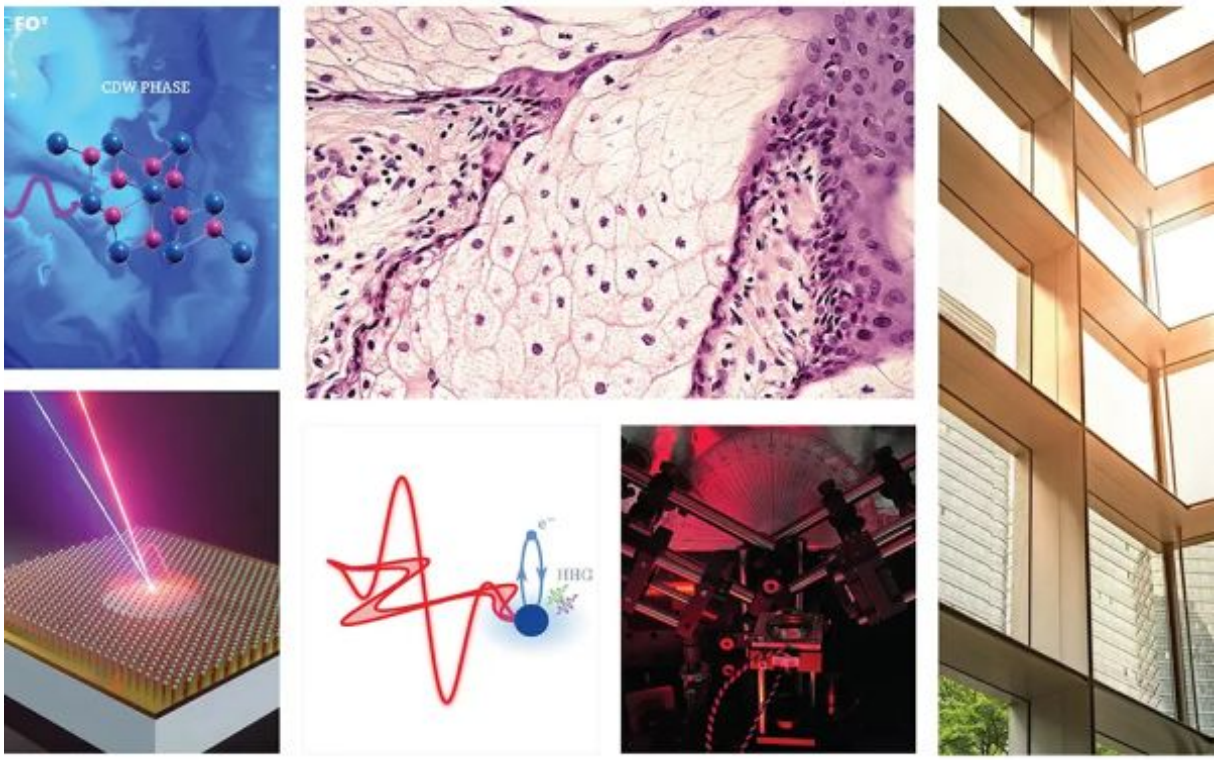


July Science News Recap

ICFO's summary of news highlights of the scientific discoveries and stories from the month of July 2025

August 04, 2025

July was packed with different scientific discoveries, results and findings that have sparked different stories to share. We've gathered the most important updates to keep you in the know. Whether you missed a few of them or just want a quick recap, our summary of July's top scientific news has you covered. Dive in and catch up on everything that happened this month.

News 1

Circular polarization is no longer a barrier for High Harmonic Generation

High harmonic generation (HHG) is a process where an intense laser interacts with a material to produce new light at much higher frequencies -the harmonics of the incoming laser's frequency. Typically, it has been observed that when light is circularly polarized-that is, its electric field rotates as it propagates-the generation of high harmonics in atoms is suppressed.

