Abstract Submitted
for the APR21 Meeting of
The American Physical Society

**Generalized geodesic deviation equation** ISAAC RAJ WALDSTEIN, University of North Carolina at Chapel Hill, DAVID BROWN, North Carolina State University — The geodesic deviation equation (GDE) describes the tendency of objects to accelerate towards or away from each other due to spacetime curvature. The "standard" GDE assumes that nearby geodesics have a small rate of separation, which is formally treated as the same order in smallness as the separation itself. This assumption is discussed in various papers, but is not recognized in most textbooks. Relaxing the restrictive assumption that the rate of separation is small leads to the generalized geodesic deviation equation (GGDE). We explore the GGDE via the metric on a unit two-sphere, by considering a fiducial geodesic and a secondary geodesic (both great circles) that cross at the poles. These geodesics are spanned by a "connecting geodesic", whose tangent evaluated at the fiducial geodesic defines the separation vector. The second derivative of the separation vector describes the relative acceleration between the fiducial and secondary geodesics. Near the north pole, where the separation between these geodesics is small but the rate of change of separation can be large, we show that the GGDE holds but the GDE fails to apply.

Isaac Raj Waldstein
University of North Carolina at Chapel Hill

Date submitted: 07 Jan 2021 Electronic form version 1.4