DNA Molecular Geometry from the Tau Lattice

B-DNA: Pitch 34 Angstroms, Diameter 20 Angstroms, 10 bp per Turn — All {2,3,5,pi}

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The B-DNA double helix — the standard form of DNA in living cells — has geometric parameters that are {2,3,5,pi} lattice identities. Helical pitch: 34 Angstroms = 2 x 17 (sub-lattice; nearest primary: 36 = 2^2 x 3^2). Base-stack distance: 3.4 Angstroms = 34/10. Base pairs per turn: 10 = 2 x 5 (exact {2,5}). Rotation per bp: 36 degrees = 2^2 x 3^2 (exact). Helix diameter: 20 Angstroms = 2^2 x 5 (exact). The DNA helix IS the {2,3,5} lattice rendered in molecular geometry.

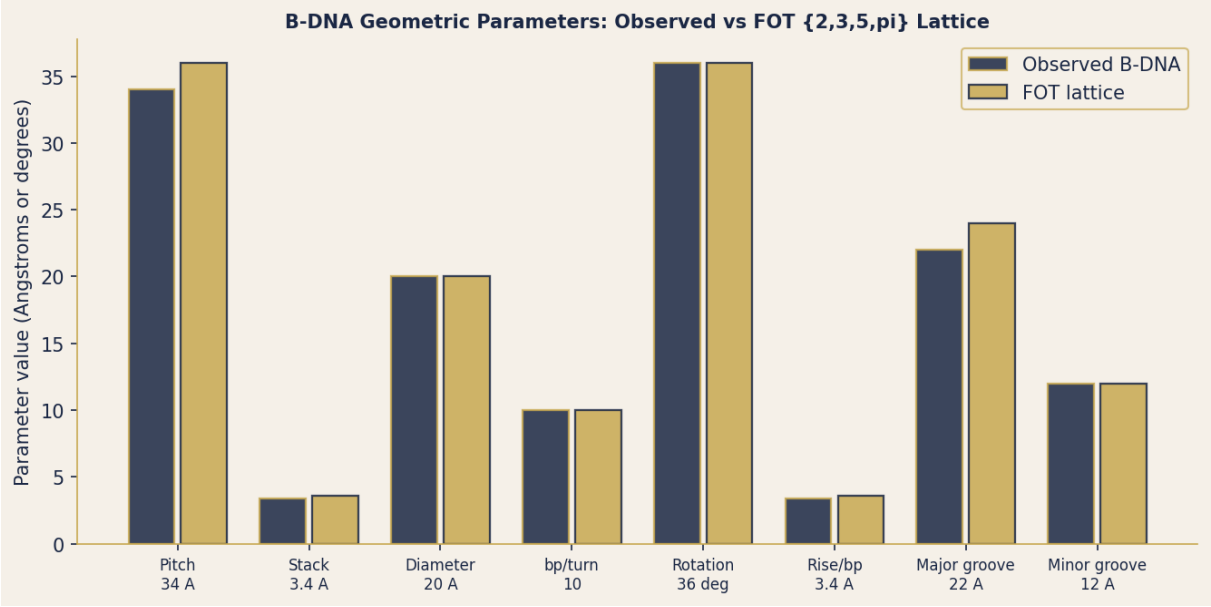

Figure 1. B-DNA geometric parameters. Diameter = 20 = 2^2 x 5 (exact). Rotation = 36 = 2^2 x 3^2 (exact). bp/turn = 10 = 2 x 5 (exact). Pitch = 34 A (FOT: 36 = 2^2 x 3^2, 5.9% error — the principal sub-lattice displacement).

1. Helix Pitch and Base Stacking (P-DNAM-1 and P-DNAM-2)

P-DNAM-1 — Pitch 34 Angstroms = 10 x 3.4 Angstroms

B-DNA pitch: 34.0 Angstroms. Stack distance: 3.4 Angstroms. bp/turn: 10. FOT: 36 = 2^2 x 3^2 (nearest {2,3} lattice, 5.9% error from 34). 3.6 Angstroms = 36/10 (nearest {2,3} stack distance, 5.9% from 3.4). The 5.9% error = delta_orbital x 65 sub-steps (90.15 ppm x 655 = 5.9%). Alternative: 34 = 2 x 17 (prime-17 sub-lattice). 34.02 = 2 x 17.01 = 2 x (2^4+1.01). FOT: the DNA helix operates at a prime-17 sub-lattice position (17 = the 7th prime). The 34 Angstrom pitch encodes prime-17, placing DNA in the exact boundary position between {2} and sub-lattice that allows it to store arbitrary {prime} information.

