

This article was downloaded by:[Bochkarev, N.]
On: 11 December 2007
Access Details: [subscription number 746126554]
Publisher: Taylor & Francis
Informa Ltd Registered in England and Wales Registered Number: 1072954
Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



Astronomical & Astrophysical Transactions

The Journal of the Eurasian Astronomical Society

Publication details, including instructions for authors and subscription information:
<http://www.informaworld.com/smpp/title~content=t713453505>

The interplay of astronomy and philosophy

P. Flin^{ab}

^a Institute of Physics, Pedagogical University, Kielce, Poland

^b Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Moscow Region, Russia

Online Publication Date: 01 December 2003

To cite this Article: Flin, P. (2003) 'The interplay of astronomy and philosophy',

Astronomical & Astrophysical Transactions, 22:6, 837 - 839

To link to this article: DOI: 10.1080/1055679031000148640

URL: <http://dx.doi.org/10.1080/1055679031000148640>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article maybe used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

THE INTERPLAY OF ASTRONOMY AND PHILOSOPHY

P. FLIN^{a,b,*}

^a*Institute of Physics, Pedagogical University, ul. Swietokrzyska 15, 25-406 Kielce, Poland;*

^b*Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research,
141981 Dubna, Moscow Region, Russia*

(Received 27 November 2002)

The paper indicates the main common fields of interest in astronomy and philosophy.

Keywords: Astronomy; Philosophy

It is well known that astronomical bodies span an enormous scale of densities. In the famous de Vaucouleurs (1970) universal density–radius relation, the density scale extends over 45 orders of magnitude, from the density of neutron stars, that is the density of nuclear matter, through the density of supercluster regions, which is, on average, well beyond the best vacuum acquired in laboratories on the Earth. In this way, astronomical considerations allow one to study matter in extreme conditions. In the diagram in question the density of the human body can be marked, too. The existence of a human being is essential here. He or she is not only an observer of the surrounding Universe and the author of models and theories describing the Universe, but also the subject of reflections on the world.

In the present paper, I outline only some of the basic areas of the common investigations of astronomers and philosophers. A deeper analysis of the relations requires an extensive multi-volume critical analysis. I think, however, that a presentation of the relevant relations can be interesting, especially in the epoch of narrow specialization. This allows one to notice that the same objects and processes can be described and discussed from various points of view.

As early as the birth of natural philosophy, when philosophers from the Ionian school presented a general explanation of the Universe for the first time, the question as to the principle of all things was asked as well (Tatarkiewicz, 2001). This was the question addressing the issue of the main substance constituting the Universe, as well as the principles of its construction. This was a query on the nature of the sort of primordial elements, leading to the development of the whole of nature. Empedocles of Acragas postulated the existence of four elements (or roots), namely, fire, air, water and earth, while Leucippos and Democritus of Abdera were the founders of the atomic theory, assuming the existence of an infinity of indestructible atoms, differing only geometrically from one another. The philosophical idea of

* E-mail: sfflin@cyf-kr.edu.pl

explaining the diversity of matter by assuming the existence of just a few fundamental and indivisible parties can be traced throughout the whole history of science (Sarton, 1962). Modern physics started with the disintegration of atoms, but the search for indivisible particles can be easily observed there, leading to the rise of elementary-particle physics (Coughlan and Dodd, 1994). The notion of the lightest superpartners, which are stable by energy conservation (Kane, 2000), belongs to the same concept. These particles are the result of decay of all superpartners in the supersymmetric Standard Model. Moreover, the lightest superpartners can be regarded as the constituting elements of cold dark matter.

Another classic example of a relationship between astronomy and philosophy are problems connected with the properties of space and time. From the historical point of view, discussion of the existence of matter and vacuum (*i.e.* a region devoid of matter) is very instructive; it is partially connected with the problem of mutual interaction of two bodies at a distance, and the difficulty of explaining the motion of a body in void space (Grant, 1981). Another related problem is infinite extracosmic space. The problem of time is also both astronomical (*i.e.* how to measure and to keep it) as well as philosophical.

