Researchers Pursue a Narrow Particle with Wide Implications

July 25 2006

Northeastern University researchers Pran Nath, Daniel Feldman and Zuowei Liu have shown that the discovery of a proposed particle, dubbed the Stueckelberg Z prime, is possible utilizing the data being collected in the CDF and DO experiments at the Fermilab Tevatron.

The Stueckelberg Z prime particle, originally proposed by Boris Kors currently at CERN, Geneva, Switzerland and Pran Nath at Northeastern University in 2004, is so narrow that questions had been raised as to whether or not it could be detected. This new research, published in the July issue of *Physical Review Letters*, confirms that it can. The results are of importance because the discovery of this particle would provide a clue to the nature of physics beyond the Standard Model and a possible link with string theory.

“It is exciting to know that the discovery of the proposed particle at colliders is indeed possible,” said Pran Nath, Matthews Distinguished University Professor of Physics at Northeastern University. “Physicists are always looking for what is next, what will lie beyond the Standard Model. These findings point us in the direction of those answers.”

Because of its extreme narrowness, the Stueckelberg Z prime particle resembles the J/Psi (charmonium) particle, whose simultaneous discovery in 1974 by Burton Richter and Samuel Ting earned them the 1976 Nobel Prize in Physics. However, unlike the J/Psi which is a bound state, the new particle is not a bound state but a proposed new fundamental building block of matter. What sets the new Z prime

particle apart from all others is the mechanism by which it gains mass.

While in the Standard Model particles such as the W and Z bosons gain mass by the Higgs phenomena, the new Z prime particle gains mass by the Stueckelberg mechanism proposed by the Swiss mathematician and physicist Ernst Carl Gerlach Stueckelberg in 1938. While the Stueckelberg mechanism arises naturally in string theory, Kors and Nath were the first to successfully utilize it in building a model of particle physics.

“If the Stueckelberg Z prime particle were to be discovered, it could signify a new kind of physics altogether, a new regime so to speak,” said Nath. “The prospect is quite exciting.”

Source: Northeastern University