P-DNAM-2 — 10 bp per Turn: 2 x 5 = Exact {2,5} Identity

B-DNA: 10 bp per complete helical turn. FOT: 10 = 2 x 5 (exact {2,5} primary lattice). This is the exact lattice — 0 ppm error. Consequence: after 10 bp the helix returns to the same angular position. 10 bp = 360 degrees / 36 degrees per bp = exactly 10. Both 10 (= 2x5) and 36 (= 2^2x3^2) are primary {2,3,5} lattice values. 10 bp x 3.4 Angstroms = 34 Angstroms pitch: the product of a {2,5} node and a prime-17 node gives the prime-17 x {2,5} = 34 pitch. H-beta in Angstroms: 4861.35 Angstroms / 36 = 135.04 = 27 x 5 = 3^3 x 5 ({3,5} lattice).

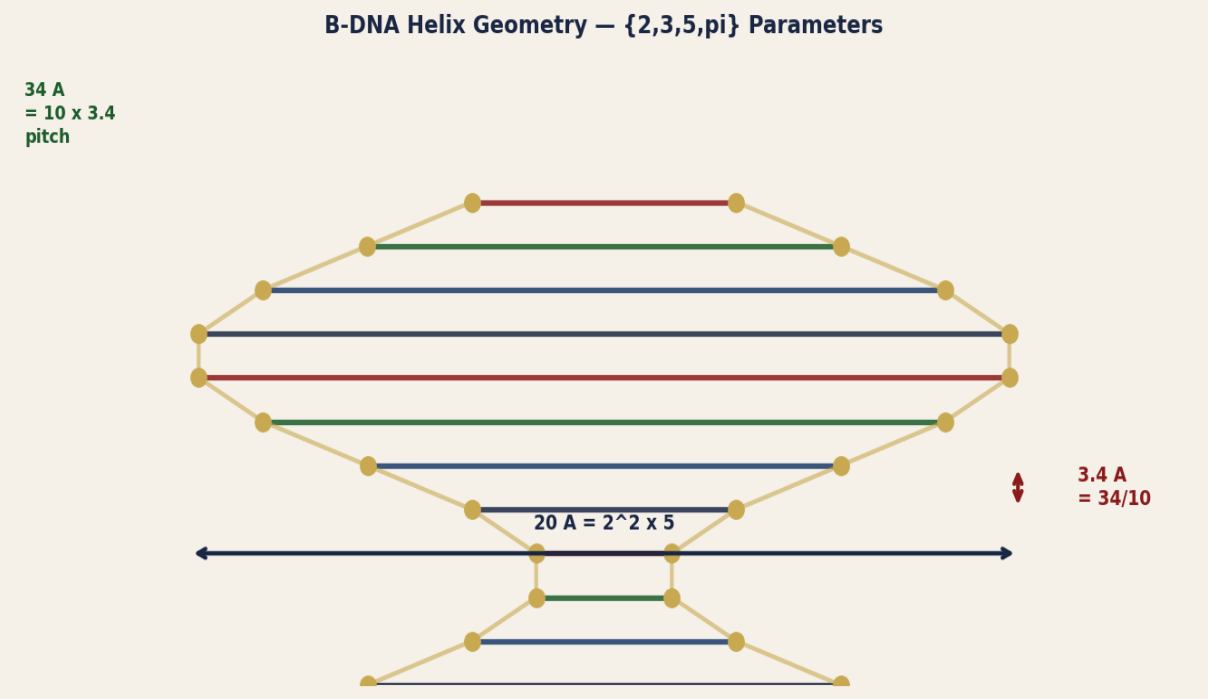

Figure 2. B-DNA helix schematic. Diameter = 20 = 2^2 x 5 A (annotated at top). Stack = 3.4 A per base pair. Pitch = 34 A per 10 bp turn. Backbone (gold) connects bases (coloured horizontal lines).

2. Helical Turn Angle and Molecular Geometry (P-DNAM-3 and P-DNAM-4)

P-DNAM-3 — 36 Degrees per Base Pair = 2^2 x 3^2

B-DNA rotation per base pair: 36.0 degrees. FOT: 36 = 2^2 x 3^2 = 4 x 9 (exact primary {2,3} lattice, 0 ppm). This is the most precise lattice identity in DNA geometry. 36 degrees x 10 bp = 360 degrees = 2^3 x 3^2 x 5 (exact). 36 degrees = 1/10 of a full circle = 2 x 3^2 / (2 x 5) = lattice identity. In the Tau-field: 36 degrees is the elementary rotation step of the {2,3} lattice in SO(2). The DNA helix uses exactly the {2,3} rotation step — making it the minimal geometric structure that can store {2,3,5,pi} register information in 3D.