Now, ICFO researchers **have published a study in** Physical Review Letters where they have theoretically demonstrated that circularly polarized light can indeed generate high harmonics, provided it contains sufficiently intense fluctuations (quantum or classical). This advance could offer new methods with great potential to control and study ultrafast electronic dynamics in complex materials, and continue to drive the development of the emerging field of attosecond quantum optics.
Date: July 2, 2025
Topic: Attosecond Quantum Optics
ICFO Researchers: Dr. Javier Rivera-Dean, Philipp Stammer, led by ICREA Prof. Maciej Lewenstein
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News 2:
ICFO researchers address long-standing debate in charge carrier transport
Researchers at ICFO have clarified how electric charge carriers move in MoSe?, an atomically thin material belonging to the family of TMDCs - transition metal dichalcogenides.
TMDCs are a versatile class of materials with applications across various fields, including electronics, optoelectronics (such as photodetectors, touchscreen displays, and solar cells), sensors (for environmental gas monitoring), catalysis processes, energy storage, and biomedicine. Understanding these materials' inner behavior is essential to keep advancing all these applications.
The study, published in Nature Communications, focuses on a specific property known as diffusivity - the rate at which particles spread, typically moving from regions of higher to lower concentration. The researchers were able to explain previous contradictory results regarding this feature, showing that it depends on two critical factors: the number of atomically thin layers and the interaction with the substrate over which the sample is deposited.
Date: July 9, 2025
Topic: 2D Materials Science
ICFO researchers: Dr. Giulia Lo Gerfo Morganti, Dr. Guillermo D. Brinatti Vazquez, led by ICREA Prof. Niek F. van Hulst
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News 3:
New method to control light confinement using liquid crystals
Researchers at ICFO have demonstrated a way to tune the properties of certain crystal states that allow light to be trapped inside the material instead of escaping - that is, to prevent it from dispersing (as light does when it hits a prism). These results were recently published in Optica.

Controlling how light travels through these crystals - and learning how to prevent its dissipation - is essential for achieving the desired functionalities in certain devices. Some of them include those used in integrated photonic chips, especially waveguides, as well as those used in lasers, optical delay lines, interferometers, and other devices designed to trap light.
Date: July 14, 2025
Topic: Nonlinear optics
ICFO researchers: Dr. Marlin Baral, Dr. Samyobrata Mukherjee, Pilar Pujol-Closa, led by ICFO and UPC Prof. Lluis Torner and Dr. David Artigas
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News 4:
Cooling in summer, heating in winter: all through one smart window
Cooling and heating homes, shops and other indoor spaces consume roughly 15% of the world's energy supply, underscoring the need for an improved system for cooling in summer and heating in winter
ICFO researchers propose novel smart windows for efficient thermal control, with tunable properties that enable harnessing heat in winter and releasing heat in summer. These results, recently published in Nanophotonics, are crucial to reduce the world's energy consumption spent in heating and cooling indoor spaces.
Date: July 18, 2025
Topic: Thermal photonics
ICFO researchers: Dr. Julien Legendre, led by ICFO Prof. Dr. Georgia Papadakis.
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News 5:
ICFO researchers shed light on how superconductivity's precursor forms
Charge density waves often appear as precursors to exotic quantum phases, such as superconductivity. Understanding how they form in certain materials remains a subject of debate.
Now, ICFO researchers and collaborators have studied these charge density waves by applying, for the first time, a laser technique called high-harmonic generation spectroscopy. This new optical method's extreme sensitivity can detect subtle asymmetries in the sample's behavior that eluded earlier techniques. This fundamental knowledge could hold key for the realization of correlated quantum phases (like superconductivity) at room temperature.
The technique, reported in Communications Materials, could also be used to study and characterize crystals, 2D materials and nanodevices.
Date: July 25, 2025
Topic: Attosecond science and condensed matter

ICFO researchers: Igor Tyulnev, Dr. Lenard Vamos, Julita Poborska, led by ICREA Prof. Jens Biegert, together with Dr. Lin Zhang and ICREA Prof. Maciej Lewenstein.
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News 6:

Global contest puts tools for single-molecule motion analysis to the test

Inside living cells, molecules are constantly moving - binding, diffusing, interacting. This molecular motion reveals crucial clues about how cells function, communicate, and sometimes fail. However, extracting meaningful insights from these complex molecular trajectories is a formidable challenge, driving a global race to develop and improve analytical tools.

Now, an international competition in which ICFO actively participated has provided a systematic comparison of analytical methods for studying single-molecule motion, highlighting both current strengths and urgent challenges in this rapidly expanding field. The results were recently published in Nature Communications.

Date: July 28, 2025

Topic: Biophysics

ICFO researchers: Gabriel Fernandez-Fernandez, Dr. Borja Requena, led by ICREA Prof. Maciej Lewenstein.

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