Fast and Ultrafast Wavelet Control: The High Resolution Problem of Spinor Image Processing

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The phenomenon of time is measured in human–scale units, with 1 s equivalent to a heart beat, more or less; but the physical world encompasses enormous ranges of time, from the origin of the universe some 14 billion years or 4.10^7 s ago, to time–scales that are as short compared to a second as a second is short compared to the age of the universe. These brief instants, a few billionths of a billionth of a second, or 10^{-18} s, are called attoseconds. In this sense, attosecond physics is the study of physical processes that occur in less than a fraction of a cycle of visible light, in times less than a quadrillionth of a second. Attosecond spectroscopy is fundamentally the study of electronic wavepacket motion inside atoms, or on the atomic scale.

The paper provides a survey of the mathematical tools needed for an appropriate treatment of high resolution spinor image processing. Non–commutative harmonic analysis specifically encompasses the range from the non–invasive modalities of clinical magnetic resonance tomography and optical coherence tomography to the attosecond control of light waves by light wavelets and supercurrent driven spintronics of topological insulators in modern material science.