agree with the observed values (1.5–3 msec). Identical values of $\Delta\tau$ for the optical and x-radiation are due to the generation of both radiations by the same electrons. A similar profile of the pulses at the radio frequency is possibly connected with the fact that the distribution of relativistic electrons responsible for the radio emission with respect to the pitch angles is influenced by the action of the powerful optical and x-radiation.

The received radiation becomes pulse-like if the angle β between the rotation axis ω and the magnetic dipole **M** is not equal to zero. When

$$\beta = \pi/2,$$

the radiation pulses, which are registered twice every revolution, follow at equal time intervals (this case is typical of most pulsars). On the other hand, if $0 < \beta < \pi/2$, then in the case of observation at an angle γ to the ω axis ($\pi/2 - \alpha < \gamma < \pi/2$) the intervals between three successive pulses become unequal (a situation typical of the NP0532 pulsar, and also of NP0527 and CP0950).

In the case of rotation of a star having a magnetic moment **M** not parallel to ω, a strong interaction occurs between the magnetic field and the plasma in the magnetosphere of the star and the surrounding medium (effects of plasma dragging, spin-off of matter, and radiation of low-frequency waves, which, in principle, may be responsible for the change of the period of the rotation of the object). The revolution frequency $\omega = 2\pi/\tau \sim 2\text{–}2 \times 10^2$ satisfies the inequalities $\omega < \omega_{Hi}$ or $\omega_{Hi} < \omega < \sqrt{\omega_{Hi}\omega_{He}}$, where ω_{Hi} and ω_{He} are the ion and electron gyrofrequencies in the plasma surrounding the pulsar, i.e., in the interstellar medium or in the supernova envelope. Therefore the radiated low-frequency waves correspond to Alfven waves or to waves in the region intermediate between magnetohydrodynamic waves and waves of the type of whistlers in the earth's magnetosphere. According to estimates by V. P. Dokuchaev and Yu. V. Chugunov, the power $W \sim W_0 n^3$ of the magnetic dipole radiation of a rotating star in a medium will be much higher (by a factor 10^6 and more) than the corresponding power in the vacuum W_0 (owing to the large values of n—the refractive index of these waves).

It is not excluded that the radiation of the low-frequency waves is the main cause of the observed growth of the period of rotation of the pulsar.

[1] V. L. Ginzburg, V. V. Zhelezhyakov, and V. V. Zaĭtsev, Usp. Fiz. Nauk 98, 201 (1969) [Sov. Phys.-Usp. 12, 378 (1969)]; the same, Astrophysics and Space Science (1969).

N. S. Kardashev. Possibility of Observing Extragalactic Pulsars.

The paper considers the following:

1. The possibility of observing pulsars produced in supernova outbursts of the nearest galaxies. At the instant of the outburst, the pulsar radiation power may be comparable with the radiation power of the supernova envelope. Subsequently, the pulsar radiation exceeds the envelope radiation power. It is noted that it is necessary to organize observations of supernova outbursts in the nearest galaxies. The observations are desirable in the γ, x-ray, optical, and radio bands for different instants following supernova outbursts.

2. The probable role of pulsars in radio galaxies and in quasars. There are three possibilities: 1) a decisive role in the radio sources is played by a supermassive star—s "superpulsar"; 2) in addition to the supermassive star there exists in the source a large number of ordinary pulsars, ensuring generation of cosmic rays; 3) the radio source consists of a large cluster of pulsars. A method is proposed for determining the number of pulsars in the source, the radiation of which is due to a considerable degree to the radiation of these pulsars.

3. The prospects of investigating extragalactic pulsars so as to determine the cosmological parameters, namely, measurement of the density of the intergalactic medium on the basis of the delay, measurement of the parallaxes at cosmological distances, and measurement of the expansion of the universe by determining the change of the periods of remote pulsars.

V. I. Slysh. Scattering of Pulsar X-rays in the Interstellar Medium.

The influence of the interstellar dust on the x-rays from the pulsar in the Crab Nebula NP0532 has been calculated. This influence reduces to pure small-angle scattering. Spherical particles of radius 0.5 μ scatter x-rays with wavelength 5 Å "forward" into a cone of approximate width 1.5′. In the case of NP0532 there is produced around the pulsar a halo with angle dimension 1–2′, containing about 90% of the total pulsar radiation. Since the structure of the x-ray source Tau XR-1 has the same character (the source of the pulse radiation contains 5–10% of the flux of the exnebula), it can be assumed that the radiation of the Crab Nebula itself in the x-ray band is small, and the observed nebula constitutes only the halo of the scattered radiation of the NP0532 pulsar. In this case the following should be observed: first, an increase in the fraction of the pulse radiation on going over to the harder region; second, an increase of the angular dimension of the nebula at longer wavelengths (~15′ at Å wavelength); third, a correspondence between the polarization characteristics of the pulsar and of the nebula. Analogous nebulas with a flux proportional to the interstellar absorption in the visible region should be observed also in other x-ray sources. If the scattered x-radiation is not observed, this will mean that the optical interstellar radiation is due to particles of much smaller dimension.

I. S. Shklovskiĭ. Concerning Pulsars

1. The age of the pulsar PSR0833-45, determined from the period T and its derivative dT/dt, turns out to be ~10,000 years, whereas the age of the radio nebula Vela X, with which this pulsar is identified, should be not less than 30,000–40,000 years. The probability of random coincidence of the coordinates of the pulsar PSR0833-45 and of the radio nebula is very low.