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## ***Ulysses* through the Prism of Natural Sciences**

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**Abstract:** This paper aims at analysing references to the natural sciences in *Ulysses* (1920), by James Joyce their function in the novel and the nature of physics in it. The study also focuses on the ways that Joyce could have been influenced by Einstein's theory of relativity while writing *Ulysses*. Various approaches to the role of the sciences in *Ulysses* will be considered, and several episodes will be analysed through the prism of the theory of relativity and non-Euclidean geometries.

**Keywords:** Albert Einstein; Bernhard Riemann; Theory of Relativity; Geometry; Astronomy; Physics; Mathematics.

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It seems a worthwhile endeavor to analyse *Ulysses* (1920) by James Joyce through the prism of the natural sciences. It is particularly compelling to conduct this analysis using the ongoing discourse on the nature of physics that Joyce explores in this work, oscillating between Newton and Einstein. Several scholars have already attempted to study the works of Joyce from the point of view of the natural sciences, encompassing fields such as geometry, mathematics, relativity, quantum theory, new physics, topography<sup>1</sup>.

At least two approaches can be identified in the scientific discourse utilized in the works of Joyce? The first approach emphasizes the fact that Joyce's knowledge of the natural sciences was very poor. Some researchers, such as Richard Ellmann, suggest that Joyce's relationship with the sciences during his youth was not particularly positive. Describing the writer's medical studies at University College, Ellmann observes that Joyce "attended a few lectures in biology, chemistry, and physics, but his faculty of application to disagreeable subjects, which had sustained him at Belvedere, had diminished during his truant years at University College"<sup>2</sup>. Ellman refers to the sciences as "disagreeable subjects" for Joyce, implying that Joyce faced difficulties

in studying sciences. Similar to the Joycean critic, Dominika Oramus points out that “in his youth, Joyce did not enjoy the sciences”<sup>3</sup>.

Other scholars hold that Joyce read about science and employed scientific ideas in his works. Jean-Michel Rabaté observes that “Joyce had felt the necessity to update his scientific terminology and his view of modern physics, mathematics and astronomy around 1918, when he was preparing the Ithaca episode of *Ulysses*”<sup>4</sup>. Rabaté points out that Joyce is here<sup>5</sup> taking notes from a book or an encyclopaedia which reproduces the theories of Henri Poincaré, whose *La Science et l’hypothèse* (published in 1902) was extremely influential at the time, and triggered a controversy with Bertrand Russell. Russell published his *Introduction to Mathematical Philosophy* in 1919, and Joyce made extensive notes on this book in another notebook<sup>6</sup>. As we know, Poincaré was an important inspiration for Einstein.<sup>7</sup>

Also Patrick McCarthy reports that Joyce studied many mathematics texts which he hoped to mine for terms and problems that he intended to use in “Ithaca”<sup>8</sup>. McCarthy observes that Phillip Herring’s transcription of the notesheets for this episode contains many pages of mathematical terms, symbols, and operations<sup>9</sup>. The scholar holds “although many of the notes did not find their way into the final text of *Ulysses*, there are still an unusually large number of mathematical terms in ‘Ithaca’”<sup>10</sup>, and in *Ulysses* in general.

It is hardly possible to overestimate the importance of the natural sciences in *Ulysses*, especially in the Ithaca episode, from a biographical point of view. Although in his letter to Claud Sykes<sup>11</sup>, Joyce cites mathematics, astronomy, physics,

mechanics, geometry, and chemistry, we find references to even more natural sciences in the Ithaca episode. As Ellmann observes, Joyce “reported to Claud Sykes that he was *struggling with the acidities of Ithaca – a mathematico-astronomicophysico-mechanico geometrico-chemico sublimation of Bloom and Stephen*”<sup>12</sup>. Ellmann adds that Joyce stated this purpose more fully in a letter to Budgen. Joyce intended to write Ithaca in the form of a mathematical catechism, where “Bloom and Stephen thereby become heavenly bodies, wanderers like the stars at which they gaze”<sup>13</sup>.

For Joyce, one of the instruments to achieve this purpose to depict Bloom and Stephen as heavenly bodies is the introduction of astronomy and astrophysics into the text to create parallelisms between heavenly bodies and Bloom/Stephen. Hence, the use of the natural sciences in *Ulysses* is not incidental, it serves many purposes and helps Joyce realize his initial intentions expressed in his letter<sup>14</sup> to Budgen<sup>15</sup>. Joyce steadily follows this intention to depict protagonists as heavenly bodies; he describes Bloom as a wandering comet: Ever he would wander, selfcompelled, to the extreme limit of his cometary orbit, beyond the fixed stars and variable suns and telescopic planets, astronomical waifs and strays, to the extreme boundary of space, passing from land to land, among peoples, amid events<sup>16</sup>. Following the romantic idea that has been present in literature since the 19th century, and even earlier, other contemporary writers of Joyce, as for instance Olaf Stapledon, were inspired by the idea of portraying the protagonist as celestial bodies. The narrator of *Star Maker* becomes a bodiless spirit and wonders in the universe. Thus, Stapledon extrapolates

*Odyssey* far into space, not only to the past, but to the future as well. In *Star Maker*, Stapledon takes Joycean stream of consciousness employed in *Ulysses* even further, until it turns into telepathy: "In that sense, what is telepathy if not a transmitted stream of consciousness in its absolute and pure form?"<sup>17</sup>.

