CrossMark

The codes of matter and their applications

Xiao-Lin Wang

Abstract The elements in the periodic table are the building blocks used to form substances with different compositions. Nevertheless, it is the properties of substances that are decisive for their existence and practical applications. Searching for new class of materials with exotic properties has always been challenging because of the complexity of both the theoretical and the experimental approaches developed so far. Here, we propose that the three ubiquitous and paramount attributes of all existing matter charge (Q), spin (S) or rotational motion, and linear motion (K) can be used to account for the formation of different types of matter/materials and their properties that have been or will be known to us. The three attributes or original codes can produce six primary codes which can further produce another sixty codes. The physical meanings represented by each code are unlocked. The table consisting of the 60 codes is introduced as the table of properties of codes of matter. We demonstrate that these codes can be used as building blocks to form new properties and new materials. Many new types of quasiparticles and new classes of materials with exotic properties of Q, S and K are predicted. Their possible experimental realizations are proposed. The possible applications of the codes of matter in other fields such as elementary particles, photonics and chemistry are briefly discussed. We know that there should

be more new materials and new electronic, spin and photonic states to be discovered, but we do not know what they are. The codes of matter clearly reveal to us how many and what they are and how easily we can recognize what they are. Experimental and theoretical exploration for new forms of matter, new quasiparticles, or new electronic and spin states, or new states of photon or properties of light, as well as macroscopic entities with exotic properties represented by the codes of matter, is imminent.

1 Introduction

Thanks to the existence of matter and its degrees of freedom, the codes of matter (including dark matter) and the attributes for their existence can be explored and unlocked. Elementary particles or matter particles form the elements in the periodic table, and they constitute all the matter in the universe and all the substances in our world. Each element in the periodic table can be used as a building block to form substances with different chemical compositions. The periodic table has guided the creation of new substances with unprecedented great success since its invention in the eighteenth century. Nevertheless, it is the characteristics or properties of matter that are most significant for us.

Despite the complexity of all the different forms of matter and their properties, some fundamental attributes or codes should exist with which all the different forms of matter are endowed. We have always been eager to explore the unknown properties of existing forms of matter without any boundaries. To do this, we need to determine what are

X.-L. Wang (✉)
Spintronic and Electronic Materials Group, Institute for Superconducting and Electronic Materials, Australia Institute for Innovative Materials, University of Wollongong, North Wollongong, NSW 2512, Australia
e-mail: xiaolin@uow.edu.au

the fundamental attributes or codes that are responsible for the existence of elementary particles and other forms of matter, as well as determining their properties.

Here, we propose three ubiquitous and paramount codes or attributes that are found in all the existing forms of matter—electric charge (Q), spin (S) or rotational motion, and linear motion (K), which can be used to account for the formation of all the forms of matter or entities and their properties that have been or will be known to us, based on the following principles. Due to the contrasting duality from the nature of negative and positive states for each attribute, these three ubiquitous attributes or original codes can produce six primary codes. One of the important conservation laws in the physics of the universe is charge conservation. The negative (−Q) and positive (+Q) charges in the universe are balanced. Microscopic and macroscopic objects have spins that are either clockwise (−S) (or spin down) or anticlockwise (+S) (or spin up), based on the right-hand rule. To allow the charges to function or to do work, freedom of linear motion in space (or momentum, K) has to be allowed, which can involve negative (−K) or positive directions (+K) in the one-dimensional (1D) case. Therefore, we now have three pairs of entities or six entities −Q, +Q, −K, +K, and −S, +S, as shown in

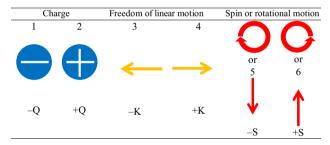Table 1. We denote them as the six primary codes, and they can determine all Q, K, and S states in all the building blocks of materials/matter or matter particles or quasiparticles that exist in reality. Simply by combining any two codes, these six primary codes can further produce another sixty codes as illustrated in Table 2. The 60 codes can account for all types of building blocks or various entities such as particles or quasiparticles or ions or atoms with different Q, S, and K states, and they have many significant implications and applications. Only 36 types of single entities or particles could be possible (Table S1 online), and many of them can find their corresponding counterparts in reality, whereas those codes or entities or particles unknown to us so far can be regarded as possible new particles or quasiparticles, and can guide and tempt us to explore their existence in reality. We demonstrate that these codes can be used as building blocks to form new physical states of matters or new materials. Therefore, the table consisting of the 60 primary codes is introduced as the table of properties of codes of matter. This is similar to the periodic table of elements, with the fundamental difference that the former provides direct guidance for the formation of matter/materials based on properties, whereas the latter yields compounds with little information on physical properties. By pairing the 60 codes (or using the 60 codes as building blocks), many new types of quasiparticles and new classes of materials with exotic properties of Q, S, and K are predicted. The physical meanings represented by each code in Table 2 are unlocked, and their possible experimental realizations are also proposed.

The principles of the codes of matter reveal that searching for new forms of matter/materials will never be exhausted. The codes of matter can also find great applications in searching for new microscopic and macroscopic systems, from elemental particles to macroscopic objects. Experimental and theoretical exploration for new forms of

Table 1 Six primary codes: Q, K, and S

Table 2 Properties of the codes of matter produced by Q, K and S

All the codes can be massless or massive. For massless case, each code should be replaced by an open circle