FOREWORD

EVERY FEW SECONDS, a subatomic particle with the kinetic energy of a well-thrown baseball (approximately 10^{20} electron volts) strikes somewhere in the earth's upper atmosphere, unleashing a magnificent cascade of up to one hundred billion particles over an area of several square miles. Unfortunately, the show is over in a few nanoseconds, and most of the time no one is there to watch it. It is a shame to miss not only the fireworks, but also the chance to learn about the particle's birthplace. Clearly, this must be in some extreme environment, for instance near a supermassive black hole at the center of an active galaxy, but we don't really know where. Another mystery stems from the prediction (by Greisen, Zatsepin, and Kuzmin) that cosmic ray protons above about 10^{20} eV should be rapidly degraded by interactions with the cosmic microwave background, yet no falloff has been seen to date.

The trajectories of cosmic rays of such tremendous energies are bent very little by galactic magnetic fields, so that with more than the present handful of observed events one could begin to "do astronomy" by identifying individual sources on the sky. In this issue of the *Beam Line*, Paul Mantsch describes the two techniques that have been used to detect the highest-energy cosmic rays: giant air shower arrays that sample the debris of the cascade once it reaches the ground, and telescopes that capture the distant flash of fluorescing air molecules excited by the ionizing radiation. He also gives an overview of the Pierre Auger Project (named after an early pioneer in cosmic ray physics), which plans in the next few years to combine both approaches and provide us with our best clues to the origin of these particles.

As Gaurang Yodh points out in the second article in this issue, gamma rays, being neutral, also point back to their birthplace, and at TeV energies their air showers can be detected by related techniques. (Detection of Cerenkov radiation supplants the fluorescence approach in this case.) The challenge in high-energy gamma ray astronomy is to suppress the much more copious charged particles of the same energy. But this can be done, and TeV gamma rays have been traced back to at least a couple of active galaxies. Several new detectors are in the works in this field as well.

Virginia Trimble puts this extraterrestrial high-energy frontier into perspective in her usual inimitable style. Finally, we return to Earth for Reinhard Brinkmann's description of a proposed accelerator at the terrestrial high-energy frontier: the TESLA superconducting linear collider.

In the Winter 1997 issue of the *Beam Line* (Vol. 27, No. 4), we announced three new contributing editors: Gordon Fraser from CERN; Judy Jackson from Fermilab; and Pedro Waloschek from DESY. These talented people have already helped us by authoring, editing, and alerting us to interesting articles in particle physics. With their help we have America and Europe pretty well covered, but we have been missing a contributing editor from Asia. Accordingly, Akihiro Maki from the National Laboratory for High Energy Physics (KEK) in Tsukuba, Japan will fill that role. Maki joined KEK in 1972 right after its establishment to build the first proton synchrotron in Japan. During his 26 year career there he has worked on experiments at Fermilab and Rutherford Laboratory, in addition to ones at KEK. He served as the director of the Washington Liaison Office of the Japan Society for the Promotion of Science (JSPS) to promote academic collaboration and exchange of researchers between the United States and Japan. He has since returned to KEK, and we are pleased to have him as a contributing editor.

Akihiro Maki at the Gastown Steam Clock, Vancouver, British Columbia, July 1998

Lance Dixon