To realize his intention to depict Bloom and Stephen as heavenly bodies, Joyce employs astronomy extensively, often with meticulous details<sup>18</sup>, catalogues, as well as related sciences such as physics, geometry, mathematics. For Joyce, astronomy is an exceptionally suitable tool as it seamlessly integrates references to ancient times, when it was used by seafarers for navigation, with the modern context in which Bloom lives. Hence, astronomy and the related sciences not only help depict Bloom as a heavenly body but also create metaphorical connections between Bloom and Ulysses.

For the first time Joyce introduces astronomy in the Lestrygonians episode when Bloom is thinking about parallax<sup>19</sup>: "Fascinating little book is that of Sir Robert Ball's<sup>20</sup>. Parallax"<sup>21</sup>, parallax is mentioned by Joyce more than once<sup>22</sup>. However, Joyce has borrowed much more from Ball's<sup>23</sup> books. In the passage below, Joyce skilfully uses another concept from Ball's books, which conveniently unites references to the world of antiquity (as Joyce wanted his readers to feel that connection) with that of contemporary to Joyce science. Aristotle suggested that it might be possible to see the stars in daylight from a dark cave; Robert Ball in 1891 also mentioned

this possibility, substituting a shaft for a cave. [...] of the infinite lattiginous scintillating uncondensed milky way, discernible by daylight by an observer placed at the lower end of a cylindrical vertical shaft 5000 ft deep sunk from the surface towards the centre of the earth: of Sirius (alpha in Canis Maior) 10 lightyears (57,000,000,000,000 miles) distant and in volume 900 times the dimension of our planet: [...] of Orion with belt and sextuple sun theta and nebula in which 100 of our solar systems could be contained: of moribund and of nascent new stars such as Nova in 1901: of our system plunging towards the constellation of Hercules: of the parallax or parallactic drift of so-called fixed stars, in reality evermoving wanderers from immeasurably remote eons to infinitely remote futures[...]"<sup>24</sup>.

Here we witness a compelling integration of grand metaphors and scientific facts. While some of these facts have maintained their scientific status until the present (*e.g.* evolution of stars, the appearance of a "new star" in the constellation Perseus in 1901<sup>25</sup>), some of the facts mentioned are now obsolete, while in the times of Joyce they were considered scientific. For example, Joyce's reference to the possibility of seeing the stars during the day is based on a common belief of his time. At the turn of the 19<sup>th</sup> and 20<sup>th</sup> centuries, it was considered a solid scientific fact, described by R. Ball.

[...] A good telescope will always show the stars, and even without a telescope, they can sometimes be seen

in daylight in rather an odd way. If you can obtain a glimpse of the blue sky on a fine day from the bottom of a coal pit, stars are often visible. [...] The eye thus becomes more sensitive, and the feeble light from the stars can make its impression, and produce vision<sup>26</sup>.

Sometimes Joyce uses astronomy, maths, and other natural sciences to characterise Bloom in an ironic way, as in the following passage: As a physicist he has learned that of the 70 years of complete human life [...] 20 years are passed in sleep. As a philosopher he knew that [...] only infinitesimal part of any person's desires has been realised. As a physiologist he believed in the artificial placation of malignant agencies chiefly operative during somnolence<sup>27</sup>.

Bloom's further expertise in astronomy comes forth when "Bloom was pointing out all the stars and the comets in the heavens to Chris Callinan and the jarvey: the great bear and Hercules and the dragon, and the whole jingbang lot. [...] He knows them all, faith"<sup>28</sup>. The irony of the situation lies in the fact that, while Bloom demonstrates his expertise in astronomy to Callinan, he does not notice Lenehan taking liberties with Molly. Joyce depicts Bloom in a satirical way, as the latter seems to know a lot about remote worlds but does not notice what is going on right in front of him. McCarthy holds that a big number of scientific terms, concepts, errors employed by Joyce create an ironic effect that is suggestive of an artistic uncertainty principle. For McCarthy, the central irony of "Ithaca" lies in the fact that the style gives us the impression that everything

is being described quite precisely. In the meantime, many errors and other details (e.g. the problem of squaring the circle) let us conclude that a sort of artistic uncertainty principle is at work in this episode<sup>29</sup>. The scholar concludes: "The large number of errors in mathematical descriptions of the characters serves a satiric purpose"<sup>30</sup>.

Bloom is interested in astronomy; M'Coy tells Lenehan that Bloom bought a book about astronomy, with stars and comets with long tails<sup>31</sup>. During Bloom's contemplations as to "what final visual impression was communicated to him by the mirror"<sup>32</sup>, we come across the optical reflection of the same book. It is *A Handbook of Astronomy*, referred to in Bloom's inner monologues and it is not the only textbook of science on the shelf, there is also a book on *Geometry: Short but yet Plain Elements of Geometry*<sup>33</sup>. It is no coincidence that we encounter both books on astronomy and geography on the shelf. Geometry is widely used in astronomy; the extensive use of geometry in the novel is not incidental: both sciences are put to work to create parallelisms between Bloom and Ulysses. Hence, geometry plays a very important role in *Ulysses*. First, it metaphorically connects Bloom to the times of Ulysses when the knowledge of astronomy and geometry was indispensable for sea navigation. It also roots Bloom in the present via a book on geometry and allusions to non-Euclidian [e.g. Riemannian] geometry. Geometry and astronomy metaphorically project Bloom into space as a heavenly body, using, for example, the concept of parallax. Geometry also launches Bloom and the novel into the future by merging Riemannian geometry, which paved the way to Einstein's relativity, with the New Physics.

