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Elasticty, geometry and fractons

This seminar explores the evolving field of fractons, quasiparticles with limited mobility, and their relationship with elasticity. Mechanical properties of crystals on curved substrates mix elastic, geometric and topological degrees of freedom. In order to elucidate properties of such crystals I formulate the low-energy effective action that combines metric degrees of freedom with displacement fields and defects. I propose new dualities for elasticity coupled to curved geometry formulated in terms of tensor gauge theories. I show that the metric degrees of freedom, evolving akin to linearized gravity are mapped to tensors with three indices. Finally, when coupled to crystals, metric degrees of freedom become gapped and, in the presence of dislocations and disclinations, multivalued. The elastic degrees of freedom remain gapless and mapped to symmetric gauge fields with two indices. In analogy with elasticity on flat space we assume that the trace of the total quadrupole moment is conserved. In the dual formulation, topological defects, which act as sources for the gauge fields, are fractons or excitations with restricted mobility. This leads to generalized glide constraints that restrict both displacement and gravitational defects.

Primary author: Prof. SURÓWKA, Piotr (Wrocław University of Science and Technology)

Presenter: Prof. SURÓWKA, Piotr (Wrocław University of Science and Technology)

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