Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Scaling Behavior in Twisted, Helical and Undulating Lysozyme Amyloid Fibrils RAFFAELE MEZZENGA, CECILE LARA, JOZEF ADAMCIK, IVAN USOV, SOPHIA JORDENS, ETH Zurich — We combine atomic force microscopy single-molecule statistical analysis with polymer physics concepts to study the molecular conformations of lysozyme amyloid fibrils. We use different denaturation conditions to yield amyloid fibrils of different types. At 90 ˚C and pH2, highly laminated twisted and helical ribbons are found, in which as many as 17 protofilaments pack laterally for a total width approaching 180 nm. In the case of 60 ˚C and pH2, we find thin, wavy fibrils, in which the scaling behavior varies at multiple length scales. We use bond and pair correlation functions, end-to-end distribution and worm-like chain model to identify 3 characteristic length scales. At short length scales there is a first bending transition of the fibrils, corresponding to a bending length Lb. At slightly larger length scales (>2Lb), the fibrils become pseudoperiodic and start to undulate. Finally, at length scales larger than the persistence length Lp, the fibrils become flexible and are well described by a 2D self-avoiding random walk. We interpret these results in terms of the periodic fluctuations of the cross-section orientation of the fibrils (twisting) and the impact these have on the area moment of inertia and the corresponding propensity of the fibrils to bend.

Raffaele Mezzenga
ETH Zurich

Date submitted: 08 Nov 2011 Electronic form version 1.4