Euclidian and non-Euclidian geometry is also intertwined into the narrative structure of *Ulysses*. Speaking about the development of non-Euclidean geometries, McCarthy observes that mathematicians can make any assumptions provided they are not self-contradictory<sup>34</sup>. According to the scholar, Joyce knew this in general terms and tried to use this knowledge in his novel<sup>35</sup>. McCarthy concludes that “The literary equivalent of the development of non-Euclidean geometries is that the writer may construct any fictional world he likes, adopt any style or point of view he likes; in other words, Joyce may make any assumption about his characters and is not bound by assumptions of previous writers about how a novel should be constructed”<sup>36</sup>.

There is still an ongoing process of employing some geometrical concepts by literary studies, especially those related to narratology. As McMorran observes, literary criticism has also tended “in the direction of geometry”:

Narratives can be linear, circular or multi-directional; revisit common points and envisage them from different angles; diverge, overlap or run parallel with other narrative strands; operate on different semantic planes or dimensions intertextually; and – on the level of language itself – be elliptic, chiasmic, hyperbolic or circumlocutory<sup>37</sup>.

Indeed, most of these terms may be applicable to Joycean prose. McMorran reports that Michael Gillespie explores critical and aesthetic re-appropriations of the linear in *The Aesthetics of Chaos: Nonlinear Thinking and Contemporary Literary Criticism*. He points out that

non-linearity is not only an essential facet of modernist literature but it has also come to define the way we describe it: “[t]he New Physics, which has already had an impact upon the way we think in general, also has specific application to literary criticism, as the procedures of non-linearity can be employed for a better accommodation of our needs as readers<sup>38</sup>.

Geometry in *Ulysses* can be seen as a link between Newtonian physics and the new physics treated in the second part of the paper. Joyce pays tribute to George Riemann<sup>39</sup>, who was another “giant” that influenced the theory of relativity. “Riemannian revolutionary geometry not only laid the foundation for Einstein’s relativity but anticipated other major developments in physics”<sup>40</sup>. As said, also Poincaré was an important inspiration for Einstein. Rabaté mentions that Joyce read Poincaré and “Poincaré’s aim was to introduce a conception of relativity [...]. His starting point was the new mathematics of Lobachevski and Riemann, which he explains at length”<sup>41</sup>. Rabaté observes Joycean notes on geometries of Lobatschewsky and Riemann, saying: “When Joyce sums up their differences: Eud. space no total curvature of spine (Milly)// Lobatschewsky const. tot. curv. neg// Riemann “” pos. 4// he reproduces what Poincaré says about these geometries [...] adding with a kind of schoolboyish humour, a pun on the ‘curvature of the spine’ which could have applied to Milly Bloom, but was not used<sup>42</sup>.

In his notes<sup>43</sup>, Joyce briefly confronts Euclidian and non-Euclidian geometries. According to McMorran, “it is questionable whether Joyce’s knowledge

of Euclidian geometry was all that 'basic' given that he had to pass two geometry modules for his matriculation examination at UCD<sup>44</sup>. The reference to Riemann Joyce made in his notes is fundamental for our understanding of the nature of physics Joyce employs in the Ithaca episode. Boyarkina observes:

Riemann's study of gravity and warping of hyperspace paved the way for Einstein's relativity, which postulated that the gravity of extremely massive objects curves the spacetime continuum around them into tunnels that hypothetically might serve as passages between two different points in time or space in the same universe or might connect different universes. [...] we should remember that like Newton, also Riemann "stood on the shoulders of giants" in his study of gravity, his research was grounded in the Newtonian laws of gravity, who in his turn used the works on gravity by Johan Kepler [...]<sup>45</sup>.

The name of Kepler is also used by Joyce in *Ulysses*<sup>46</sup>. As we know, in his celebrated lecture at the University of Göttingen, Georg Riemann presented his theory of higher dimensions. In his essay "On the Hypotheses Which Lie at the Foundation of Geometry", Riemann demonstrated the properties of higher-dimensional space. This essay shattered the foundations of classical Euclidian geometry<sup>47</sup>.

An important reference to Riemann's thought appears at the beginning of the Ithaca episode:

What parallel courses did Bloom and Stephen follow returning? Started

united both at normal walking pace from Beresford place they followed in the order named Lower and Middle Gardiner streets and Mountjoy square, west: then at reduced pace, each bearing left, Gardiner's place by an inadvertence as far as the farther corner of Temple street, north: then at reduced pace with interruptions of halt, bearing right, Temple street, north, as far as Hardwicke place. Approaching, disparate, at relaxed walking pace they crossed both the circus before George's church diametrically, the chord in any circle being less than the arc which it subtends<sup>48</sup>.

