remote Himalayan region that prevents telemetry support, rendering it unavailable. Instead, telemetry-based monitoring of the glacierized Himalayan catchment using satellite systems (e.g., the Narrowband Internet of Things) is needed to take timely actions during the next hydrological disaster. The integration of monitoring devices with satellite networks will not only provide telemetry support in remote locations that lack complete cellular connectivity but will also provide greater connectivity coverage in the cellular dead zones in extreme topographies such as valleys, cliffs, and steep slopes.

Real-time data would help to develop a strong network of early flood warning systems in the glacierized catchment of the Himalayas. Real-time monitoring technologies would not only help to predict and warn of the impending danger and prevent loss of life, but the availability of real-time data would allow scientists to monitor the performance of the installed instruments remotely and take timely actions against any instrument malfunction, preventing the loss of vital data. Therefore, these enriched datasets will help us to better understand the effects of climate change on the Third Pole, which is often regarded as a “white spot” on the global map—indicating the presence of very limited continuous field hydrometeorological data (9).}

REFERENCES AND NOTES

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QUANTUM GASES

The Weyl side of ultracold matter

Ultracold gases in optical lattices provide control and tunability for the exploration of Weyl semimetal physics

By Nathan Goldman and Tarik Yefsah

The discovery of Weyl semimetals in 2015 was a breakthrough in the modern history of quantum matter, connecting relativistic phenomena predicted in particle physics with unusual topological properties of the solid state (1). This connection originates from the peculiar band structure of Weyl materials. In general, the band structure of a solid governs which energies are accessible to an electron moving with a given momentum. In Weyl semimetals, energy bands touch at singular points (the Weyl nodes), around which energy has a linear dependence on momentum k, reminiscent of relativistic elementary particles. On page 271 of this issue, Wang et al. (2) realized Weyl-type band structures for ultracold atoms with a high degree of control and tunability. This work paves the way for the exploration of the properties of Weyl-type band structures with a bottom-up, tunable approach and incremental complexity.

Whenever a concept of relativity finds an echo in the realm of quantum materials, it triggers a wave of astonishment and excitement. Indeed, relativistic phenomena are naturally linked to high-energy physics. The excitement comes from the possibility of bringing to reality predictions that otherwise may only be recognized for their mathematical esthetics. Herman Weyl’s 1929 prediction of hypothetical massless fermions is a prime example because their existence was never confirmed in particle-physics experiments but was instead observed in solid-state quantum materials (1).

Observing “pseudo-relativistic electrons” in materials is not completely surprising, given the formal equivalence between the Dirac or Weyl equations describing relativistic elementary particles and the effective Schrödinger equation describing electronic excitations in semimetals (1). Beyond this formal analogy, the pseudo-relativistic band structure of Weyl semimetals also hosts a robust mathematical property, a so-called topological defect that cannot be removed under small deformations of the crystal (1). To appreciate this notion, one should first realize that a fictitious “magnetic” field (also called Berry curvature) can be associated with the energy bands of crystalline structures.
Mosaic synapses in epilepsy
Mismatch of synaptic cadherins perturbs hippocampal circuitry

By Belal Shohayeb and Helen M. Cooper

The inherited X-linked early-onset childhood epilepsy, called EFMR (epilepsy and mental retardation limited to females), has baffled clinicians and geneticists for more than 50 years. In contrast to other X-linked disorders in which the hemizygous (hemi) male, but not the heterozygous (het) female is affected, it is only the het females that exhibit seizures and intellectual disability (1, 2). Clues to the origin of this enigmatic disorder came when deleterious mutations in the X chromosome gene protocadherin-19 (PCDH19), which encodes a cell adhesion molecule, were identified (3). On page 255 of this issue, Hoshina et al. (4) provide answers to two pieces of the EFMR puzzle: They reveal that hippocampal synaptic transmission is compromised in Pcdh19 hemi female mice but not in hemi males, and they provide a molecular explanation for how the retention of one wild-type (WT) allele, but not the loss of both alleles, disrupts neuronal connectivity.

In general, females with X-linked disorders are asymptomatic because they carry one WT allele. Conversely, hemi males only express the mutated gene and are unable to produce a functional protein. What accounts for the EFMR sex reversal? Important insight came with the identification of idiopathic males with EFMR symptoms (5). Affected males carried postzygotic somatic PCDH19 mutations, and therefore regions within the developing brain that normally express PCDH19 comprise a mixture of PCDH19-positive and -negative (has a non-functional PCDH19 allele) neurons. To ensure appropriate levels of gene expression, females undergo X-inactivation in which one X chromosome is silenced. Females heterozygous for PCDH19 mutations will therefore also exhibit somatic mosaicism due to ran-
The Weyl side of ultracold matter
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