Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Screw-Joints and Symmetries: Designing Nucleic Acid Nanotubes as Nano-Machines WILLIAM SHERMAN, NADRIAN SEEMAN, New York University — In 2001, Mathieu *et al.*[1] presented the first nanotube constructed from DNA. Similar experimental techniques can be used to build a variety of other DNA nanotubes, but finding solutions to the structural constraint equations can be difficult. We show how symmetry based analysis can be used not only to find viable tube structures, but also to identify tube based devices. Such devices can pass through several states with varying tube profiles, inner and outer radii, and lengths. The theoretical basis for actuation of the devices is the screw-joint – two double-helical domains joined by two or more symmetric Holliday junctions and one (or more) immobile Holliday junction(s). Two of the strands in the immobile junction can be pulled out of the system and replaced with different strands. This process changes the state of the device in a controlled and reversible manner. These devices are promising as gated pores, as well as stiff mechanical manipulators. This research supported by NIGMS, ONR, and NSF. [1] F. Mathieu, C. Mao, N. C. Seeman, *Journal of Biomolecular Structure & Dynamics*, **18**, p.907 (2001).

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Date submitted: 05 Dec 2004 Electronic form version 1.4