According to McMorran, here "Joyce evokes Riemann's elliptic version of the parallel postulate"<sup>49</sup> when Bloom and Stephen take parallel courses despite started united. I agree with this idea. I would like to emphasize that it seems very symbolical that their parallel courses cross the circle precisely near the church that also bears the first name of Riemann. Interestingly enough, this church appears more than once in *Ulysses*, it dominates the landscape and attracts the strands of narration as massive objects in the theory of relativity curve the spacetime continuum around them; hence, it may be seen as a metaphorical allusion to the theory of relativity.

In the *Ithaca* episode, Bloom can be seen thinking about the universe, its scale and evolution. Bloom is contemplating the vast variety of life throughout the evolution of our planet; this passage alludes to several natural sciences including geology, biology, microbiology, chemistry, physics:

Were there obverse meditations of involution increasingly less vast? Of the eons of geological periods recorded in the stratifications of the earth: of the myriad minute entomological organic existences concealed in cavities of the earth, beneath removable stones, in hives and mounds, of microbes, germs, bacteria, bacilli, spermatozoa: of the incalculable trillions of billions of millions of imperceptible molecules contained by cohesion of molecular affinity in a single pin-head: of the universe of human serum constellated with red and white bodies, themselves universes of void space constellated with other bodies, each, in continuity, its universe of divisible component bodies of which each was again divisible in divisions of redivisible component bodies, dividends and divisors ever diminishing without actual division till, if the progress were carried far enough, nought nowhere was never reached<sup>50</sup>.

Bloom also contemplates the possibility of alien life and the inhabitability of the planets: "Did he find the problems of the inhabitability of the planets and their satellites by a race, given in species [...]?"<sup>51</sup> In *Ulysses*, there is no indication that Bloom has read *The War of the Worlds* by H. G. Wells (1898), published before Joyce started drafting *Ulysses*. However, we know that Wells appreciated *Ulysses* and Joyce considered Wells a very appreciative critic of his work<sup>52</sup>.

In the passage below, some influence of Wells might be traced when Bloom contemplates constructed human species on other planets. The passage also contains

references to mathematics, medicine, biology, and physics.

Why did he not elaborate these calculations to a more precise result [...] in 1886 when occupied with the problem of the quadrature of the circle [...]. Conscious that the human organism, normally capable of sustaining an atmospheric pressure of 19 tons, when elevated to a considerable altitude in the terrestrial atmosphere suffered with arithmetical progression of intensity, according as the line of demarcation between troposphere and stratosphere was approximated from nasal hemorrhage, impeded respiration and vertigo, when proposing this problem for solution, he had conjectured as a working hypothesis which could not be proved impossible that a more adaptable and differently anatomically constructed race of beings might subsist otherwise under Martian, Mercurial, Veneral, Jovian, Saturnian, Neptunian or Uranian sufficient and equivalent conditions, [...] an apogean humanity of beings created in varying forms with finite differences resulting similar to the whole and to one another [...]<sup>53</sup>.

The last sentence clearly refers to genetic engineering (eugenics in the times of Joyce) applied to the human race. This idea might have been picked up by Joyce during his short studies of medicine or might be a sign that Joyce was influenced by H. G. Wells on this issue. As we know, Wells was an advocate of eugenics starting from his *The Island of Dr Moreau* (1896)<sup>54</sup>. Joyce suggests an idea that eugenically modified,

constructed human species can inhabit other planets. The idea of “constructing other human species” was already in the air in the beginning of the 20<sup>th</sup> century; eight years after *Ulysses* publication, it was further developed by Stapledon in *Last and First Men* (1930)<sup>55</sup>.

The passage below is important, because it further shows how Joyce employs astronomy and other sciences to realize his intention to associate Bloom and Stephen with heavenly bodies. Here we once more encounter a fusion of astronomical scientific facts with astrological concepts, combining the names of notable scientists and writers with those of Bloom and Stephen. Constantly changing points of view and recalibrating systems of reference from the universal scale to the single lives of the Blooms, Joyce treats Bloom with irony but at the same time, steadily follows his intent to depict Bloom and Stephen as heavenly bodies and to inscribe them into the magnificent frame of the Universe, choosing astronomical events as reference points to their birth.

Which various features of the constellations were in turn considered? The various colours significant of various degrees of vitality [...]: their degrees of brilliancy: their magnitudes [...]: their positions: [...] the interdependent gyrations of double suns: the independent synchronous discoveries of Galileo, Simon Marius, Piazzzi, Le Verrier, Herschel, Galle: the systematisations attempted by Bode and Kepler [...]: the [...] compressibility of hirsute comets and their [...] orbits [...]: the sidereal origin of meteoric stones: the Libyan floods on Mars

[...]: the annual recurrence of meteoric showers [...] the new moon with the old moon [...] the posited influence of celestial on human bodies: the appearance of a star [...] about the period of the birth of William Shakespeare [...] and of a star (2nd magnitude) [...] which had appeared in and disappeared from the constellation [...] about the period of the birth of Leopold Bloom [...] the attendant phenomena of eclipses, solar and lunar [...].<sup>56</sup>

