meagre and meek, and [since] we have no strength to enter the ample ascensions established for us by the first [scholars] in the Temples of Wisdom many years ago... in the wisdom of astronomers and astrologers. This is because of the work, labour and toil of [our] time, our knowledge has diminished until we find commentated books accompanied by commentated exegesis, with the paucity of our mind we are not capable to understand the matters, in particular, in the books on [astronomical] tables which involve calculations and numbers, unless we have examples and commentaries. Therefore, I, the youngest at my father's home, have consented to the request of a beloved friend, who wishes to learn the tables of *Orah Selulah*, composed by my master, my father, of blessed memory. My friend asked me

²⁹ SPIEGEL, *הגדה של פסח*, p. 14, and CHABÁS & GOLDSTEIN, Isaac Ibn al-Āhadib and Flavius Mithridates, p. 148.

³⁰ *Commentary on the Tables in The Paved Way*, Moscow, Russian State Library MS Günzburg 1080/3, fol. 39r and *The Paved Way*, London, British Library, MS Or. 2806, fol. 20v.

³¹ *The Paved Way*, Paris, Bibliothèque Nationale, MS héb. 1047/18, fol. 172r.

to give him an example from the gentiles' tables in order to facilitate the calculation of eclipses and oppositions of the luminaries. For the sake of his friendship, and to fulfill his will and desire and respond to his request, I have written this example to him and to all those who wish to study gentile tables easily. I ask the reader to forgive me if he finds any mistakes, may God save us from errors. I shall start, with God's help, may His name be blessed and exalted.³²

Abraham And Zaddik

Abraham and Zaddik were the elder brothers of Yaakov, to whom Isaac wrote affectionate poems on their wedding day, teaching them how to behave morally and how to choose the right path in life. As can be read in his poems, despite Isaac's extensive scientific activities, he attached foremost importance to religious studies. According to his poems, science appears to be of secondary importance, in particular foreign science. This corroborates the general image of the prolific medieval Jewish scholar, who is constrained by his religious beliefs.³³ In 1491, Abraham ben Isaac, named Yosha, copied *Orah Selulah* in Syracuse.³⁴

The Descendents

Some scholars are identified as Isaac's descendents, e.g., Rabbi Abraham bar Solomon al-Ḥadab, who was a religious judge, a *Dayan*, in Corfu in 1530. Other possible descendents up to the 18th century are to be found in Fez, Venice, and different towns of today's Greece as well as in Tiberias. Isaac is the earliest member of the al-Ahḍab family whose work is known to us.³⁵

6. Isaac's Works

Altogether, there are over eighty manuscripts which refer to Isaac's works, and they are scattered in tens of libraries around the world. The richness of the domains covered within these manuscripts designates Isaac as a polymath in various fields: poetry, astronomy, astrology, mathematics, philosophy, and exegesis.

Mathematics

³² אורה סלולה, London, The British Library, MS Margulioth 1007 fol. 45v.

³³ *A Poem for the wedding of Abraham*, Moscow, Russian State Library, MS 1080 (Günzburg), fol. 39r-43r. Also See RAANAN, *Poems*, pp. 37-43.

³⁴ אורה סלולה, fol. 155v.

³⁵ ZUNZ, *Zur Geschichte*, pp. 423-424, and SPIEGEL, *הגדה של פסח*, p. 9.

In the past, a mathematical treatise by the name of *Ma'ase ḥoshev* (מעשָׁה חָוָשֵׁב) was erroneously attributed to Isaac.³⁶ To the best of our knowledge, in the mathematical domain, Isaac composed *The Epistle of the Number* on arithmetic and algebra. Furthermore, his exegetical treatise *Leshon ha-Zahav* contains some arithmetical elements. This treatise will be described shortly in the passage on Isaac's exegetical oeuvre.

