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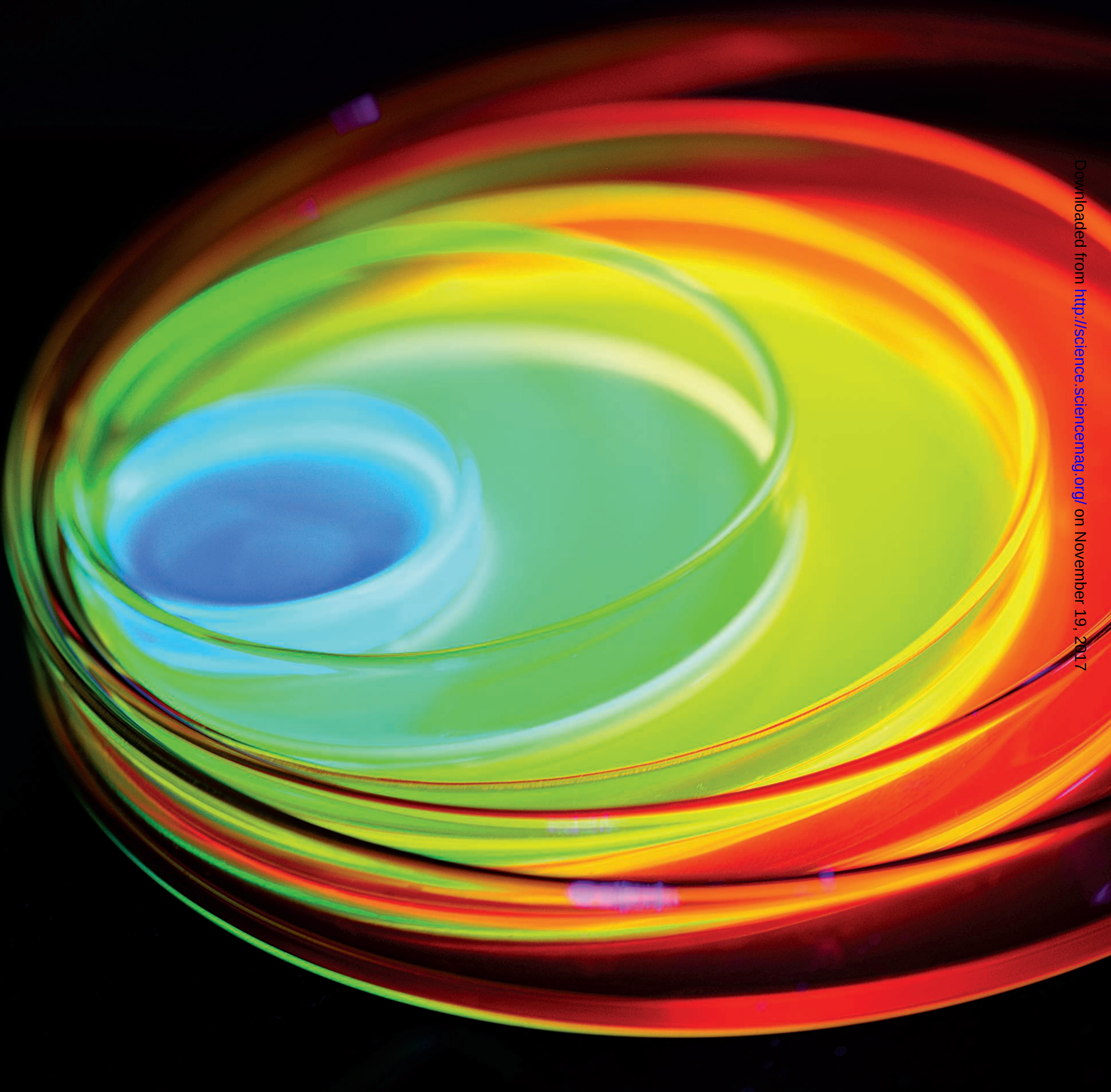

PEROVSKITES

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Perovskite quantum dots in solution emit light across the visible spectrum and could find applications in displays. Other applications of perovskite materials in photovoltaics and catalysis, as well as their importance in Earth's mantle, are highlighted in this issue.

By **Phillip Szuromi** *and* **Brent Grocholski**

Perovskite is an unremarkable calcium titanium oxide mineral discovered in 1839 with an extremely versatile crystal structure. The compact crystal structure marks the transition to Earth's lower mantle as silicate perovskite becomes stable. Silicate perovskites make up the bulk of the lower mantle and are the most abundant minerals in Earth. The importance of perovskites extends to exoplanets, because silicate perovskites are stable in the mantle of planets larger than Mars.

The perovskite crystal structure can accommodate a wide variety of cations, which allows the development of many materials. The cuprate high-temperature superconductors adopt a structure that can be described as an oxygen-deficient multilayered perovskite. Organic-inorganic hybrid perovskite solar cells have power conversion efficiencies exceeding 20%. Inorganic perovskite nanoparticles display bright, narrow-band photoluminescence that is useful in optoelectronics. Further development efforts will focus on improving material stability.

The tunability of the perovskite structure also makes these crystals attractive for catalysis and electrocatalysis. In solid oxide fuel cells, perovskites serve as oxygen ion conductors separating anodes and cathodes. For applications such as automotive pollution control, perovskite catalysts based on earth-abundant elements could provide alternatives to existing catalysts based on scarce precious metals.

Methodological developments, including high-pressure diamond anvil cells and advanced spectroscopic techniques, help drive our understanding of perovskites. Experimental breakthroughs are complemented by theoretical approaches that can now tackle such complex structures. Continued progress will be spurred by societal needs and aided by synergy between the different subdisciplines that have investigated this fascinating mineral structure.

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Science **358** (6364), 732-733.
DOI: 10.1126/science.358.6364.732