

Parallel Thinking Part 16: The Fabric of Reality 1

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The Rambam (Maimonides, d. 1204) proposed that the study of science and the natural world helps to bring a person to love and fear God. Understanding the nature of God's creation of a physical world is an essential scientific study for those who seek to enhance their understanding of God.

From a scientific perspective, it is very hard to pin down what physical things are actually made of. The ancient Greeks were the first to propose that all matter is made of fundamental, indivisible building blocks. The idea probably originated with the Greek philosopher Democritus, around 2,500 years ago. The word 'atom' comes from the Greek word *atomos*, which means indivisible. However, one of the most successful scientific endeavours of the late 19th and early 20th century was the discovery that atoms consist of smaller particles – protons, neutrons and electrons.

The model of the atom was refined by Danish scientist Niels Bohr (d. 1962), who described a central nucleus comprised of protons and neutrons surrounded by orbiting electrons. The dimensions of the atom are astonishingly small. Humans can see objects as small as 0.4 mm wide, roughly the diameter of a human hair. The width of a human hair contains approximately 100,000 atoms, end to end! Yet the relative distance between the nucleus and the orbiting electrons is vast. If we expanded the size of the nucleus to the size of a standard fishball, the electrons would be orbiting approximately five miles away. In other words, if that fishball was at the New West End kiddush, its electrons would be orbiting as far away as Golders Green United Synagogue! The rest of the atom is empty space, which means the vast majority of all physical objects is also empty space.

By the mid-20th century, scientists had discovered that these smaller building blocks

consisted of even smaller, fundamental parts called quarks. Trying to understand what quarks and electrons are made of is very challenging, even for scientists!

For our purposes, imagine a snooker table; these particles are represented by the different balls on the table. In varying circumstances, the balls could whizz around anywhere on the table; so too these particles could exist anywhere in the universe at any time. Physicists would describe the 'table' as a 'field'. The strength of the field in positions where there are no balls is low. In contrast, the strength where there is a ball is high. Electrons and quarks (like the snooker balls) are described by scientists in similar terms.

However, if those particles are always whizzing around at very high speed, they cannot come together to form all of the physical things in the Universe. In the mid-1960s, Peter Higgs proposed the idea that there is a unique field which gives other particles mass by slowing them down below the speed of light. This would be like someone pouring golden syrup all over the snooker table, which would slow the balls down so they could come together. The Higgs field has the same effect.

The discovery of the Higgs Boson, dubbed 'the God particle' proved the existence of this field which explains how almost everything in the Universe is solid and stays still. While scientists do not currently know how these fields originate, the concept highlights Einstein's famous remark that reality really is an illusion, "albeit a very persistent one".