Astronomy

Astronomical quest was legitimized and encouraged in medieval Jewish circles and indeed, one finds abundant Jewish astronomical writings in the Middle Ages. It is no coincidence, then, that more than half of the known copies of Isaac manuscripts are astronomical. Isaac wrote about astronomical devices such as the astrolabe and the quadrant as well as some of his inventions or adaptations of existing tools. His astronomical work includes the following tracts:

- *Orah Selulah* (אורח סלולה)³⁷

This tract reflects Isaac's most extensive work in astronomy. It was composed in Syracuse in 1396 and about 25 copies of it survived. It elaborates on the motion of the luminaries and it includes a set of user-friendly tables for conjunctions and oppositions of the Sun and the Moon, and the computation of a true syzygy,³⁸ as well as the circumstances for solar and lunar eclipses. This work was part of a rich astronomical tradition in the Iberian Peninsula and southern France in Isaac's time, which consists of works by Immanuel Bonfils of Tarascon, Abraham Zacut (Salamanca, c.1450-1515) and Judah ben Verga (15th c.). This tradition derives from the Ptolemaic astronomy, elaborated in al-Andalus, then diffused to Jewish and Christian communities in Europe. This tradition also gave birth to a separate branch of tables, which is independent of the Toledan or Parisian Alfonsine Tables.³⁹

- *The Precious Instrument* (כלי חמדה)

³⁶ TONY LÉVY, L'algèbre arabe dans les textes hébraïques (I). Un ouvrage inédit d'Isaac ben Salomon al-Ahdab (XIVe siècle), in: *Arabic sciences and philosophy* 13 (2003), pp. 269-301, esp. p. 301.

³⁷ Proverbs 15: 19.

³⁸ I. e., a constellation in which the sun, the moon and Earth lie in a straight line.

³⁹ CHABÁS & GOLDSTEIN, Isaac Ibn al-Hadib and Flavius Mithridates, pp. 147-8, 169.

There are about 15 copies of this book, which contain several variations of the manuscript. This tract includes two epistles about the astrolabe. In the colophon the copyist wrote:

Epistles on the precious instrument, composed by the wise man, Rabbi Isaac ibn al-Aḥdab, be his name in blessed memory, who said: the precious instrument is precious to you above all instruments of marvel. Its name is dear and pleasant. Isaac ben Solomon is like a father to you, and you are to him like a beloved child.⁴⁰

• *The Intermediate Instrument* (כלי מומוץ)

In this treatise, Isaac describes an instrument which is a combination of an astrolabe and the *new quadrant* invented by Jacob ben Makhir around the year 1300.⁴¹ Isaac composed two epistles on the subject, one about the construction of the instrument and the other about its application. Isaac followed the doctrine of al-Raqqām and used tables calculated by both al-Battānī and al-Raqqām. This treatise includes 26 chapters. This device was designed for latitude 36°, even though Syracuse lies in latitude 37°. It is possible that latitude 36° was chosen for the convenience of the calculation.⁴²

- Various astronomical and astrological tables, such as *A Table of the Islamic calendar and their analogues in the Jewish Calendar*.⁴³

• *Leshon ha-Zahav* (לשון הזהב) (The Wedge of Gold)

This is an exegetical book in which Isaac comments on the measures and weights mentioned in the Bible. In the course of time, this book was erroneously believed to be lost and then it was mistakenly believed to have been published in Venice in 1552. In this tract, Isaac builds a model of the tabernacle and explores numismatics.⁴⁴ The text involves

⁴⁰ *A Precious Instrument*, London, British Library, Or. 2806, Margulioth Catalogue 1013/1, fol. 1r. נטע שעשועים literally means “a plant of delight”, in the sense of “a beloved child”. See BERNARD R. GOLDSTEIN, Descriptions of Astronomical Instruments in Hebrew, in: DAVID A. KING & GEORGE SALIBA (eds.), *From deferent to equant: a volume of studies in the history of science in the ancient and medieval Near East in honour of E.S. Kennedy*, New York 1987, pp. 124-128.

⁴¹ This new quadrant, which became very popular in Latin Europe, derived from the astrolabe, by the folding the stereographic projection of the heavens in half, twice. See GOLDSTEIN, Astronomical Instruments, pp. 121-3.

⁴² SPIEGEL, הגדה של פסח, pp. 16-17.

⁴³ RAANAN, שיר יצחק בן שלמה אלאחדב, p. 17.