Another question very closely connected to the use of the natural sciences in *Ulysses* is the nature of physics Joyce employs in the novel. Since the publication of Einstein's general and special theories of relativity and their gradual popularization, there have been various attempts to apply relativity to the analysis of Joycean works. There is no unanimity among Joycean scholars about the legitimacy of the application of the Einstein's theories of relativity to the works of Joyce, but we can distinguish several approaches. Some scholars, like Salvadori and Schwartzman hold that “Joyce's mechanics are totally Newtonian”<sup>57</sup>. Also, Whittaker and Jordan hold that “the physics of the narrative remain Newtonian”<sup>58</sup>. Others claim that Joyce read about the new physics only after publishing *Ulysses* in 1922. Allen Thiher, for instance, states the following: “Joyce did not know anything about Heisenberg or quantum theory when he was writing *Ulysses*. In fact, quantum mechanics didn't exist yet when he was writing *Ulysses*, and Joyce probably knew little at that time about Einstein and relativity. It is dubious that Joyce knew much of anything about



the new physics until after publishing *Ulysses*<sup>59</sup>.

Indeed, there is no biographical evidence suggesting that Joyce would have had Einstein in mind for *Ulysses*, so further clues in the text are necessary to establish the relation between relativity and *Ulysses*, especially given the fact that many chronological and informational discrepancies in the novel cannot be an accident but a part of a larger experimental pattern. However, it is clear that occurrences in *Ulysses* of certain names, people and concepts related to the theory of relativity, quantum mechanics, some other hypotheses are by no means incidental.

Some researchers, like Jeff Drouin, observe that “Joyce did not adopt one or the other physical model exclusively, but only those aspects that suited his artistic ends. In fact, we can regard the physics in a given section as Newtonian, while the whole episode [“Wandering Rocks”] with its relationships between limited perspectives is Einsteinian<sup>60</sup>.”

Other scholars point out aspects of Einsteinian physics in Joyce. A considerable amount of such studies are focused on *Finnegans Wake*, which contains many direct references to Einstein and on *Ulysses*, which narrative technique demonstrates various experiments with the treatment of the space-time continuum. Sanson observes that two articles deal affirmatively with the links between *Ulysses* and Einsteinian theory, while Fleishman only briefly refers to Einsteinian cosmology in ‘Ithaca’: “Hannay identifies Einstein’s relative motion postulate in the movement of Bloom’s crumpled paper ball in the “Throwaway of ‘Wandering Rocks’”. Stephen Whittaker and Francis Jordan

find that Bloom’s musing about light at U 4.83–86 hints at relativistic time dilation<sup>61</sup>. Sanson observes that in 1927 Wyndham Lewis directly claimed a relation between *Ulysses* and Einstein, though, according to Lewis, it was more a spiritual connection than a scientific one<sup>62</sup>. Sanson points out, “Joyce never refused Lewis’s basic assumption: that *Ulysses* is organized along the lines of Einsteinian time theory, ‘the universal philosophy’ of time established by the special and general theories<sup>63</sup>. This fact may demonstrate that Joyce had Einstein in mind while writing *Ulysses*.”

Joyce’s obsession with time in *Ulysses* is well known, “contemporary literary critic Wyndham Lewis severely condemned Joyce for being obsessed with time in his novels<sup>64</sup>. Udaya Kumar examines the pervasive use of repetition in *Ulysses* showing that this results in a disruption of linear time<sup>65</sup>. Analyzing time in *Ulysses*, it becomes obvious that the Joyce’s organization of time is slippery; the writer constantly shifts out of the present, into the past, into the future and back again<sup>66</sup>. As Sanson holds, “This constant sabotage of Newtonian time by Einsteinian warpage of circular patterning is highlighted in several ways. The text virtually abandons any form of linear organization after *Wandering rocks*<sup>67</sup>. There are constant shifts between exterior, naturalistic and chronological time and interior, psychological response to time and reworking of that time. Sanson draws a conclusion that Leopold Bloom is constantly on the verge of an Einsteinian epiphany, though he clings to Newtonian principles<sup>68</sup>, while anticipating Einstein’s theory of relativity.”

It is hardly possible that *Ulysses* was not even minimally influenced by Einstein’s

relativity, considering the significant impact of the latter both in academic circles and among the general public. I would like to emphasize that Joyce lived through and witnessed the transition from Newtonian physics to the New physics like quantum mechanics, the theories of relativity of Einstein, etc. Since these transitions were widely discussed not only by scientists and academics but also by ordinary people<sup>69</sup>, it is hard to imagine that Joyce missed all these discussions altogether and was not influenced by them at all. Especially if we take into consideration, that the special theory of relativity was published in 1905 and Joyce started drafting *Ulysses* in 1906. In the beginning of the 20th century the groundbreaking relativity theory was widely discussed, so once Einstein even wrote to his friend, the mathematician Marcel Grossman, "This world is a strange madhouse [...]. Every coachman and every waiter is debating whether the relativity theory is correct"<sup>70</sup>. With such a huge resonance that the special and general relativity found in the society, it is no wonder that many prominent artists and writers speculated about it in their works, Joyce being no exception. According to Sanson, Joyce was drafting *Ulysses*, incorporating some of Einstein's accomplishments into the characterisation of Bloom, while Einstein's name and theories were very popular in the media<sup>71</sup>.

