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COVER Fullerene derivatives have been widely used as electron acceptors in organic/polymer solar cells and perovskite solar cells. To investigate the stereomeric effects of fullerene on the photovoltaic performance, two stereomers of the bisadduct analogues of [6,6]-phenyl-C₇₁-butyric acid methyl ester (bisPC₇₁BM) were isolated and blended with poly(3-hexylthiophene) (P3HT) for fabricating polymer solar cells. Although both *trans*- and *cis*-bisPC₇₁BM showed similar spectrometric and electronic properties, a photovoltaic discrepancy resulted from the difference in their molecular packing. Accordingly, the guidelines for designing an efficient electron acceptor should be supplemented, and the stereomeric effect should be envisaged in addition to the fullerene core, type of functional group, and number of addends and their addition positions. The cover picture shows the structures of the *trans*- and *cis*-bisPC₇₁BM molecules as well as the polymer solar cells (see the article by Lin-Long Deng et al. on page 132).



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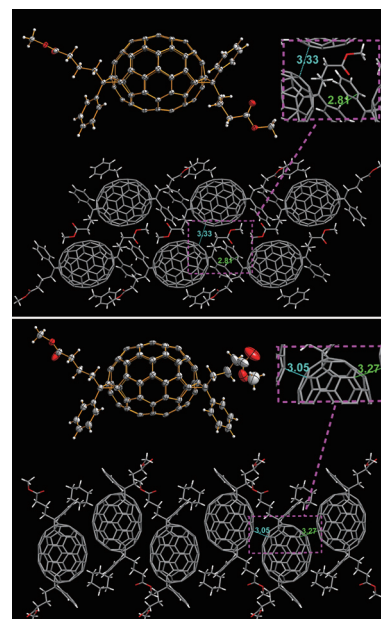
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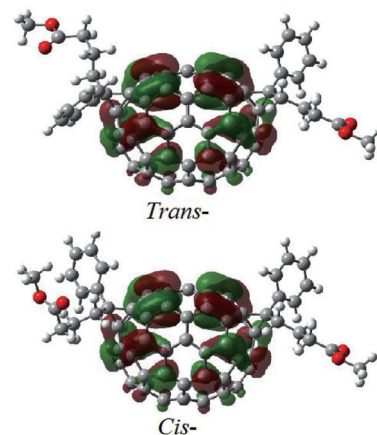
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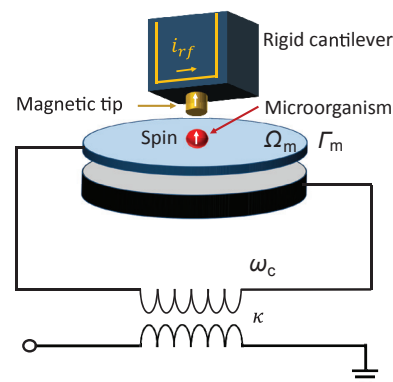
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Toward quantum teleporting living objects

Qing Ai

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In American science fiction television series *Star Trek*, teleporting crews from the spaceship to the surface of a planet was one of the most impressive scenes, as shown in Fig. 1. Teleportation was believed to be a beautiful dream until 1993, when a seminal paper by Bennett et al. [1] showed that with the help of classical communication and quantum entanglement, a qubit can be transferred from one location to another, without moving a physical particle along with it. In 1997, the first experiment of quantum teleportation was realized in photons [2]. In the last decade, quantum teleportation was realized in many different systems, such as atoms [3], nitrogen-vacancy centers [4]. As living objects have multiple degrees of freedom, in order to teleport living organism, we should teleport all the degrees of freedom at the same time. In 2010, Sheng et al. [5] gave a theoretical scheme for teleportation of a particle with two degrees of freedom, the polarization and spatial degrees of freedom. In 2015, Profs. Janwei Pan and Chaoyang Lu's group [6] from University of Science and Technology of China teleported two degrees of freedom of a single photon at one time. These made us one step closer to the dream of teleporting living objects.

All the previous proposals and experiments were related to the nonliving objects. In a recent work [7], Tongcang Li from Purdue University and Zhang-qi Yin from Tsinghua University proposed a scheme to realize quantum superposition states, entanglement and teleportation in cryopreserved microorganisms on the top of an electromechanical oscillator. The mass of microorganism is much less than the mass of mechanical oscillator. Therefore, the frequency

and quality of mechanical oscillator should not be changed a lot. As the electromechanical oscillator has been cooled down to the quantum ground state [8], the microorganism on the top of it could be cooled at the same time. With the help of superconducting circuits, quantum superposition, entanglement and teleportation between remote microorganisms can be realized. This paper is the first proposal of teleporting the states of living objects. As the memory of an organism is stored in the internal states of it, this proposal may be used for teleporting memory between remote organisms. This is another step closer to teleporting living things.

Besides teleportation, the paper also proposed a method to realize the quantum-limited magnetic resonance force microscope under the same setup. It would be helpful for

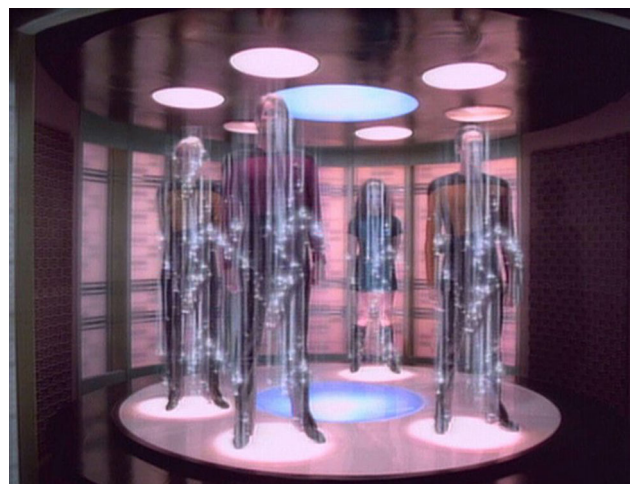


Fig. 1 (Color online) Transporter in *Star Trek* is transporting living people. Accessible from <http://martinjclemens.com/no-the-star-trek-transporter-is-not-almost-a-reality/>

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studying defects and structures of proteins, or other biologically important molecules. Several new directions could be investigated in future. For example, this proposal enables the study of quantum wave function collapse due to the biochemical reactions, such as photochemical reactions with photons [9], and quantum coherence in photosynthesis [10]. In the future, we may study the living objects that are in the quantum superposition of different thought states, demonstrating the quantum interference between thoughts.

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