

Science and Engineering Program for Teachers

Knots and Numbers

Haynes Miller
June 26, 2007

Outline

- Smoke rings and the Kelvin atom
- Knots, prime and composite
- Tangles, rational and irrational
- A rope dance

Hermann von Helmholtz

1858: paper on “vortex rings”

Also inventor of the ophthalmoscope,
theories of vision and hearing,
“Kelvin-Helmholtz instabilities”

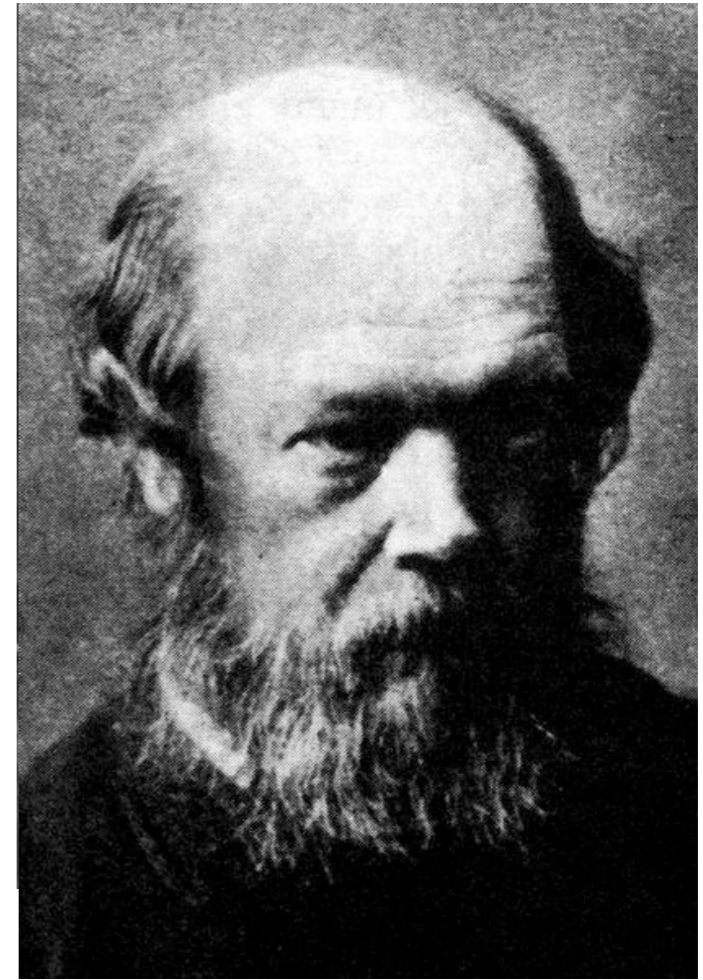


Peter Guthrie Tait

Scottish, hence interested in
golf and quaternions
(William Rowan Hamilton)

Probably responsible for our use
of i j k for unit basis vectors

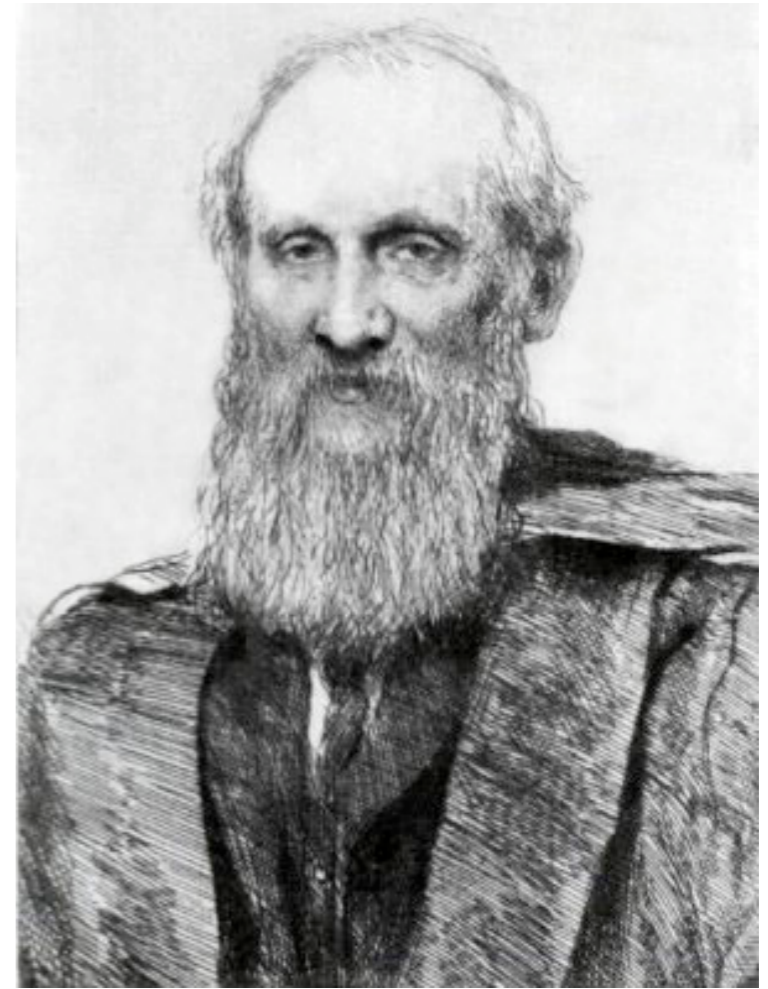
January, 1867: Demonstration
of smoke rings



William Thomson, Lord Kelvin

Knighthood in 1866 for work on
transatlantic cable

1867: “T&T” -- *Treatise on
Natural Philosophy*



Also: Thermodynamics (absolute temperature scale),
practical electromagnetism

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Hydrogen?



