Seminar: Geometric Algebra for Physics ↔ Physicists for Geometric Algebra

… for geometry, you know, is the gate of science, and the gate is so low and small that one can only enter it as a little child.

William K. Clifford (founder of Geometric Algebra)

Instead of having special mathematics for all the different fields of physics, Geometric Algebra (GA) supplies a unified and unifying mathematical language for the whole of physics. It not only allows for a geometric interpretation of the constituent elements, it uncovers hidden connections between the otherwise seemingly unrelated mathematical descriptions. It is not the ambition of this course to teach a new language in five days, for as with so many things, it is learning by doing. I will merely convey the concept of the language and its application to a variety of subjects. It is therefore a prerequisite for the students to already be familiar with these topics. Emphasis will be on electromagnetism and special relativity, but we will also cover the Pauli and Dirac theories. At the end I will discuss what GA is recently doing for scattering theory and computer science.

„Why hasn‘t anyone told me that before?“ is a regularly heard, awing reaction of students being exposed to this language for the first time. Is it too late to learn it? See for yourself and awe with us: GA is just incredible!

Below is a list of topics and comitted speakers. During the first class, this list can still be expanded and/or slightly modified.

	Date	Topic	Theme	Speaker	EMail	BSc/MSc	Sem
0	15.10.2021	Organisation & Motivation	Venue, Speakers, Motivation, Intro	Maarten DeKieviet	maarten@physi.uni-heidelberg.de	Priv.Doz.	∞
Ia	29.10.2021	Classical Mechanics	2D space, geometric product, complex numbers				
Ib		Classical Mechanics	3D space, reflections & rotations, Quaternions				
IIa	05.11.2021	Quantum Mechanics	Basis, operators, expectation value, time				
IIb		Quantum Mechanics	Spin & spinors,				
IIIa	12.11.2021	Special Relativity	Space Time Algebra, Minkowski				
IIIb		Special Relativity	Contraction, dilation, boosts				
IVa	19.11.2021	Electromagnetism	Maxwell Equation, Poynting Vector				
IVb		Electromagnetism	Vacuum; Duality, chirality				
Va	26.11.2021	Electromagnetism	In media, Anisotropy				
Vb		Dirac Equation	Gamma Matrices, Pauli Equation				
VIa	03.12.2021	Relativistic QM	Geometric & dynamic phases				
VIb		Relativistic QM	Norm, PT-QM, Ghost States				
VIIa	10.12.2022	Geometric Calculus	Green's Functions, Fourier Tansform				
VIIb		Geometric Calculus	Scattering, Inversion, Directional derivative				
VIIIa	17.12.2022	QCD	Grassmann variables				
VIIIb		QCD	In GA, Strong CP-Problem				
IX	14.01.2022	Conformal GA	Projective & conformal spaces				
IX		Computer Science	3D-Graphics				
X	21.01.2022	General Relativity	Gravity; Curved Spacetime				
X		General Relativity	Cosmology				
XI	28.01.2022	Solid State	Reciprocal Space, Scattering				
XI		Solid State	Quasi-crystals in GA				
XII	04.02.2022	The Standard Model	Summary: GA the GUM !	Maarten DeKieviet	maarten@physi.uni-heidelberg.de	Priv.Doz.	∞