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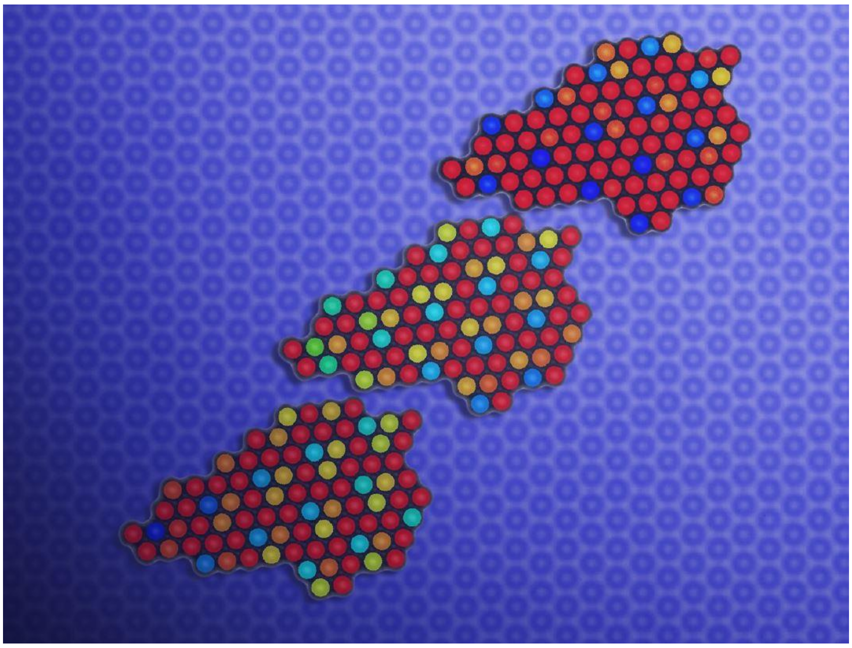
PRESS RELEASE

Movements in the microworld

As they move on surfaces, particles seem to follow invisible tracks. The explanation lies in a study published in Nature Physics



Trieste, 22 May 2019

An inclined plane, a surface and miniscule spheres that slide on top unexpectedly, as though following invisible grooves, true "energy tracks" which are created thanks to the particular nature of the contact between the two surfaces: Down there in the microworld, where the dimensions reach a millionth of a metre, in specific conditions, highly interesting things can occur, whose practical applications could expand to the field of nanotechnologies. This is what a new study published in Nature Physics has shown, conducted in its theoretical part by SISSA of Trieste, CNR-IOM and the University of Milan. The University of Konstanz carried out the experimental observations.

Between theory and experiment, the reason why they move that way

The initial questions, connected to the unexpected movement, experimentally recorded, of small flat islands formed by particles of 4-5 microns in diameter on a

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particular microstructured surface, came directly from the University of Konstanz. The singular nature of the phenomenon and the amazement of the researchers required the intervention of scientists of three Italian institutions. Together they elaborated a theoretical model that could explain this phenomenon. Andrea Vanossi of the CNR-IOM says: “The model thus devised, and later experimentally validated, has shown that it is the way with which the particles that form these islands “interlock” with the surface, in a periodic pattern of the area of contact, that defines the movement of the particles, making invisible energy tracks emerge which form at the interface between the two structures. Thanks to this interlocking pattern called “Moiré Pattern” and its periodic repetition, the particle can move in the most convenient direction following a specific trajectory which we, at this point, are able to foresee regardless of the specific details of the material and how these interact”.

Possible applications in nanotechnologies

This result, besides shedding light on the fascinating aspect of how microscopic attrition works, also has possible applicative repercussions. “In general, if we can foresee the trajectory of the movement of very small objects, we can think of acting on their dynamics operating on contact geometry,” explains Emanuele Panizon, who worked on the project with SISSA. “We could build objects making them move in a specific direction without having to impart control over them. Furthermore, if in our case, it was gravity to provide the energy, the general nature of our model offers hope that all this can be useful even at much smaller scales than those seen experimentally, in which other types of strength are at play. For example, to make new molecular machines with nanotechnological uses of transport and positioning on an atomic scale move in preferential directions on surfaces”. The study has been partly funded by Prof. Erio Tosatti’s ERC project “MODPHYSFRIC.

IMAGE
Credits:
Emanuele Panizon e Andrea Vanossi

LINK
The paper:
https://go.nature.com/2HKlb5b

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