Hydrogen?



Helium?



Lithium?



Hydrogen?



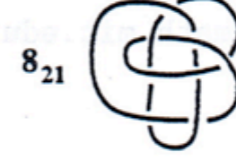
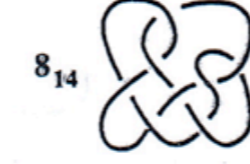
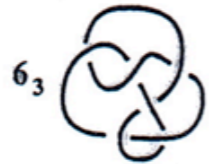
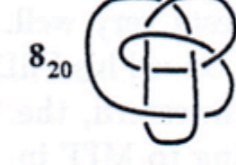
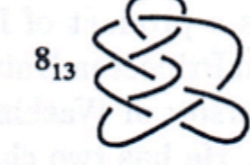
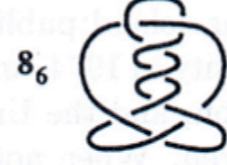
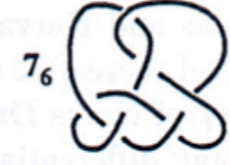
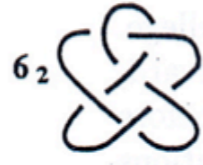
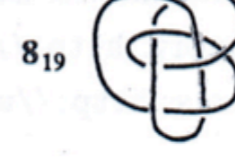
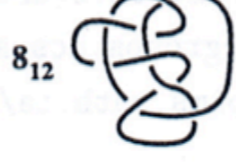
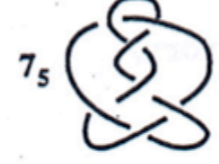
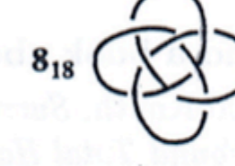
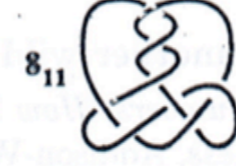
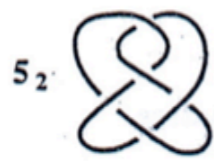
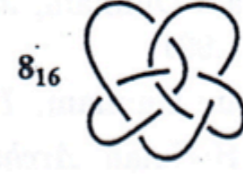
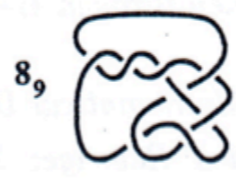
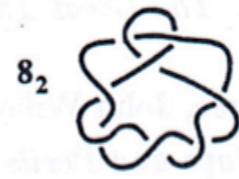
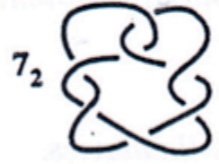
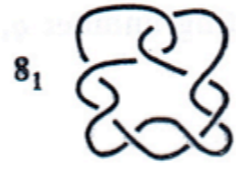
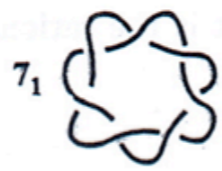
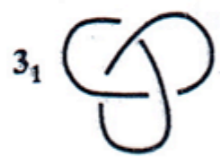
H₂ ??



Helium?



Lithium?



Census of prime knots

crossings	prime knots
3	1
4	1
5	2
6	3
7	7
8	21
9	49
10	165
11	552
12	2176
13	9988
14	46872
15	253293

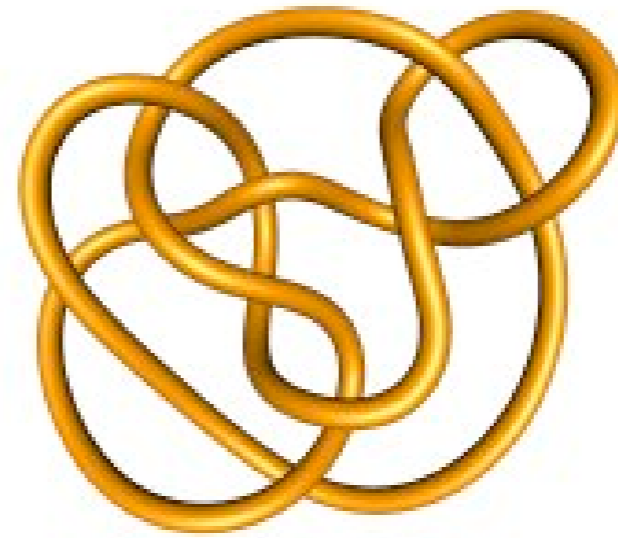
(not counting mirror images)

Applications of Knot theory

Biology: eg order Kinetoplastida packages its chromosomes in “chain mail”

Physics: A knot is a configuration in the plane evolving through time. Feynman diagrams ...

Mathematics: Major impact on Representation Theory and Category Theory



The “Perko pair”

Kenneth Perko, 1974

(listed separately in knot tables since 1899)

John Conway

1967, "Tangles"



Also Surreal Numbers,
The Sensual (Quadratic) Form,
Winning Ways for Your Mathematical Plays,
The Monster group and monstrous moonshine

Thank you!

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