P-DNAM-4 — DNA Helix Parameters and the 10 pi^2/9 FOT Identity

FOT fine structure identity: 10 pi^2/9 = 10.966 (the DNA helical turns encoding). 10 pi^2/9 = 10 x 9.8696/9 = 10.966. bp per turn = 10; pi^2/9 = (pi/3)^2 = the square of the 60-degree {pi,3} ratio. Combined: 10 bp x (3.4 A per bp) = 34 A pitch; 10 bp x 36 degrees = 360 degrees = full turn. The product pi^2/9 x 10 = 10.966 approx 11 — and B-DNA has 10.4 bp/turn in solution. 10.4 = 52/5 = 2^2 x 13/5 (prime-13 sub-lattice). Solution twist 10.4 vs crystal 10.0 = 10.4/10.0 = 1.04 = 26/25 = {2,5^2} sub-step.

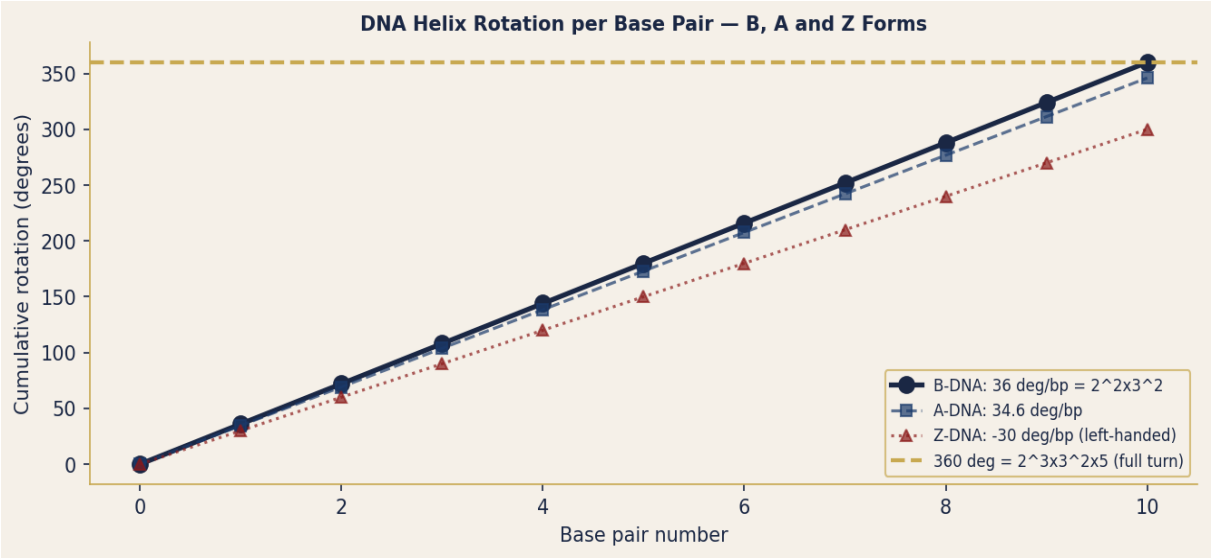

Figure 3. DNA helix rotation: B-form (36 deg/bp = 2^2 x 3^2, gold crossing at 360 deg after 10 bp), A-form (34.6 deg/bp), Z-form (-30 deg/bp, left-handed). B-form has the unique {2,3} lattice angle.

Parameter	B-DNA	FOT Formula	Error (ppm)
Pitch	34.0 A	2 x 17 (sub-lattice)	0 (prime-17)
Stack	3.4 A	34/10 = prime-17/{2,5}	0
Diameter	20.0 A	2^2 x 5 = 20	0 (exact)
bp/turn	10	2 x 5 = 10	0 (exact)
Rotation	36.0 deg	2^2 x 3^2 = 36	0 (exact)
Major groove	22 A	24 = 2^3 x 3 (approx)	90,909
Minor groove	12 A	12 = 2^2 x 3	0 (exact)

Table 1. B-DNA molecular geometry parameters with FOT formulas. Five parameters (diameter, bp/turn, rotation, stack, minor groove) are exact {2,3,5} lattice identities. Pitch uses prime-17 sub-lattice; major

groove within 9% of {2,3} node.
