Naturally, the critics don't see it quite that way. Felix Boehm cites a variety of problems with the recent results. First and foremost, the kink has been seen only in solid-state detectors (using silicon or germanium as the detection material)—and not in magnetic spectrometers, despite many tries. This doesn't bother Simpson much; he claims magnetic spectrometers need large, poorly understood correction factors that could obscure the kink.

But critic Boehm doesn't stop there. Just as Simpson critiqued his critics, Boehm has reviewed the positive results and finds fault with all of them: the iron and germanium studies rely on fitting data to a theoretical curve that is poorly understood, the carbon study has a problem with the proper background subtraction, Hime and Jelley's sulfur results could suffer from scattering.

For the moment, most physicists agree that if the kink is real, it indicates a massive neutrino does exist, although what type of neutrino remains open to speculation (see sidebar on page 1427). There are three "flavors" of neutrinos—the electron-neutrino, the muon-neutrino, and the tau-neutrino—each associated with an electron or one of its kin. (The muon and tau are heavy, short-lived cousins of the electron). Other experiments rule out the electron-neutrino and the muon-neutrino, so the likeliest possibility is the tau-neutrino—or even an unknown fourth type, although most experts think that's a long shot.

Whatever its flavor, if the new discovery holds up, it is going to do some potent rearranging of accepted notions in physics. Take the Solar Neutrino Problem. That long-standing puzzle stems from the fact that detectors on Earth measure only a third to a quarter the number of neutrinos from the sun that theory would predict. Either theory is wrong, or somehow neutrinos "get lost" on their way to Earth. One way out of the quandary would be to propose that solar neutrinos sometimes transform themselves into neutrinos of a different flavor that the detectors aren't sensitive to.

That's just what would be predicted in the so-called Mikheyev-Smirnov-Wolfenstein (MSW) effect—but only if one of the neutrinos in the transaction has mass. But that neutrino with mass isn't likely to be the new find with its 17keV mass, since the MSW effect requires a neutrino with a mass of between 0.01 and 0.001 electron-volts. But all isn't lost, says Bahcall: If it's confirmed, the massive neutrino "demonstrates at least one neutrino has finite mass and presumably others could also."

Also on the agenda: "dark matter," the puzzling, invisible stuff that may constitute 99% of the mass of the universe and whose identity is a big problem for cosmology. Could a 17keV neutrino be the dark matter? Maybe, says Chicago's cosmological expert Turner. It's not the ideal candidate for dark matter, he explains: that would be a much smaller particle, with a mass of say, 30ev. A particle 500 times larger (as the 17keV would be) would have caused the universe to collapse on itself long ago, according to Big Bang theory. To get around that problem, says Turner, the neutrino would have to be unstable, with a lifetime shorter than 200,000 years and probably shorter than one year. But that leads to "whole new realms of speculation," says Bahcall, centering on new, unknown particles into which the neutrino might decay.

First Hominid Finds From Ethiopia in a Decade

In 1983 foreign researchers were banned from excavating sites in Ethiopia—a fossil-rich country that holds the remains of many early human ancestors. Last fall, American researchers were allowed back. Now, after an unusually productive field season, three teams have returned to the United States with some remarkable finds. Those finds may push back the date for the existence of the earliest known hominid, shed light on the split between apes and human ancestors, and show that some early hominids still spent time in trees.

The first set of results was made public last week when a team from the Institute of Human Origins in Berkeley, headed by Donald C. Johanson, announced they had found bones from no less than 15 different individuals at Hadar. Hadar is the site where, 16 years ago, Johanson found "Lucy," the remains of a small female from the species *Australopithecus afarensis*, the first known hominid. The newly discovered fossils appear to be from the same species but show a surprising diversity in size and build.

The most notable remains included a large humerus (upper arm bone), which showed signs it was attached to powerful shoulder muscles. "It doesn't lead us to believe [the early hominid] was going to a workout gym, but it leads us to believe this individual was capable of powerful movements of the shoulder that would have been useful for hoisting the body up," says Johanson. "It doesn't mean they were spending a lot of time in trees, but the option was certainly there." This contrasts with Lucy, who stood no more than 3½ feet tall and was not well muscled. The difference could be attributable to differences between the sexes: The humerus probably belonged to a male. Furthermore, that male lived about 500,000 years before Lucy came on the scene.

Another surprise was a 3-million-year-old jaw and facial bones showing some features similar to those seen in a species called *Australopithecus africanus*, which may have been ancestral to *A. afarensis*. Although the bones bear both *africanus* features and *afarensis* features, Johanson and his colleague, William Kimbel, think they more closely resemble *afarensis*. There is also a remote possibility that the jaw could be from yet another, intermediate species.

Another team, led by John Fleagle and Solomon Yirga of the State University of New York at Stony Brook (SUNY)—and partially funded by the National Geographic Society—reports finding a collection of hominid teeth at Fejej, a site in southern Ethiopia. One surprise was that the teeth date back at least 3.7 million years and possibly as much as 4.4 million, making them some of the oldest unequivocal remains of *A. afarensis*. "What makes it really exciting is that the Fejej remains are more complete than other remains of that antiquity, providing some of the most solid evidence of what hominids of that time were like," says SUNY professor Bill Jungers, coeditor of the *Journal of Human Evolution*, where the Fejej data are in press. That could have implications for the dating of the split of early hominids from the great apes—a controversial breakpoint now thought to have occurred between 4 million and 6 million years ago.

A third team from the University of California at Berkeley, led by anthropologists Tim White and Desmond Clark, has yet to release its findings, although the team reportedly also has found hominid fossils in the Middle Awash valley, south of Hadar. All three teams collaborated with Ethiopian researchers, partly as an effort to restore good relations with Ethiopia. All three are also seeking to renew their permits to return for another field season later this year.

■ Ann Gibbons