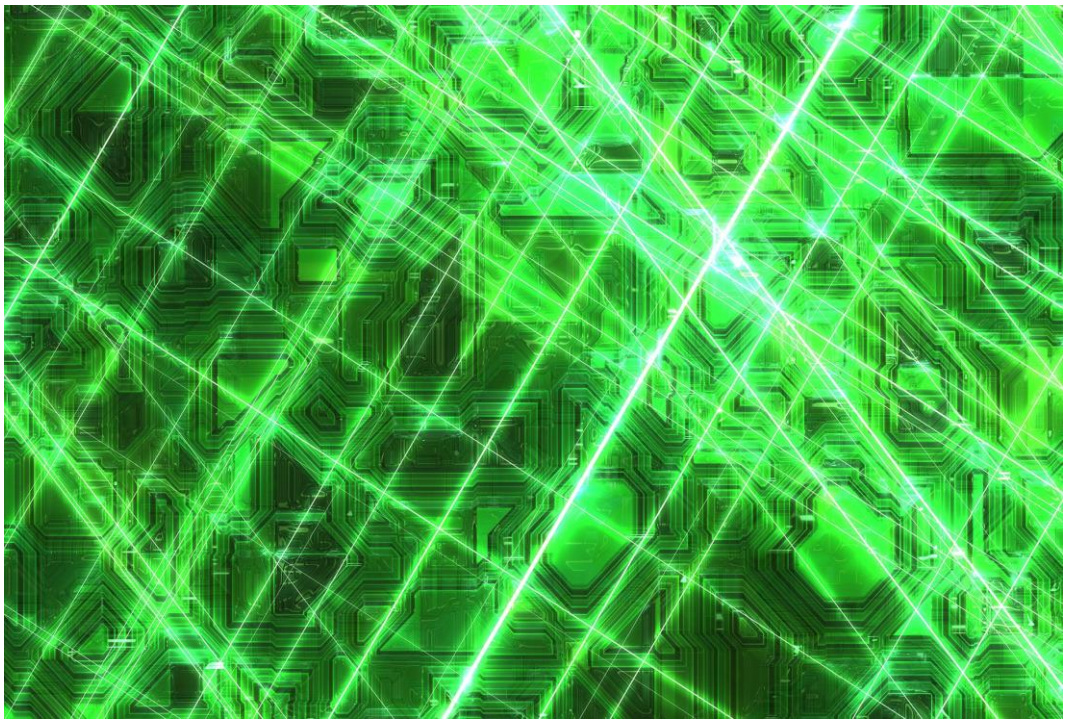
Press release

Cooling by laser beam

A new study explains the principles that underlie the phenomenon of light-induced superconductivity observed experimentally



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A laser pulse that for a few picoseconds – i.e. one millionth of one millionth of a second- transforms a material into a high-temperature superconductor. Different experiments have unveiled this interesting phenomenon, with potential applicative implications. Research carried out by SISSA scientists a year ago had already provided several basic principles of the phenomenon. A new study published on “Physical Review Letters” now clarifies other important aspects.
It is a well-known fact that light heats. This seems to be an obvious observation; in actual fact this is correct only for sufficiently long times, much longer than those in which photo-induced superconductivity has been observed, and in which the quantum effects of light-matter interaction become relevant, with particular reference to the fact that light

is absorbed in a highly selective manner. What SISSA scientist Michele Fabrizio has explained with his new study is that in the very short space of time in which it acts, the laser pulse can, in some circumstances, populate high-energy states, which heat up, and simultaneously depopulate low energy ones, which thus cool down. It is precisely the latter that are responsible for superconductivity. This selective cooling, shown rigorously in a very simplified theoretical model, could explain not only the experimental observations, but also open the way to new and potentially important research activities.

The ultra-short control of materials by light is a topic that attracts the interests of the scientific community, and others, in the perspective of building electronic devices whose physical properties, for example the ability to conduct electricity, could change with the application of a laser pulse, which, therefore, would effectively play the role of an ultra-fast switch.

Read the paper: https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.120.220601

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