⁴⁴ There is only one copy of this manuscript, which is located at the British

many area calculations and hence, apart from being an exegetical work, *Leshon ha-Zahav* can be considered of mathematical nature as well. The type of mathematics used here involves basic arithmetic, mainly multiplication. The types of numbers present are integers and fractions. The numeration system is either rhetorical or alphanumerical.⁴⁵

- *A saying on the definition of things*, (מאמר בגדרי הדברים): in this tract Isaac writes about the meaning of the mind, the soul, angels and stars.
- *A comment on the seven precepts for the sons of Noah* (הערה על ז' מצוות): these seven precepts (six negative and one positive) are perceived by the Jews as the basis of the ethical code for the non-Jews.
- *A commentary on the Azharot* composed by Rabbi Shlomo ibn Gabirol (Málaga c. 1021 - c. 1058 Valencia) (פירוש האזהרות שהביר ר' שלמה אבן גבירותול): Isaac declared that he “had only come to comment on the purity of the [author’s] language and the beauty of its subject”.
- Exegesis of the Passover *Haggadah*: This book includes rules for the *Seder* dinner, followed by an extensive commentary on the *Haggadah*. In the introduction, Isaac says that the purpose of his writing is “to explain some of the terms in the Passover *Haggadah*, as requested by some of his friends”. In the marginalia, Isaac insinuates the Reconquista (גלוות אדום). His language is clear and witty. He elaborates on every deed of the Eve of Passover. This exegesis was probably written in Sicily, since the local custom of having a lengthy *Kiddush* is mentioned.⁴⁶ Isaac also discusses the Sicilian habit of adding dates, grains and seedless raisins, apples, almonds, hazelnuts and spices to the Passover horseradish, instead of the habitual vinegar, in order “to render the *Matzah* tasty”.⁴⁷ In this tract, Isaac focuses on the interpretation of terms in the *Haggadah* and unlike other exegeses of this kind he does

Library, and to the best of our knowledge, this manuscript has never been published. The wrong assumption is due to Roth, see CECIL ROTH, Jewish Intellectual Life in Medieval Sicily, in: *The Jewish Quarterly Review* N.S. 47 (1957), pp. 323-334, esp. p. 324. Gutwirth expresses his intention to publish *Leshon ha-Zahav*, see GUTWIRTH, Fourteenth Century Supercommentaries on Abraham Ibn Ezra, pp. 149-150.

⁴⁵ For details about the contents and mathematical terms of this text see WARTENBERG, *The Epistle*, pp. 38-39.

⁴⁶ SPIEGEL, הגדה של פסח, p. 23.

⁴⁷ SPIEGEL, הגדה של פסח, p. 29.

not collect previous commentaries. Isaac's writing has a strong personal and independent touch.⁴⁸

Poetry

There are about ninety poems known to have been written by Isaac, all of which were studied and categorized. These poems have various natures: humorous-satirical, didactic-ethical and a few of religious character. In the poems dedicated to his sons on their wedding days, Isaac includes Maimonides' *Thirteen Articles of the Creed*. Another poem concerns the thirty-two hermeneutic principles interpreting the Torah according to the Jewish tradition. Isaac also wrote poems as prefaces to books, proverbs, polemics and rhymed prose. He is believed to have written a humorous prayer in which all words start with the Hebrew letter nun (נ).⁴⁹ No trace of this poem exists, but it is known that this type of poetry was common in the Iberian Jewish milieu, mainly as a brain teaser.

In one of his poems, Isaac complained about the religious interdiction to kill fleas on Shabbat. Two poems are addressed to the poet Zarahia Ibn Danon, mentioned above, as part of a polemic exchange between the two poets about whom of the two was the better poet. Another category of poems includes strophic poems, i.e., those in which the same rhyme scheme is repeated from one stanza to the other, such as in *Hymn to Esther* and *A Diligent man*. This poem is well-known, and is written with considerable wit, sarcasm and humour. In its composition, Isaac was probably influenced by Immanuel The Roman, who himself may have been influenced by the *serventes* and *vanti* poems. This poetic style, which was common in Italy, is characterized by bragging and vanity, a poetic style common in Christian Italy. In *A Diligent Man*, Isaac joyfully enumerates tens of social skills or trades which he himself practised. There are thirty-six stanzas, the first twenty-two of which open with the letters of the Hebrew alphabet in sequence and the

⁴⁸ SPIEGEL, הגדה של פסח, p. 23. Only one copy of this exegesis is known to have survived and it dates from the end of the 15th century, now owned by private hands. Originally, this copy belonged to descendants of Isaac, as can be read from the signature of the proprietor, Ḥabib ibn Isaac, and signatures of other family members on the cover. There are very few Passover exegeses which survived the persecutions on the Iberian Peninsula, this enhances even more the value of Isaac's exegesis.

