1064-35-401 **Stephen C. Preston*** (stephen.preston@colorado.edu), Department of Mathematics, UCB 395, Boulder, CO 80309-0395. *The motion and geometry of whips and chains.*

A whip can be modeled as an inextensible string, which satisfies the wave equation $\eta_{tt} = \partial_s(\sigma\eta_s)$, where t is time and s is the length along the string. Inextensibility is expressed as the constraint $|\eta_s| \equiv 1$, which requires the tension σ to satisfy the ODE $\sigma_{ss} - |\eta_{ss}|^2\sigma = -|\eta_{st}|^2$. The tension is zero at the free end, making the problem nonlocal and degenerate.

I will discuss local well-posedness of this problem in weighted Sobolev spaces given by seminorms $\|\eta\|_{k,k}^2 = \int_0^1 s^k |\partial_s^k \eta|^2 \, ds$: we prove that if the initial data is bounded in norms up to $k = 4$, then we have local existence and uniqueness. The solutions are constructed as limits of a discrete problem, the motion of a chain, which essentially reduces to the method of lines. I will also discuss some preliminary results and numerics of blowup.

Finally I will discuss the geometric context of this problem, showing that it can formally be viewed as a geodesic equation on an infinite-dimensional manifold. I will describe the properties of the exponential map and the sectional curvature of this manifold. (Received September 15, 2010)