

letters

and music, presumably be very capable of managing scientific concepts, and yet be very immune to the transcendent beauty and philosophical depth of our evolving world view? Does Roy believe that theoretical thought, guided by social utility, should have stopped with classical physics? the atom? the nucleus? Where, Professor Roy, does science cease to be useful to society? At 10 eV? 100 MeV? 40 TeV? Which committee should, in solemn conclave, set the limit?

If science—pure, applied, large, small, but above all good science—is to thrive in the next decade, it will be by our standing together in mutual respect for quality and for our common heritage. The vast majority of physicists, whatever their disciplines, operate with a complete awareness of the symbiotic nature of basic research, applied science and technology. The SSC, costly as it is, but representing the need of one discipline to make progress beyond the mid 1990s, deserves more rational debate.

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8/85

Quasar redshifts

The call to "recant" from those who question the validity of the Big Bang hypothesis, in light of recent data claimed to support this cosmology (PHYSICS TODAY, December 1984, page 17), deserves closer scrutiny.

The advent of three-dimensional, relativistic and fully electromagnetic particle-in-cell simulations on large computers have only recently been applied to astrophysical problems (PHYSICS TODAY, June 1984, page 90). The importance of the simulational approach in astrophysics derives from the fact that it offers a third, and largely independent, method to understand the behavior of plasma phenomena in the universe, in addition to theory and observation.

It is therefore of interest that the first such simulations replicate much of the observed data but do not support the cosmological interpretation of quasar redshifts and microwave background radiation.

Following a suggestion that cosmic plasmas are generally filamentary for all scale lengths from kilometers to megaparsecs,¹ simulations of galactic-dimensional current-conducting plasma filaments (Birkeland currents²) have been carried out to study what physical processes occur³ in the course of their evolution. The following sequence of events is observable in a single simulation:

► A burst of synchrotron radiation having an approximate magnitude of

10³⁷ watts lasting 10⁷–10⁸ years, with the isophotal contours of double radio galaxies

► A compression of intergalactic plasma into a central elliptical separatrix, followed by an alternating ejection of quasar-like plasmoids and "jets" (actually, relativistic electron beams accelerating toward the observer)

► Formation of peculiar, Seyfert and spiral plasma morphologies⁴ that, using observed masses, have the characteristic rotational velocity of galaxies⁵

► A total radiated energy of 2.07×10^{51} J within a 1.73×10^{65} -m³ volume, or an equivalent blackbody temperature of 2 K; the microwave radiation produced⁶ will have a high degree of isotropy in a metagalaxy of Birkeland currents

► A Marklund convection of plasma into the radiatively cooled filaments⁷ with a redshift

$$z = d\lambda/\lambda_0 \\ = (1 + \beta)^{1/2} (1 - \beta)^{-1/2} - 1 \\ \beta \approx E_x/B_{\theta c}$$

decreasing nearly linearly from the initial convection cutoff value 3.4 to essentially zero during simulation time (as $B_{\theta} \sim I_{\text{Birk}}$ increases).

The correspondence between simulation and many of the interpretations of those suggesting noncosmological redshifts is striking. In conclusion, the statement "Apostles of the noncosmological origin of quasar redshifts must now... recant, or else maintain that the unknown laws of physics which fix [these] redshifts... extend [over] appreciable distances to apparently normal galaxies..." can be taken in good humor, but it does preclude the possibility that we live in a plasma universe.

References

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Colliding-beam physics

In the March issue (page 29), I read: "The development of colliding-beam physics began at Stanford University, which operated an electron-electron



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