

APR12-2012-000201

Abstract for an Invited Paper
for the APR12 Meeting of
the American Physical Society

Rossi and high-energy astronomy

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The contributions of Bruno Rossi to high-energy astronomy began in Italy in the 1930s with investigations concerning the nature of cosmic rays in theory and in hands-on experiments at the universities of Florence and Padua. Recent discoveries had cast doubt on Robert Millikan's idea that the primary cosmic rays are gamma rays created in the production of the elements by fusion of hydrogen atoms in interstellar space. Rossi entered the field with a prediction published in 1930 of a difference between the intensity of cosmic rays from the east and the west that would occur if the primary cosmic rays were charged particles of one sign. In the same year he invented the first practical electronic coincidence circuit, which he used in a series of fundamental particle experiments and in an unsuccessful attempt to detect an east-west effect at Florence. Expecting by theory that the effect would be greater at high altitude near the equator, he took his experiment to Eritrea in 1934 where his measurements demonstrated that the primary cosmic rays are predominantly positive particles. In the report of his expedition he also described his discovery of extensive cosmic-ray air showers. After WWII and his work at Los Alamos, Rossi resumed his cosmic-ray research, now at MIT, in a new style best described in his own words: "Now I had the responsibility of an entire group, and what mattered was no longer my own work, but the work of the group." He suggested the new methods of "density sampling" and "fast timing" for air shower studies, and promoted their application in numerous experiments on the nature and origins of the highest energy cosmic rays. In 1959 he initiated and participated as a consultant in the work of Riccardo Giacconi that led to the discovery of the first x-ray star, Sco X-1, and the development of the first imaging x-ray telescopes. At MIT, members of the Rossi Cosmic Ray Group took the early steps in gamma-ray astronomy, first with balloon experiments that set lower and lower limits on the intensity of primary gamma rays, and then with the satellite experiments led by William Kraushaar that discovered the galactic and extra-galactic components of cosmic gamma rays. After Sco X-1, Rossi focused his efforts on exploring the solar wind and the interplanetary plasma while leaving his younger colleagues to pursue the new field of extra-solar x-ray astronomy with balloon, rocket, and satellite experiments.