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Atomism

Atomism takes every substance (including living beings) to be made up of indivisible and extremely small material particles, the atoms (greek *átomos* = indivisible). Every sensual quality of perceptible bodies has to be explained by the qualities, configurations, and changes of the atoms composing it, so that the (secondary) qualities of a compound are completely determined by and reducible to the (primary) qualities of its component atoms. Historically atomism can be traced back to antiquity, namely to the pre-Socratic philosophers of nature, Leucippus (born about 480/470 B.C.) and Democritus (about 460-370 B.C.). Due to Aristotle's convincing arguments against atomism, and because of its materialistic and atheistic world-view, it was unimportant during the Middle Ages. It was only with the seventeenth century, that atomism was transformed into a scientific theory. Pierre Gassendi (1592-1655) revived classical atomism again and explained the physical world as being constituted by finitely many atoms, which move in a void and have been endowed by God with a conserving momentum, thus freeing atomism from the stigma of being atheistic. He already allowed atoms to form compounds, which he called *moleculae* or *corpuscula*. The eighteenth and nineteenth century then gave rise to chemical atomism, distinguishing element from compound. While Isaac Newton (1642-1727) had already speculated in detail on the atomic nature of matter and light in his "Optics", physical atomism became widely accepted only after the development of the kinetic theory of gases in the nineteenth century. It strongly supported the deterministic world-view of classical mechanism.

With the discovery of the electron and of radioactive decay, atoms themselves were recognized as composites and not indivisible units. The first atomic models were constructed in analogy to a macroscopic planetary system obeying classical laws of motion (negative electrons circling around a nucleus of neutrons and positively charged protons), but they proved to be inconsistent. Erwin Schrödinger (1887-1961) and others then applied quantum mechanics to the atom. They substituted the electron orbits by probability distributions (orbitals), that indicate in which regions of space the electron is most likely to be found. The transition from one state of the atom to another also follows quantum principles, which imply fundamental uncertainties. It has also been shown, that two quantum objects, which interacted once, stay correlated in some of their properties, even if they move away from each other (EPR effect). Thus modern atomism with its dynamic view of matter has overcome the mechanistic tendencies of classical atomism and presents material reality as a holistic, fluctuating, and not fully determined net of coherence, which can not be reconstructed as a set of completely separable, massive objects, that follow determined trajectories. Consequently Alfred North Whitehead (1861-1947) suggested, that processes ('actual entities') rather than substances are "the final real things of which the world is made up" (PR 18).

Thus contemporary atomism opens new perspectives for the dialogue between science and religion, insofar nature can be envisioned as being open for divine and human creative action. Living beings, human values, the strive for meaning and fulfillment in life, religious beliefs, and science itself are not mere agglomerations and idle enterprises in a mechanical world of swirling atoms, but can be understood as emergent and meaningful phenomena in an evolving process of creation.

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