that the coincidence in phase relationship between the Earth's orbit around the Sun and that of the planet around the pulsar is not explained by the model of Helfand and Hamilton, but rather argues against it.

There is further relevant observational evidence, concerning the frequency dependence of the amplitude of the sinusoid formed by the timing residuals. The data set used in ref. 2 contains observations at frequencies around 1,408 MHz and 1,630 MHz. Independent fits at these frequencies give amplitudes of 7.7 ± 0.3 ms and 7.4 ± 0.6 ms respectively, whose ratio is 1.04 ± 0.08. This is significantly different from the value of 1.34 that would be expected if the dispersing cloud were a cold plasma, because the magnitude of any delay will depend on the inverse square of the observing frequency. A ratio of 1 is of course what one would expect for the planetary interpretation, in the absence of any dispersing clouds.

Two other aspects of this model also worry me. First, it seems most unlikely that the structure of the cloud should give rise to an integrated density profile that produces such a closely sinusoidal form in the observed time delay. Second, such a large, dense plasma cloud so close to the Sun would be expected to produce substantial Hα emission, which to my knowledge is not observed.

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Another look at the Big Bang

SIR — In a discussion[1] on the resolution of Olbers' paradox, prompted by Wesson's article[2], Maddox compares the effects of the age and expansion of the Universe. The age limits the light emitted by stars, and expansion redshifts the starlight. The age limit was first calculated by Lord Kelvin[3] in 1901, who showed that the night sky is dark because the visible Universe, having a size determined by the finite speed of light, contains too few stars to cover the whole sky. Bondi in 1952 attributed darkness[4] of the night sky to expansion and argued that the darkness is direct proof of the expansion of the Universe. Bondi's popular argument, true in a steady-state universe of infinite age, fails in an evolving universe of finite age. For, if Kelvin's solution applies in a static universe uniformly populated with stars, then it also applies in an expanding universe of galaxies, and expansion, absorption, and clustering of stars serve only to make the night sky darker.

I discussed[5] the age limit in 1964, and showed that to fill a static universe with starlight in thermodynamic equilibrium with stars requires that stars shine continuously for 10^{23} years. The energy density of starlight in a static universe only 10^{10} years old is 10^{-13} of that needed to create the bright sky of Olbers' paradox. Even in a much older universe, the sky remains dark because the lifetime of luminous stars is typically 10^{10} years.

I also showed[5] that the effect of expansion is usually small. Two universes of equal age, one static and the other expanding, with stars in identical states, contain equal numbers of photons emitted by stars. In the expanding universe the average redshift of photons is $\langle z \rangle = (1 + q)^{-1}$ and the radiation energy density is $u_s/(1 + \langle z \rangle)$, or $u = u_s(1 + q)/(2 + q)$, where u_s is the radiation energy density in the static universes, and the deceleration term q is constant. In all decelerating universes of $q > 0$, expansion reduces the radiation to a level never less than 0.5 of that in the static universe. Thus, in the standard model (density parameter equal to unity), $q = 0.5$, hence $u = 0.6u_s$. Bondi's redshift solution, applied to a Big Bang universe, reduces the radiation field by a factor not less than 0.5, whereas Kelvin's solution limits the radiation field to 10^{-13} of that needed to create a bright sky. The age effect clearly dominates.

The visible Universe has a radius roughly 10^{10} light years. Stars in a sphere of radius 10^{10} light years cover geometrically (not diffractionally) 10^{-13} of the sky. Insufficient stars exist in the visible universe to cover the sky. In the long history of the paradox[6], Kelvin was the only person to relate the radiation density of starlight to the sky-cover fraction[7], thereby proving the aptness of Olbers' geometic line-of-sight argument[8].

When the effect of expansion dominates, as in Bondi's steady-state solution, the sky is covered with stellar disks, most of which cannot be seen because of large redshift. When the effect of age dominates, as in Kelvin's solution, the sky is not covered with stellar disks; stars in the visible Universe must increase in number by 10^{13} to cover the sky and come into equilibrium with starlight.

Olbers' paradox is full of intricacy and subtlety, which explains why it continues to fascinate, if only for theoretical reasons. Substitution of galaxies for stars changes the name of the game: a more suitable name would be 'Bonnor's paradox'[9], were it not that a sky tiled with galaxies is not in paradoxical conflict with observation.

Olbers' paradox has climaxed this century with the realization that the sky is covered not by redshifted stars, but by the redshifted Big Bang. At night we look out between the stars to immense distances and far back in time before the formation of galaxies and stars. We look out and back to the limit of the visible Universe, and almost every line of sight terminates in the early Universe. The Big Bang covers the entire sky, but its brilliance is mercifully redshifted by the expansion of the Universe into an infrared gloom invisible to the naked eye.

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Rhythms of war

SIR — We decided to examine whether seasonal rhythms exist in the opening dates of wars. Our analysis is based on a total of 2,131 acts of hostility, appearing as entries in Laffin's monograph[1], for which a defined opening month date is given. Each act of hostility was assigned both its opening month date and its line of latitude.

In the Northern Hemisphere, latitudes 30–60° N, the annual rhythm in the opening dates of wars shows a peak in August and a nadir in January (*a* in the figure). An inverse pattern in the annual rhythm of wars with a peak in December–February and a nadir in July was found in the Southern Hemisphere, latitudes 30–60° S (*c* in the figure). The circannual rhythms in the acts of aggression, both in the Northern and the Southern hemispheres, have a statistically significant positive correlation with the annual rhythm of the photoperiod duration in the same geographical regions. The results in the Northern Hemisphere suggest that there is a phase-shift of about one month between the two rhythms. We found a constant rate of acts of hostility throughout the year around the line of the Equator (*b* in the figure).

Barbara Tuchman[2] designates affectiveness and irrationality as dominant contributory factors in the series of wars from Troy to Vietnam. Elongation of the daily photoperiod may induce increases