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Optimal packing of curved filaments LUIS CAJAMARCA, GREGORY GRASON, University of Massachusetts Amherst — The interactions between straight filaments generically favor a uniform hexagonal arrangement, a packing motif that is frustrated when filaments are *curved* which forces a compromise between uniform spacing and uniform shape. Examples of curved biological filaments include bacterial flagella and filamentous components of the bacterial cytoskeleton. We address a simple question: what is the optimal ground state packing of N curved filaments? We present a geometric and mechanical model that incorporates the helical shape of the filaments and adhesive interactions, described by hard tube short-range repulsion and larger range of inter-filament attraction. We discuss two generic geometric classes of helical filament packings: vertically-stacked (N-plies) and side-to-side (N-packs). While N-plies maintain constant spacing with neighbors at constant shape, the cylindrical structure of the enclosing packing space limits the number and coordination of helices of a given geometry, resulting in fewer adhesive contacts than the "looser" N-pack class, where the lateral packing is unconstrained. We show that this geometric interplay gives rise to rich phase diagram of optimal packing, sensitively dependent to helical geometry, range of adhesion and filament number.

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