Abstract. We develop a unifed theory to study geometry of manifolds with different holonomy groups. They are classified by (1) real, complex, quaternion or octonion number (in the appropriate cases) and (2) being special or not. Specialty is an orientation with respect to the corresponding normed algebra $\mathbb{A}$. For example, special Riemannian $\mathbb{A}$-manifolds are oriented Riemannian, Calabi-Yau, hyperkähler and G_2-manifolds respectively.

For vector bundles over such manifolds, we introduce (special) $\mathbb{A}$-connections. They include holomorphic, Hermitian Yang-Mills, Anti-Self-Dual and Donaldson-Thomas connections. Similarly we introduce (special) $\frac{1}{2}\mathbb{A}$-Lagrangian submanifolds as maximally real submanifolds. They include (special) Lagrangian, complex Lagrangian, Cayley and (co-)associative submanifolds.

We also discuss geometric dualities from this viewpoint: Fourier transformations on $\mathbb{A}$-geometry for flat tori and a conjectural SYZ mirror transformation from (special) $\mathbb{A}$-geometry to (special) $\frac{1}{2}\mathbb{A}$-Lagrangian geometry on mirror special $\mathbb{A}$-manifolds.