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Novel negative Poisson's ratio behavior induced by an elastic instability KATIA BERTOLDI, Harvard University, PEDRO REIS, M.I.T., STEPHEN WILLSHAW, TOM MULLIN, Univ. of Manchester — When materials are compressed along a particular axis they are most commonly observed to expand in directions orthogonal to the applied load. The property that characterizes this behavior is the Poisson's ratio which is defined as the ratio between the negative transverse and longitudinal strains. Materials with a negative Poisson's ratio will contract in the transverse direction when compressed and demonstration of practical examples is relatively recent. A significant challenge in the fabrication of auxetic materials is that it usually involves embedding structures with intricate geometries within a host matrix. As such, the manufacturing process has been a bottleneck in the practical development towards applications. Here we exploit elastic instabilities to create novel effects within materials with periodic microstructure and we show that they may lead to negative Poisson's ratio behavior for the 2D periodic structures i.e. it only occurs under compression. The uncomplicated manufacturing process of the samples together with the robustness of the observed phenomena suggests that this may form the basis of a practical method for constructing planar auxetic materials over a wide range of length-scales.

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