1.-Discrete mechanics

1.1 Introduction

1.1.1 Taking into account the relativistic conflicts and inconsistencies we have found in the previous chapters, as well as the increasing claims for a discrete spacetime coming from other areas of physics as superstring theory or quantum loops theory, the consideration of a discrete, digital, discontinuous model for reality might be a reasonable proposal. As has been repeatedly said along its pages, the objective of this book is just to propose the consideration of a digital paradigm for explain the world.

1.1.2 Now then, if spacetime were of a discrete nature we would have to change our continuum-based concept of motion by a new digital conception: Discontinuous motion; motion through a fabric of indivisible quantum space units (qsits) along a succession of indivisible quantum time units (qtits). This chapter examines the (pre)fundaments of discrete motion as well as the principles of relativity from this new digital perspective. We will finally end our relativistic discussions by summarizing the reasons and conveniences of the digital paradigm.

1.2 Motion in discrete spaces

1.2.1 In Chapter **??**, it was proposed a new interpretation of Lorentz transformation: In the place of a spacetime distortion caused by relative motion, that distortion could be the consequence of ignoring the discrete nature of spacetime; of forcing its description in terms of analog mathematics. Lorentz transformation would be a necessary operator to translate between digital and analog languages. In the same chapter it was also proposed the consideration of CALMs as possible candidates for a new digital model of spacetime.

1.2.2 Although we know nothing on motion through discrete spacetimes (as in CALMs), let us have the luxury of a brief speculation about its possible nature, and then about the possibility of a discrete mechanics.

1.2.3 In the same way as with a film, we perceive motion as a continuous process. But, in the same way a film is a sequence of indivisible photograms, motion could also be a sequence of separated indivisible changes of positions. Imagine an ultramicroscopic object occupying a qsit at a certain qtit and then occupying a next adjacent qsit at the next qtit, and then occupying a next adjacent qsit at the next qtits, and so on. We would be describing a discontinuos motion at the maximum possible speed of one qsit per qtit.

1.2.4 Discontinuity would be the most striking characteristic of motion through discrete spacetimes because we always observe motion as a continuous process. But this could be the consequence of certain biological functionalities, the consequence of using certain scales for sensorial perceptions that can only yield sensations of continuity.

1.2.5 Notice first that discrete motion could only be described in terms of the successive qsits a body traverses during a certain number of qtits. The set of traversed qsits would be its (discrete) trajectory and the ration qsits/qtits its (discrete) velocity. Due to the discrete nature of spacetime that ratio will always be less or equal to 1. Thus, velocity would have a natural limit in discrete spacetimes and could only be expressed by rational numbers.

1.2.6 At least in the corresponding theoretical models, each qsit and each qtit of a discrete spacetime could be identified and, consequently, discrete motion could be described in absolute terms. For reasons of convenience we could also refer discrete motions to an arbitrary discrete reference frame, although in this case it would not be a theoretical artifact, as in the cases of the continuum-based models, but a particular collection of actual qsits.

1.2.7 Relative motion could also be arbitrarily defined. To say, for example, that an object A moves relative to other object B could simply mean that each time B moves, A also move, and that at certain qtits in which B does not move, A moves. But in any case the velocity and the trajectory of A can be independently defined in terms of the particular qsits A moves through in a certain number of qtits.

1.2.8 Acceleration could also be defined in discrete terms as the increment in the number of qsits an object traverses in a given number of qtits. For the same discrete reasons as in the case of velocity, it would also have a natural unsurmountable limit so that if the object moves s qsits in t qtits its acceleration would have to be limited by a maximum increment of $t - s$ qsits, simply because after such an increment it would have reached the maximum speed of one qsit per

qtit.

1.2.9 An interesting advantage of discrete mechanics is the successiveness of changes (of positions, velocities, etc.). As we will see in Appendix **??** successiveness is so necessary to solve the problem of change as impossible in the continuum spacetime.

1.2.10 Discrete mathematics and computational sciences could surely provided the appropriate instrumental for developing a discrete mechanics, although some of those instruments would surely have to be refined, particular those related to discrete geometries.