⁴⁹ RAANAN, שירי יצחק בן שלמה אללאדב, p. 17.

last stanzas form the acronym **חזק ואמץ** (be strong and of good courage). The narrator tells us about his frequent change of professions. This long list of professions with their accompanying detailed descriptions sheds light on urban life styles among the Jews at that time. We can also learn about the Jewish perceptions of those professions, such as in the case of doctors, who are characterized as cupid.⁵⁰ Furthermore, Isaac is also attributed with a book on the art of poetry, of which all traces are lost.⁵¹

7. The Echoes of Isaac's Work

In some manuscripts are found the names of people and places relating to Isaac's work: students, copyists and readers. The leading figures are described below:

- Nissim al-Faragi is known to have been Isaac's student. Between 1429 and 1433, he copied quite a few of Isaac's manuscripts in astronomy, philosophy, exegesis and poetry. There is an interesting connection here: Nissim's son, Samuel, is no other than the shadowy Flavius Mithridates. Samuel was born in Caltabellotta, Sicily. He converted to Christianity in the 1460s and changed his name to William Raymond of Moncada, the name of his first patron, the Count of Adrano. He was a student at the University of Naples in 1473. Four years later, he arrived in Rome and met the Duke of Urbino, to whom he dedicated some astronomical tables in Latin. These tables derived almost entirely from Isaac's *Orah Selulah* (copied by his father Nissim). Although his tables depend on Isaac's *zīg*⁵², Mithridates does not mention the source of his tables, and this omission may have been deliberate. Around 1486, Mithridates translated cabalistic tracts into Latin for Giovanni Pico della Mirandola, for whom he served as advisor. Being a controversial personality, he nevertheless evoked admiration thanks to his uncommon knowledge and apparent genius and linguistic proficiency in Hebrew, Aramaic, Arabic and Syriac.⁵³

⁵⁰ ELEAZAR GUTWIRTH, Widows, Artisans, and the Issues of Life: Hispano-Jewish Bourgeois Ideology," in: BERNARD DOV COOPERMAN (ed.), *In Iberia and Beyond: Hispanic Jews Between Cultures*, Newark, DE 1998, pp. 143-173, pp. 154-6.

⁵¹ RAANAN, *שירי יצחק בן שלמה אלאחדב*, p.19.

⁵² I. e., an astronomical table.

⁵³ JOSÉ CHABÁS & BERNARD R. GOLDSTEIN, Isaac Ibn al-Hadib and Flavius Mithridates, pp. 147-8, 169, and ANGELA SCANDALIATO, *Le radici familiari*

- Muscato Bar Menahem completed copying *Instrument of Marvel* (חמדת אגרת כל) in 1482.⁵⁴
- Rabbi Abraham Zacut used *Orah Selulah* in his composition of the astronomical treatise *The big Composition* (החיבור הגדיל).⁵⁵
- Abraham ben Haim Gascon wrote a commentary on Isaac's astronomical tables in 1542.⁵⁶
- Rabbi Mordekhai ben Haim, completed in 1422 a copy of *An Epistle on the Precious Instrument* (אגרת כל חמדת), i.e., during Isaac's lifetime.⁵⁷
- Rabbi Samuel bar Yoav from Modena wrote a commentary on *Orah Selulah*.⁵⁸
- Joseph ben Suleiman copied Isaac's poem to his son Abraham in Baghdad in 1680.⁵⁹
- Isaac's astronomical tables and *The Precious Instrument* were used in Napoli in 1492⁶⁰ and in Baghdad, Jerusalem, Damascus and Palestine in 1738.⁶¹

culturali di Guglielmo Raimondo Moncada, ebreo convertito del rinascimento, nella Sicilia del sec. XV', in: MAURO PERANI (ed.), *Una manna buona per Mantova, Man Tov le-Man Tovah, Studi in onore di Vittore Colorni*, Firenze 2004, pp. 204-205.

⁵⁴ *The Precious Instrument*, Paris, Bibliothèque Nationale, MS Héb. 1051, fol. 138v.

