Yang-Mills Origin of Gravitational Symmetries

By regarding gravity as the convolution of left and right Yang-Mills theories, we derive in linearised approximation the gravitational symmetries of general covariance, p-form gauge invariance, local Lorentz invariance and local supersymmetry from the flat space Yang-Mills symmetries of local gauge invariance and global super-Poincare. Turning to global symmetries we give a division algebra $\mathbb{R}, \mathbb{C}, \mathbb{H}, \mathbb{O}$ description of Yang-Mills with $N(L/R) = 1, 2, 4, 8$ and hence, by tensoring left and right multiplets, a Freudenthal magic square $\text{RR, CR, CC, HR, HC, HH, OR, OC, OH, OO}$ description of $N=N(L)+N(R)$ supergravity.