

MDPH480/PHYS480/ASTR480/MAPH480 Research Projects 2009

Project Title: Clifford's geometric algebra (projects 1, 2, 3, 4)

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Abstract of the Proposed Research (use this page only)

Clifford's geometric algebra – assumptions at the foundations of physics. We are offering several topics in this area, being extensions of work done by Niels Gresnigt (PhD just submitted), by Jake Gulliksen (480 in 2008) and by Sam McCahon and Sebastian Horvath (493 projects this summer).

Physics has many theories, also called models or sets of laws, including Newton's mechanics, Maxwell's electromagnetism, Schrodinger's quantum mechanics, Einstein's special relativity, Dirac's relativistic quantum mechanics, Feynman's quantum electrodynamics Einstein's general theory and the Standard Model of Particle Physics.

From one view, all are correct: all have wide areas of applicability and have been well tested against experiment. From the contrary view, all are wrong: there is no unified theory, and all above theories clash with each other in different ways. Now the large majority of physicists are not bothered by this on a day to day basis, they work in areas where the theories don't compete, of at least it is known how to skirt the difficulties.

Several recent books have taken the second view. Roger Penrose in *Road to Reality* writes "[T]here are [many] deeply mysterious issues about which we have very little comprehension. It is quite likely that the 21st century will reveal even more wonderful insights than those we have been blessed with in the 20th. But for this to happen, we shall need powerful new ideas, which will take us in directions significantly different from those currently being pursued. Perhaps what we mainly need is some subtle change in perspective---something we have all missed..."

Possible topics for 2009 include:

1. The classical electron including magnetic moments
2. Measurement, observation and perspective
3. The electromagnetic field in Clifford geometry
4. Quantum mechanics in Clifford geometry
5. Toroidal functions in Clifford geometry