Abstract Submitted
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Broken chiral symmetry in nanotube sliding[1] GIUSEPPE ERNESTO SANTORO, XIAOHUA ZHANG, International School for Advanced Studies (SISSA), UGO TARTAGLINO, Pirelli Tires, Milan, ERIO TOSATTI, International School for Advanced Studies (SISSA) — We discovered, in simulations of the frictional sliding of coaxial nanotubes, an unanticipated example of dynamical symmetry breaking – in fact a family of examples – taking place at the nanoscale. While both nanotubes are armchair, thus perfectly left-right symmetric and nonchiral, a nonzero angular momentum appears spontaneously at a series of critical sliding velocities, in correspondence with large peaks of the sliding friction. The angular momentum is not connected with real bodily rotations, but rather to breathing phonon pseudorotations. The nonlinear equations governing this phenomenon turn out to share common elements with another classic problem exhibiting a dynamical chirality breaking, that of forced oscillations of a string or a rope. Several newer elements that are exquisitely "nano" appear in the nanotube case making it a richer, more elegant and intricate case, with a variety of different phenomena, and the crucial involvement of umklapp and of sliding nanofriction.

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