100 YEARS AGO

The little Warwickshire village of Stockton, ploughed and excavated by three manufacturing cement firms, has long yielded to collectors choice specimens of Lower Middle Lias fossils. Its late rector educated the quarrymen by lectures and in conversation [and] left them with a prediction that a perfect monster would some day be unearthed… A week or two ago, the prediction was fulfilled, and the advice remembered. The wielder of a pickaxe suddenly announced that he was "grapplin' along a lot of backbones"; the work was stopped, the foreman summoned, and slowly with due precaution a noble Icthyosaurus was uncovered. He lies 45 feet below the surface; 20 feet in length and 3 feet 10 inches across.

From *Nature* 1 September 1898.

50 YEARS AGO

From September 13 to September 17 the American Association for the Advancement of Science will hold in Washington, D.C., the centennial celebration of its founding… Beginning with 1900 each member received with his membership a subscription for the weekly journal *Science*, and since 1915 a subscription for either *Science* or *The Scientific Monthly*. At the beginning of this calendar year (1948) the annual membership dues, including a subscription for either of the two journals, became 6.50 dollars a year.

From *Nature* 4 September 1948.

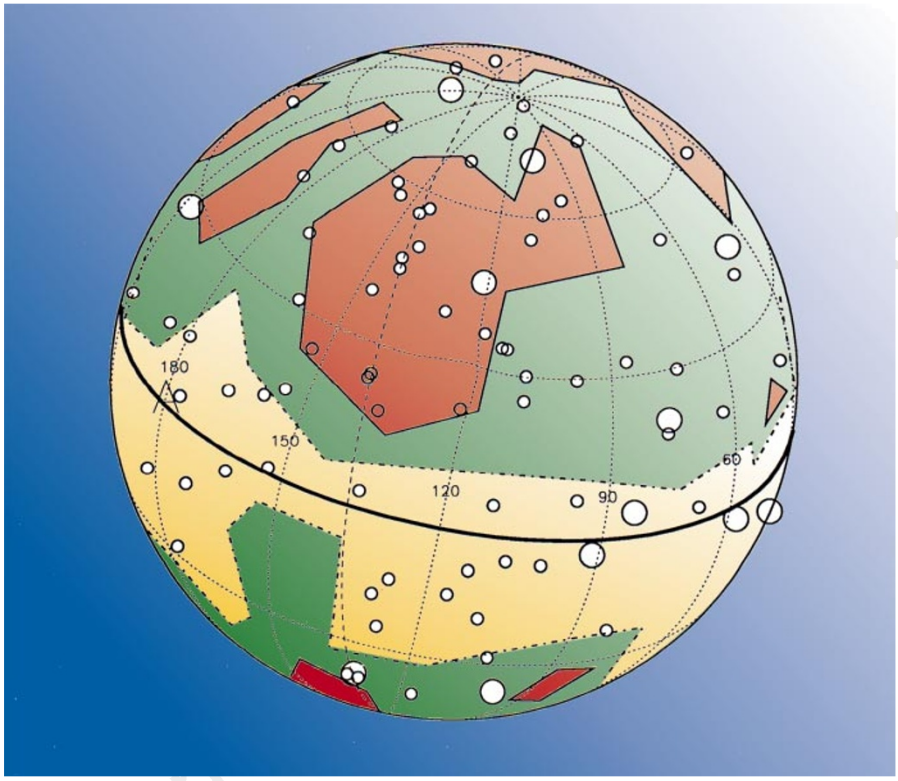

Figure 1 **The high-energy cosmic-ray sky. Circles show the arrival directions of cosmic-ray particles; those above 10^{20} eV are larger. There are concentrations of galaxies in the nearby Universe (red directions) and voids (yellow)[7]; if the cosmic rays were coming from radio galaxies or quasars we would expect some bias towards these directions. Similarly, we would expect a bias towards the Galactic plane (thick black line) if they came from objects in our Galaxy's disk. Neither bias is seen, and the simplest solution is that the highest-energy cosmic rays come from sources in our Galactic halo — perhaps from the decay of exotic supermassive particles. (Adapted from Uchihori *et al.*[6].)**

show no imprint of the Galactic disk). The Galactic halo itself is probably not a site of enough magnetic activity to generate such energetic protons. But most astronomers believe it to be filled with dark matter. Berezinsky[8] and Birkel and Sarkar[9] have proposed two ways in which super-heavy particles might form in the very early Universe (echoes of Lemaître), and cluster in galactic haloes, eventually decaying with a half-life greater than the age of the Universe and generating cascades of high-energy protons, gamma rays and neutrinos. These speculations are not yet closely constrained by observations. But, if the particles have a mass about 10^{12} times the mass of a proton, the resulting decay spectrum is very reasonable[9].

The paper by Takeda *et al.*[1] redresses another curious imbalance: there are now more particles that have been observed above 5×10^{19} eV than theoretical papers attempting to explain them. Many attempts have been made to bring particle physics and the early Universe to bear on the problem[8], including the possibility of exotic particles that can pass unscathed through the primeval radiation, but most fail to match the known facts.

How fortunate, then, that the international Auger project is planning to set up its first detector in Argentina. The planned 3,000-km^2 array of particle detectors will map out the spectrum and arrival directions of cosmic rays above 10^{19} eV from the southern sky. It should show whether the source distribution has a maximum — in the direction of the Galactic halo's centre or Centaurus A or elsewhere — and whether many gamma rays and neutrinos are mixed into the cosmic ray flux at these extreme energies, which would be evidence of massive-particle decays. □

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