Other researchers argue along these lines. Duszenko suggests that Joyce was inevitably exposed to the discussions about Einstein's relativity theory while living in Paris in 1920 due to the publicity that surrounded the experimental confirmation of the general theory of relativity in 1919 "both through media coverage and through

his contacts with the artistic milieu of the French capital. [...] Relativity and its implications were an important part of the intellectual atmosphere of the time"<sup>72</sup>.

Joyce clearly knew about Einstein and his great contribution to science, as it follows from his letter to Harriet Shaw Weaver in 1927, when 167 important people agreed to sign the protest against the theft of *Ulysses*. In this letter, Joyce mentions that the protest has been cabled to 900 papers in U.S. The writer felt honoured by many of the signatures and humiliated by some, including Gentile, Einstein and Croce<sup>73</sup>. Rabaté suggests "it is probable that most of Joyce's notions of relativity derive from the 11<sup>th</sup> edition of the *Encyclopaedia Britannica*"<sup>74</sup> (1911). We also should keep in mind that Joyce communicated with some contemporaries with solid scientific backgrounds (e.g. with H.G. Wells)<sup>75</sup> and this fact could not but influenced his writing and understanding of sciences. Sypek suggests that Joyce's knowledge about Einstein and relativity could also have come from British and Irish newspapers. Sypek cites Ellmann who observed that the notes made by Joyce's brother in his diary in 1906 demonstrated that Joyce would often write to his Aunt Josephine in Dublin asking for Irish newspapers, magazines, and books<sup>76</sup>. Ellmann holds that in his notebooks for *Finnegans Wake*, Joyce took the vast majority of notes from Irish newspapers and periodicals. Also Joyce's friends often saw him reading English newspapers<sup>77</sup>.

Sypek studies the coverage of relativity in *The Times* and *Irish Times*, starting from "The Revolution of Science," published by *The Times* on November 8th, 1919, which aimed at popularizing of new physics. Sypek observes:

On this day, both *The Times* and the *Irish Times* present information on Einstein and his 'remarkable' theories. They provide brief biographical sketches of the physicist while reporting the discussion on his work held the previous week at the Royal Society in England after a total eclipse experiment in Brazil that supported the hypothesis of general relativity<sup>78</sup>.

Sypek holds that such phrases as 'the Newtonian principle has been upset', 'a new philosophy of the universe' (*The Times*), 'may revolutionize human thought,' and 'threatens the fundamental axioms of physical science' (*Irish Times*) make it evident that the radical implications of Einstein's work was not lost<sup>79</sup>. Sypek reports that Einstein was asked by *The Times* to write an article on his new theories, which was published on November 28th, 1919. In this article, Einstein explained his theories in understandable language and discussed their place within the greater Newtonian scientific tradition<sup>80</sup>. According to Sypek, this article does two things: "First, it shows how the everyday reader of a daily newspaper can grasp Einstein's science, with some degree of accuracy. Second, it shows the initial stages of Einstein's ascendance into cultural iconography"<sup>81</sup>. Sypek observes that toward the end of 1919 several articles on Einstein and relativity appeared. The researcher points out that *The Times* published various articles on Einstein between 1919 and 1922, including philosophical musings, letters to the editor, and cultural analysis. Sypek notices a significant increase in the number of articles in 1921. The researcher also reports that an article dated June 20<sup>th</sup>, 1921 employed relativity to

describe Shakespeare<sup>82</sup>. The researcher observes that *Irish Times* published the next article on Einstein on October 24<sup>th</sup>, 1922, which described his candidacy for the Nobel Prize in physics. Sypek concludes that "Einstein's coverage in *The Times* was steady and generally laudatory [...]. Although the *Irish Times* was less consistent in its reportings, it presents small morsels of information about Einstein and his science"<sup>83</sup>. Thus, we see that the information about Einstein and his theories was abundant in *The Times* and the *Irish Times*, and Joyce could have used what he read in his writing.

Scholars point out that Einstein's theories found a very fertile ground in arts and literature<sup>84</sup>. As an early example, see the article from 1921 cited above, which used relativity to describe Shakespeare's plays. Duszenko explains why the theory of relativity was so attractive to many artists, Joyce being no exception.

The spirit of Einstein's theory was too well suited to the modernistic temper of the Paris avant-garde [...]. The radical character and abstract nature of the new theory, the sense of crisis accompanying its creation, and the emphasis on the subjective element in the new definition of time led several artists to embrace [...] relativity as a dramatic scientific counterpart to their own artistic and philosophical endeavors. The 'exiled' Dubliner was one of them<sup>85</sup>.

Speaking about relativity in *Finnegans Wake*, Duszenko observes that subjectivity and relativism are central to both *Finnegans Wake* and Einstein's theory<sup>86</sup>. We can

conclude that this is true about Einstein's theory and *Ulysses*, and there are more allusions to Einstein's theory in the novel. Jay Jim finds references to Einstein's relativity in the opening sentences of the Ithaca episode. Jay holds,

'Ithaca' reimagines the speed of light here as normal walking pace. As Bloom and Stephen perambulate back home, there is a continual decrease in walking pace [...]. By the time they approach George's church, [...] their speed is no longer fast enough to sustain relativistic phenomena, and their world returns to a Euclidean approximation<sup>87</sup>.