⁵⁵ SPIEGEL, *הגדה של פסח*, pp. 11-12.

⁵⁶ Examples using Isaac's Tables are found in *The Paved Way*, New-York, Jewish Theological Seminary, MS 2571, fol. 1r. Also, see BERNARD R. GOLDSTEIN, *Theory and Observation in Ancient and Medieval astronomy*, London 1985, pp. 240, 244.

⁵⁷ *A Precious Instrument*, Paris, Bibliothèque Nationale, MS héb. 1065, fol. 70r.

⁵⁸ *Commentay on Orah Selulah*, Budapest, Magyar Tudomanyos Akademia, Kaufmann Coll. MS A13/14 (Kaufmann), fol. 242r.

⁵⁹ *A Poem to the Wedding day of Abraham*, Jerusalem, MS. Sassoon 778, fol. 105r.

⁶⁰ *A Precious Instrument*, Naples, Biblioteca Nazionale Vittorio Emanuele III, MS 12/31, fol. 173r.

⁶¹ *Astronomical and Astrological Tables*, Jerusalem, MS Sassoon 52, fol. 139r.

- Mordekhai Finzi, the Hebrew scholar from the 15th century, mentions Isaac's astronomical works.⁶² However, it is not known whether Finzi had read *The Epistle of the Number*. Bearing in mind that only one copy (from the 16th century) of the latter survived, it is safe to assume that *The Epistle of the Number* may have not been widely circulated during the 15th century.

8. Where was Isaac in 1391?

Given the dates and birthplace of Isaac, one has to wonder where Isaac was during the Castilian persecutions of 1391, since none of his writings mention these tragic events. Shirman is strongly convinced that Isaac fled the persecutions in Castile.⁶³ It is surprising that no scholar envisaged the possibility that Isaac was spared these horrible events. A careful reading of Isaac's poems does not reveal any insinuation of the persecutions, perhaps because the poems that reached us date from before 1391. None of his other works, whether exegetical or astronomical, bear any indication of these events, in particular of the atrocious death of Isaac's teacher, Yehudah bar Asher the Second. Several assertions are possible: perhaps the works in which these events were mentioned were lost. It is also possible that the scribe was confined by censorship and hence, could not copy the account of such horrible events.

In any case, even if Isaac were already outside Castile in 1391, either in Islamic land or in Syracuse, we would expect this news to reach him, due to the large movement of people from one land to another. Also, he may have still been in Castile and miraculously escaped. Or, he may have been in Islamic land learning mathematics or already in Sicily. I tend to believe that in 1391, Isaac had long left Castile. Assuming that no censorship considerations are valid I claim that had Isaac left Castile after the persecutions, one would have expected the introduction of *The Epistle of the Number* to include a reference to these horrors, in particular because his own teacher committed martyrdom. It seems therefore strange that in *The Epistle of the Number*, written after 1396, Isaac would recount only of his stay in Islamic land and the trip

⁶² Y. TZVI LANGERMANN, The Scientific Writings of Mordekhai Finzi, in: *Italia* 7 (1988), Nr. 1-2, pp. 7-44, esp. pp. 17, 20.

⁶³ השירה העברית בספרד ובפרובנס: מבחר שירים וסיפורים מהחצרם (The Hebrew Poetry in Spain and in Provence), Jerusalem 1954, p. 582.

to the Holy Land which was interrupted by a vicious storm, whereby these details pale when compared with a story of the persecutions.

Even though no clear-cut answer regarding Isaac's location in 1391 exist, at least I hope to raise the attention to the possibility that Isaac was not present, or even knowledgeable of the 1391 persecutions, a possibility that no scholar has raised so far. It remains to be wished that new evidence will emerge in the future, which will shed clearer light on this intriguing issue.

9. Summary

This article endeavoured to enhance the resolution of the past known image of Isaac's personal life and intellectual creation. It also traces Isaac's reading sources and the scholars that influenced him. Isaac lived in tumultuous times for the Jewish people; yet it is far from clear whether he was directly affected by them, in particular by the 1391 persecutions. From Castile to Sicily, passing through a Muslim land (אַהֲלִי קָדָר), Isaac transmitted science, exegesis and poetry to the Sicilian Jewish world and his work allows us to peep into one page of medieval Jewish intellectual activity.