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INSPIRING COLOURS: THE HINDU EDITORIAL ON THE 2023 CHEMISTRY NOBEL

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Travelling in a bus can be an enjoyable experience if you have your own seat, the vehicle is not crowded, and there is a nice breeze. But if the bus is packed with people, you can get irritable. Something similar happens to atoms: if they are contained in a vessel at a low density, they behave in a certain way, but if they are packed densely together, with little moving space, something new happens. The 2023 Nobel Prize in Chemistry has been awarded to three people who found out what happens. Technically, they have been selected for discovering and refining quantum dots — small crystals a few nanometres wide. Each quantum dot has only a few thousand atoms (whereas a single droplet of water can have a sextillion). And because the atoms are packed so closely together in the dot, their electrons are very close to each other. In this setting, the laws of quantum mechanics describe the behaviour of quantum dots — so much so that an entire dot can mimic the behaviour of an atom. The dots have another famous property. If you shine some light on a quantum dot, it will absorb and re-emit that light at a different frequency (or colour) depending on its size. Smaller dots emit light of higher frequency (bluer) and vice versa. So, a quantum dot made of some material would respond in one way whereas a quantum dot made of the same material but smaller would respond differently. For these reasons, quantum dots have found many applications in transistors, lasers, medical imaging, and quantum computing. In 1981, Alexei Ekimov, then working in the Soviet Union, first synthesised quantum dots ‘frozen’ inside glass. Two years later, Louis Brus synthesised quantum dots in a solution in the U.S., and worked out their quantum-physical properties. Finally, Moungi Bawendi, whose work on quantum dots began as a student under Dr. Brus, found a way to make quantum dots of high quality in an easy and reliable way in 1993. For their contributions, they have shared the Nobel Prize.

Some of the most fascinating scientific discoveries, for all their technical sophistication, are actually innocuous in their appeal. Quantum dots are one such. Understanding why they behave the way they do requires specialised knowledge of quantum mechanics, but quantum mechanics do not dictate their behaviour. Dr. Ekimov himself was inspired by the colours in stained glass. While quantum dots light up LED screens and the location of a tumour that needs to be removed, it is important not to lose sight of the colours — the reds, the greens, and the blues — and whatever more they might inspire.

award and prize / chemistry

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