

Mass of the top quark and global warming consequences among year's Top 100 discoveries

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Findings of two research projects involving University of Nebraska-Lincoln scientists were named among the 100 most important discoveries and developments in science in 2004 by Discover magazine. Each year, Discover selects the 100 top science stories of the year to feature in its Year in Science issue. Global warming topped the 2004 list, which is featured in the January 2005 issue. Research involving UNL physicists Greg Snow and Dan Claes and agronomist Ken Cassman made the list.

"This is terrific news," said Prem Paul, the university's vice chancellor for research. "Having research our scientists are involved with listed among the year's top 100 discoveries by a major science magazine is indicative of the high quality of our research efforts."

Snow and Claes were part of an international team at Fermi National Accelerator Laboratory near Chicago that established the mass of the top quark, a discovery that ranked as Discover's No. 57 story.

Already known to be the heaviest of the fundamental particles that make up the nuclei of atoms, the top quark nevertheless came in at a surprisingly massive 178 billion electron volts (physicists use energy measurements to express the mass of subatomic particles). Claes said that's about as heavy as the nucleus of a gold atom.

Because of its size, the top quark extremely unstable, which is why it was the last of the six quarks to be positively identified (in 1995), and why it took nine more years to measure its mass accurately. But Snow said real significance in finding the mass of the top quark is in narrowing the search for a particle called the Higgs boson, which is believed to endow all particles with mass.

"This Higgs boson should be somewhere in the vicinity of 117 billion electron volts," Snow said. "We've narrowed down the possible window in which the Higgs mass should exist, and we know better how to look for it in the collisions that we see at Fermilab."

Research by Cassman and agricultural scientists at the International Rice Research Institute in the Philippines provided some of the first evidence that global warming could hurt food production. Their findings were Discover's No. 68 story.

This 11-year field study found that rice yields decrease 10 percent for every 1.8-degree Fahrenheit increase in nighttime temperatures when solar radiation and temperature are the only factors limiting yields, Cassman said.

"These findings suggest the yield potential ceiling could decrease if global temperatures continue to rise," he said.

Yields for rice, a leading food crop in much of the world, have leveled off in several major rice-producing regions. With rice yields already close to maximum potential in these regions, there's little room for improvement. Global warming might lower that potential, said Cassman, a scientist in the university's Institute of Agriculture and Natural Resources.

This research has implications for Nebraska where major crops,

including corn, soybeans and wheat, also are sensitive to high temperatures during the critical grain development period.

"Meeting world food demand in the next 30-40 years is going to be a challenge without global warming," Cassman said. "With global warming, it's like an additional headwind facing scientists trying to ensure food security."

Source: University of Nebraska-Lincoln

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