1.3 The principles of relativity in discrete mechanics

1.3.1 The universality of physical (natural) laws was already assumed as a fundamental principle by some of the Enlightenment geologists. I refer to the actualism and uniformitarianism principles which, without going into further historical and geological details, are in turn founded on the believing that physical laws are the same in all times and all places. This believing, in fact, legitimizes geology as an experimental science since the middle of the XIX century.

1.3.2 The first principle of the special theory of relativity also states the universality of the physical laws, but it introduces an additional artifact: the reference frames. Those laws are the same in all reference frames, in accordance with that principle.

1.3.3 Reference frames make the first principle of relativity different from the old geological principle and makes it inevitable the impos-

sibility of an absolute frame. As we saw in Chapter **??**, that impossibility is responsible for the inconsistency found in the case of the relativistic aberration of light (a visible and vertical laser beam in the proper frame of its emitting source has to be seen as an impossible moving vertical line from other frame RF_v that moves relative to RF_o in a horizontal direction).

1.3.4 That prohibition does not appears in discrete spacetimes. For example, the genuine electromagnetic considerations that led Einstein to formulate his special theory of relativity[1] do not appear in CALMs. In these models an electric charge will always move *through* the fabric of qsits rather than with respect to an observer, and then it will always produce a magnetic field, be it or not observed. From a CALM perspective to assume the laws of physics are universal is the same as to assume the laws of the CALM apply to the whole CALM.

1.3.5 In the case of the second principle, the existence of a maximum speed, be it or not the speed of light, is an immediate consequence of the indivisible minimum units of both space and time: nothing can last less than a qtit and nothing can move less than a qsit. So the second principle is not necessary in discrete spacetimes.

1.3.6 By considering space as a discrete physical entity whose stuff is not ordinary matter, but neither the vacuum, and through which all bodies move, we surely could explain nature in more appropriate terms. In those conditions Lorentz's transformation would only be an operator that converts the measurements performed in the discrete

[1] If an electric charge moves with respect to an observer he will observe a magnetic field, while if he moves with the charge he will observe an electric field.

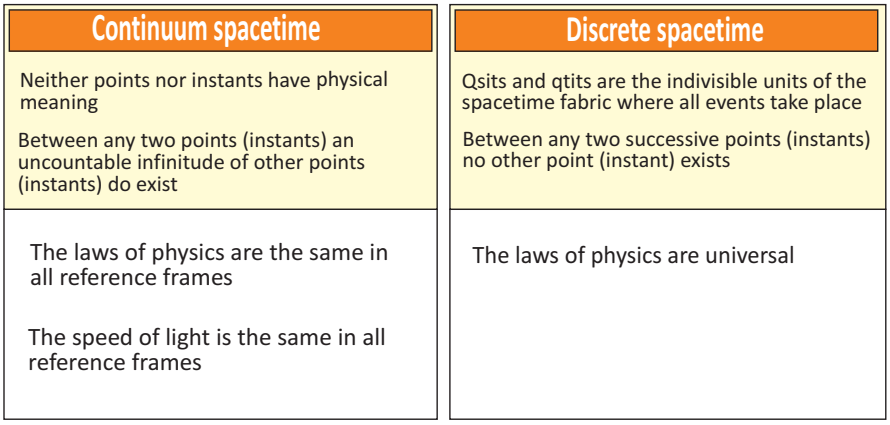

Figure 1.1: Digital models are considerably more simple than continuum-based models.

reality into the results expected from the analog perspective.

1.4 Final remarks

1.4.1 The spacetime distortions predicted by the special theory of relativity have been experimentally confirmed in numerous occasions and circumstances. Those distortions, on the other hand, could be reinterpreted in terms of discrete spacetimes where Pythagoras digital theorem holds. If that reinterpretation were correct, the special theory of relativity would be confirming the discrete nature of spacetime.

1.4.2 A discrete spacetime not only would serve to reinterpret the special theory of relativity, it would also be the key concept to found a discrete mechanics considerably more simple than the relativistic one. And also more consistent because none of the conflicts related

to the analog interpretation of Lorentz transformation we have found in the previous chapters appear in discrete spacetimes.

1.4.3 Reference frames are convenient to describe motion, but not formally necessary in discrete mechanics. Motion in discrete spacetimes could be, at least theoretically, defined in terms of absolute qsits and qtits. This possibility would resolve the inconsistency found in Chapter **??** on the relativistic aberration of light.

Bibliography