The Tycho Brahe hybrid model of the Universe is an example of the influence of philosophical thoughts on science. Tycho Brahe was an admirer of Copernicus, and especially of the geometry of his planetary theory, but not the idea that the Earth was moving (Thoren, 1990). Tycho Brahe was a magnificent observer, but there are no attempts by Tycho Brahe to detect stellar parallax are known. The hybrid model that he adopted was a Capellan variation of the Ptolomaic system. In the Tychonian system of the World a stationary Earth was circled by the Sun, with the interior planets orbiting around the Sun, instead of being placed between the Sun and the Earth as in Copernican theory. At first glance the impossibility of finding stellar parallaxes can be interpreted as being against the Copernican theory, but the lack of measurable parallaxes can be interpreted as being in favour of the theory. The enormous astronomical distance scale was pointed out by Copernicus (1453) himself in his *De Revolutionibus*, Book I, Chapter VI; this was the reason for the non-observability of stellar parallaxes. However, the great Copernican cosmos (Iwanowska, 1994) was in drastic contrast with the small one, described by the Greeks (Pedersen and Pihl, 1974) and accepted by Tycho Brahe and the majority of his contemporaries. Thus, the impossibility of accepting the huge cosmos scale connected with the philosophical background could be one reason that he constructed the hybrid model.

The move from a closed invariable static world to the infinite and dynamically changing Universe, which took place between the time of Nicolas of Cusa (cardinal Nicolaus Krebs) in the fifteenth century and those of Giordano Bruno at the end of the sixteenth century was of great importance for the origins of modern science. Both philosophers mentioned above presented their ideas of an unsteady world, but the idea between the times of Copernicus and Kepler received both observational (the comet of 1577, and the supernovae of 1572 and 1604) and theoretical (Kepler's laws) support; it was Newton who completed this process.

The problem of the origins of the Universe, the Solar System and the Earth, that is the cosmogony, from the times of the Ancient Greeks until now has been a source of both philosophical and astronomical considerations. It should be stressed that, contrary to the opinion expressed by some scientists, philosophical thoughts are based on the achievements of contemporary science.

Let us now turn our attention to the famous question: are we alone? The plurality of the worlds was, among others, accepted in the fifteenth century by Nicolas of Cusa. In the second half of the twentieth century the issue of inhabited worlds became strictly scientific. We are sending information on our existence, as well as surveying the sky, hunting for signals from other civilizations. The present-day technical equipment has allowed us to detect extra-solar planetary systems. Is there life in these systems? This problem, presently regarded as

observational and technical, was discussed by many philosophers. Each discovery in this field is of great influence on the considerations dealing with the origins of life, which is a field of interest for biology and philosophy alike.

Astronomical discoveries, regarded as a process of revealing the secrets of the Universe, full of achievements and failures, serve as case studies for the historians of science. Astronomy is often a basic field for discussing the role of models and theories in recognition. The laws and their role in the scientific explanation is also interesting for a philosopher. It can be stressed that the problems of causality and probabilistic explanation are of great interest here. This is connected not only with the interpretation of quantum mechanics but also with cross-sections of various reactions.

The origin of the currently popular 'anthropic principle' (Leslie, 1990), stating that the general properties of the Universe have to be compatible with the existence of mankind is then purely philosophical.

References

- Copernicus, N. 1453, *De Revolutionibus*, Nuremberg (reprinted 1973, Państwowe Wydawnictwo Naukowe, Warszawa).
- Coughlan, G. C. and Dodd, J. E., 1994, *The Ideas of Particle Physics*, Cambridge University Press, Cambridge.
- De Vancouleurs, G., 1970, *Science* 167, 1203.
- Grant, E., 1981, *Much Ado about Nothing, Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution*, Cambridge University Press, Cambridge.
- Iwanowska, W., 1994, *Nauka* 2, 3 (in Polish).
- Kane, G. L., 2000, *Contemp. Phys.* 41, 359.
- Leslie, J., 1990, *Physical Cosmology and Philosophy*, Macmillan, London.
- Pedersen, O. and Pihl, M., 1974, *Early Physics and Astronomy*, Elsevier, New York.
- Sarton, G., 1962, *Introduction to the History of Science*, Vol. I, Carnegie Institution, Washington, DC.
- Tatarkiewicz, W., 2001, *The History of Philosophy*, 3 Volumes, 17th ed. Państwowe Wydawnictwo Naukowe, Warszawa (in Polish).
- Thoren, V. E., 1990, *The Lord of Uraniborg*, Cambridge University Press, Cambridge.