Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Observation of NanoDNA Liquid Crystal Phases from Four Base Pair Duplexes at Subambient Temperatures[1] GREGORY SMITH, Liquid Crystal Materials Research Center, University of Colorado, Boulder (CO) U.S.A., TOMMASO FRACCIA, TOMMASO BELLINI, Dipartimento di Chimica, Biochimica e Biotecnologie per la Medicina, Università degli Studi di Milano, Italy, DAVID WALBA, NOEL CLARK, Liquid Crystal Materials Research Center, University of Colorado, Boulder (CO) U.S.A. — Based upon conventional Onsager model considerations, liquid crystal (LC) formation in DNA-water mixtures was originally thought to be impossible for DNA polymers of very short length (<100 bases). We originally reported the discovery of chiral nematic (N*), columnar C_U and C_2 LC phases in NanoDNA oligomers as short as 6 bases in length and have since described additional LC phases involving DNA with random sequences and various blunt or sticky-end duplex architecture, all in the regime of <20 bases. These results suggested a self-assembly motif where hydrophobic forces or hydrogen bond mediated base-pairing enable unusually short polymers to stack into functionally longer units that permit them to exhibit LC phase behavior. We report now the existence of LC phases of ultra short duplexed NanoDNA, 4 bases in length, in blunt-end, sticky-end and random sequence configurations, all observed at temperatures of $\sim$ 5 °C and not stable >13-15 °C. These oligomers demonstrate an unusual wealth of phase behavior, including the typical N*, C_U and C_2 phases as well as higher order dark and bright phases, including what we believe to be a Blue Phase.

[1]Grant support: NSF DMR 1207606 and NSF MRSEC DMR 0820579.

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Date submitted: 15 Nov 2013 Electronic form version 1.4