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Measuring the Scalar Curvature with Clocks and Photons: Voronoi-Delaunay Lattices in Regge Calculus WARNER MILLER, JONATHAN MCDONALD, Florida Atlantic University — The Riemann scalar curvature plays a central role in Einstein's geometric theory of gravity. We describe a new geometric construction of this scalar curvature invariant at an event (vertex) in a discrete spacetime geometry. This allows one to constructively measure the scalar curvature using only clocks and photons. Given recent interest in discrete pre-geometric models of quantum gravity, we believe it is ever so important to reconstruct the curvature scalar with respect to a finite number of communicating observers. This derivation makes use of a fundamental lattice cell built from elements inherited from both the original simplicial (Delaunay) spacetime and its circumcentric dual (Voronoi) lattice. The orthogonality properties between these two lattices yield an expression for the vertex-based scalar curvature which is strikingly similar to the corresponding hinge-based expression in Regge Calculus (deficit angle per unit Voronoi dual area). In particular, we show that the scalar curvature is simply a vertex-based weighted average of deficits per weighted average of dual areas.

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