**Proof:**

The sum of the forces is equal to the change of momentum with respect to time:

And for a constant mass system, we have:

In spacetime, the velocity is a 4-velocity.  Adding the basis vector and applying the product rule, we can expand the acceleration term to get:

Substituting back into the 4-force equation, we have:

Substituting and simplifying for the non-relativistic domain:

If the local geometry of spacetime is flat, then Christoffel symbols vanish and we’re left with:

Applying this formula to a gravitationally bound system, we get:

Your model, then, predicts that we should observe galaxies where the luminosity (a proxy for mass) is proportional to the product of the radius and the square of the tangential velocity.  We do not.  **This hypothesis fails to predict the observed relationship between mass and velocity.**

We can perform the same exercise with an assumption of curved space.  Here, the Christoffel symbols do not vanish:

Given a velocity, the maximum mass will be found at radius, r:

Substituting yields the formula for the maximum mass given the velocity:

Which is exactly what we observe.  Studies of the Baryonic Tully Fisher Relation (BTFR) show the coefficient of proportionality is . Curve fitting gives us a rough value for of and a Reduced of 0.60. **The BTFR is incontrovertible evidence that local geometry of spacetime is curved.**