Jay concludes that the diegetic world that Bloom inhabits is Newtonian, while the world of 'Ithaca' is not<sup>88</sup>. The passage below may also be seen as an attempt of metaphorical interpretation of the special relativity theory by Joyce. Molly and Bloom are lying in bed. "At rest or in motion?"<sup>89</sup> They are "[a]t rest relatively to themselves and to each other. In motion being each and both carried westward, forward and rereward respectively, by the proper perpetual motion of the earth through ever changing tracks of neverchanging space"<sup>90</sup>.

Here we see how Galilean relativity is intertwined with some aspects of the special relativity theory, while Joyce is playing with different reference systems, space and time intervals, modes of narration. While Bloom and Molly are at rest relatively to themselves and to each other, and in motion carried by our planet, we are dealing with Galilean relativity. Then the special relativity theory comes into play metaphorically. Thus, we have Molly and

Bloom, lying on their bed and at the same time flying together with our galaxy at a high speed. I would like to point out that here we have a probability that they are observed, or perceived, by the omniscient narrator of *Ulysses*. If that is the case, we have an observer who observes objects that move at a speed (relatively) comparable to the speed of light.

There are still ongoing debates about the nature of the narrative voice, or voices, in the Ithaca episode and in *Ulysses* in general. Throughout the episode, Kumar observes neither continuity, nor homogeneity of attitude on the part of the narrator<sup>91</sup>. Karen Lawrence employs the term 'lateral imagination', which puts together facts but does not establish any sense of priority among them<sup>92</sup> and "sweeps backwards and forwards both in time and in space"<sup>93</sup>. Wu holds that "Joyce's omniscient narrator ingeniously retreats from overt comments, coats his comments a layer of allusion and symbols [...]"<sup>94</sup>. For Fritz Senn it is "[s]ome abstract entity, outside [...] the characters' consciousness"<sup>95</sup>. Thus, if we summarize these definitions, we have "a lateral imagination" that "sweeps backwards and forwards both in time and in space", "some abstract entity outside the character's consciousness" "with no continuity or homogeneity of attitude on the part of the narrator throughout the episode". We might suggest, that according to the probability theory (also referred to by Joyce in *Ulysses*<sup>96</sup>), at a certain moment the narrator may find himself in space at a very far distance from Bloom and Molly that are moving at a high speed together with our galaxy. Thus, this situation may be seen as an artistic and metaphorical allusion to the special theory of relativity by Einstein. Effects

of the special relativity, like changing of lengths and time intervals can be observed at speeds close to the speed of light; probably, Joyce thought that galaxies are moving with that speed because at his time no exact data was available. Moreover, even today there is no unanimity about the speed of galaxies, because speed depends on the choice of a reference system<sup>97</sup>.

As far as the error of the “westward” turning planet in the passage above is concerned, as several scholars have noted it<sup>98</sup>, however, it may be seen as one of the many intentional errors made by Joyce. Jay suggests that it “further entrenches, or as Eddington phrased it, further assigns, space and time to the subjective-objective observer. After all, a simple turning of the head, viewed from outer space as if one were a comet, corrects this inaccuracy”<sup>99</sup>. This idea gives us one more reason to think that the observer/narrator views our planet from space and the error of the “westward” turning planet is one more hint that this episode may be interpreted as an

artistic allusion to the theory of relativity by Einstein.

This paper has analyzed *Ulysses* through the prism of the natural sciences. It has studied the way in which physics, mathematics, geometry, astronomy, and the relativity theory are employed and intertwined in *Ulysses*. The paper has focused on various approaches in the discourse about the sciences employed by Joyce and the nature of physics in *Ulysses*. It has demonstrated that the role of natural sciences is fundamental in *Ulysses*, and that they serve different purposes: to create ironic effect, and to allude to the uncertainty principle and the theory of relativity. It was shown that although *Ulysses* widely employs Newtonian physics, we may also find allusions to the relativity theory in it. Since Einstein’s theories are very complicated, the occurrences of concepts and terms alluded to in *Ulysses* have been considered, so that Bloom’s physics and its relationship to Einstein’s physics can be better understood.

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## NOTES

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- McCarthy, *op. cit.*, p. 609.
- Ibidem*, p. 610.
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- Claud Walter Sykes met James Joyce in Zurich during 1917 and the two formed a friendship that endured.
- Ellmann, *op. cit.*, p. 501.
- Ibidem*, p. 501.

