Bolen

My field of research is in Einstein’s theory of general relativity. My interests span this entire field. I have worked on problems in cosmology, black hole physics, and quantum gravity. Some past research students have examined various topics in this field. Below are some of their abstracts

* ***A comparison of the effects of gravitational radiation and global expansion on local systems*.** Bolen *et al* have introduced the effects of global universal expansion on the perihelion and possible orbital size of massive binary systems, using the McVittie metric. Here, the effects of gravity waves on the eccentricities of such systems are investigated to explore the possible outcomes on the local effects of global expansion and orbital change due to gravitational radiation. Global expansions effect on orbital eccentricity is compared against changes due to gravity waves, and the limits where each becomes more prevalent
* ***Exploring the Equations of State for Multiple-Component Universes*** The Friedmann equations are a set of differential equations which govern the evolution of spacetime for an isotropic and homogeneous universe. The traditional solutions to these equations lead to a universe whose expansion is decelerating. However, in 1998, observations of type 1A supernovae suggested that the expansion of the universe was actually accelerating. In this project, we investigate the conditions (equations of state) for multiple-component universes that satisfy an accelerating universe. A focus of this project is the investigation of the equation of state for a hypothetical substance known as the Chaplygin gas. This equation of state interpolates between a matter dominated universe and one dominated by a cosmological constant; which seems to be the state of our current universe.
* ***Effects of Minimal Length on Quantum Mechanical Scattering*** Minimal length seems to be a nearly universal concept in quantum gravity. In order to make the uncertainty principle compatible with the notion of minimal length, one must modify the uncertainty principle. This modification is known as the Generalized Uncertainty Principle (GUP). Due to this modification of the uncertainty principle; one must therefore modify the algebra generating quantum mechanics. Thus it follows that the Schrodinger equation itself must take a new form which was first shown by Kempf, Managano and Mann. In this investigation, wesolved the modified Schrödinger equation for the cases of scattering from a Coulomb potential and a “soft sphere”. This ongoing research may have bearing on future observational data for the dispersion relations of highly redshifted objects.