14. Letter to Frank Budgen, end February 1921.
15. Frank Spencer Curtis Budgen (1882-1971) was an English painter and writer who became a friend of Joyce's in Zurich.
16. James Joyce, *Ulysses*, London, Penguin Books, 1992, p. 859.
17. Iren Boyarkina, "James Joyce and the Scientific Romances of H. G. Wells and Olaf Stapledon", in *Foundation: the International Review of Science Fiction*, no. 138, 2021, p. 11.
18. For example, see endnote 23, 48, 51, 54.
19. Parallax: in astronomy, the difference in direction of a celestial object as seen by an observer from two widely separated points. The measurement of parallax is used directly to find the distance of the body from Earth and from the Sun. Strand, Kaj, "Parallax" in *Britannica*. [www.britannica.com](http://www.britannica.com).
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21. Joyce, *op. cit.*, p. 194.
22. *Ibidem*, p. 212, 542, 610, 629, 819.
23. Sir Robert Stawell Ball (1840-1913) was an Irish mathematician and astronomer.
24. *Ibidem*, p. 819.
25. A "new star" appeared in the constellation Perseus in 1901 and was observed by Professor Winslow Upton at Brown's Ladd Observatory. <http://library.brown.edu/create/libnews/nova-persei/>
26. Robert Ball, *Star-Land*, London, Paris, Melbourne, Cassel and Company, 1891, p. 56.
27. Joyce, *op. cit.*, p. 1185.
28. *Ibidem*, p. 301.
29. McCarthy, *op. cit.*, p. 612.
30. *Ibidem*, p. 613.
31. Joyce, *op. cit.*, p. 299.
32. *Ibidem*, p. 832.
33. *Ibidem*, p. 833.
34. McCarthy, *op. cit.*, p. 612.
35. *Ibidem*, p. 613.
36. *Ibidem*, p. 613.
37. McMorrán, *op. cit.*, p. 9.
38. *Ibidem*, p. 9.
39. Riemann's first name is also mentioned several times in *Ulysses*.
40. Iren Boyarkina, "Passages through Spacetime: Science and Fiction", in Boyarkina Iren (ed.), *Passages Through Enclosures and the Spacetime Continuum in English and American Science Fiction*. Cambridge, Cambridge Scholars Publishers, 2022, p. 6.
41. Rabaté, *op. cit.*, p. 2.
42. *Ibidem*, p. 2.
43. Phillip Herring (ed.), *Joyce's Ulysses Notes and Early Drafts for Ulysses*, Charlottesville, University Press of Virginia, 1977.
44. McMorrán, *op. cit.*, p. 95.
45. Boyarkina, *op. cit.*, 2022, p. 6.
46. Joyce, *op. cit.*, p. 822.
47. Boyarkina, *op. cit.*, 2022, p. 4.
48. Joyce, *op. cit.*, p. 776.
49. McMorrán, *op. cit.*, p. 23.
50. Joyce, *op. cit.*, p. 819-820.
51. *Ibidem*, p. 820.
52. Boyarkina, *op. cit.*, 2021, p. 6.
53. Joyce, *op. cit.*, p. 1150.

54. See Boyarkina, *op. cit.*, 2018 for eugenics in Wells.
55. See Boyarkina, *op. cit.*, 2018 for eugenics in Stapledon.
56. Joyce, *op. cit.*, p. 1152.
57. Sanson, *op. cit.*, p. 9.
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60. Drouin, *op. cit.*, p. 6.
61. *Ibidem*, p. 8-9.
62. *Ibidem*, p. 8.
63. *Ibidem*, *op. cit.*, p. 6.
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66. Sanson, *op. cit.*, p.10.
67. *Ibidem*, p.10.
68. *Ibidem*, p.10.
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73. Joyce James and Gilbert Stuart, *Letters of James Joyce*, vol. 1, New York, Viking, 1957, p. 249.
74. Rabaté, *op. cit.*, p. 7.
75. Wells earned a Bachelor of Science in zoology; his first book was *Text-Book of Biology*, 2 volumes, published in London in 1893 by University Correspondence College Press.
76. Sypek, *op. cit.*, p. 55.
77. *Ibidem*, p. 55.
78. *Ibidem*, p. 56.
79. *Ibidem*, p. 56.
80. *Ibidem*, p. 57.
81. *Ibidem*, p. 57.
82. *Ibidem*, p. 57.
83. *Ibidem*, p. 57.
84. Boyarkina, *op. cit.* p. 6.
85. Duszenko, *op. cit.*, p. 62.
86. *Ibidem*, p. 70.
87. Jim Jay, "The Physics of Voice in Joyce's 'Ithaca'," in *Joyce Studies Annual*, no. 1, 2013, p. 245.
88. *Ibidem*, p. 245.
89. Joyce, *op. cit.*, p. 870.
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92. Lawrence Karen, "Style and Narrative in the 'Ithaca' Chapter of Joyce's *Ulysses*," in *ELH*, no. 3, vol. 43, 1980, p. 560.
93. *Ibidem*, p. 566.
94. Qingjun Wu, "The Covert Comments of the Omniscient Narrator in *Ulysses*" in *Comparative Literature: East and West*, no. 6, 2018, p. 63.
95. Fritz Senn, "Ithaca': Portrait of the Chapter as a Long List" in Gibson Andrew (ed.), *Joyce's "Ithaca"*, Atlanta, Rodopi, 1996, p. 45.



96. Joyce, *op. cit.*, p. 845.
97. Today, many astronomers think that our Milky Way has a speed of about 600000 m/s with respect to other galaxies. This speed estimation ranges from 130 000 m/s to 1000000 m/s and depends on the choice of a reference system. The speed of light in vacuum is 299 792 458 m/s. <http://znanierussia.ru/articles/>
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