In the axi-symmetric case there are two constants of the motion because the field is independent of ϕ as well as t . It can be seen from equation (8) that in the approximation $r \ll r_L$, $\psi \approx 0$, the relativistic particle energy is approximately a constant of the motion. This conclusion has relevance for those models in which the radio pulses are generated near the star surface by particles accelerated to highly relativistic speeds away from the magnetic polar regions⁶. The details of the departure of ψ from zero near the star are in fact crucial to an understanding of these models.

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Short-Period Oscillations in Eta Carinae

IN view of the dramatic recent history of Eta Carinae¹ and the violent motions within the nebulous envelope immediately surrounding it², we have studied this object for short-period optical oscillations in the 1968–69 observing season. Following the suggestion by Ostriker and Gunn³ that the various optical phenomena may be excited by a pulsar, we extended the original search to still higher frequencies.

The data and the results are summarized in Table 1: acquisition and analysis were according to the principles given in reference 4. The 1971–72 data were taken with a live-time Fourier-analysis program (to be described in a future publication) using the Cerro Tololo Data System^{5,6}; for these data the values of A , the maximum harmonic amplitude within the statistically reliable part of the power spectrum, are only representative, as these peaks are superimposed on a poorly understood continuum presumably due to atmospheric effects on the extended nebulosity. Our results indicate that there are no short-period oscillations in Eta Carinae with amplitudes greater than 0.008 mag, and generally in the range from 0.028 to 408 s (see Table 1). Among the various data sets there are no significant coincidences in the frequencies at which

maxima appear in the power spectra. Additionally there are no obvious non-atmospheric continuum features in the power spectra.

We cannot exclude the possibility of some pulsar-like phenomenon within Eta Carinae, as the large, relatively low density, stellar-type envelope associated with the optical spectra should have very small dynamical response at the frequencies of concern here. Our null result, however, might be taken in support of Davidson's suggestion⁵ that Eta Carinae is a young massive object in its early evolutionary stages.

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Equatorial Sporadic E and Plasma Instabilities

THE radio reflexions from the sporadic E region (E_s) of the ionosphere show unique properties within a narrow range of latitudes over the magnetic equator. Matsushita¹ pointed out that the latitudinal variations of the maximum frequency reflected from the E_s region and the solar daily range of geomagnetic H component each show a sharp maximum within about $\pm 3^\circ$ from the magnetic equator, suggesting an association between equatorial E_s and equatorial electrojet currents. Knecht² has described the characteristics of equatorial E_s (E_s -q). First, it regularly occurs during daylight hours in a narrow belt along the magnetic equator; second, it is always transparent to probing by radio waves; third, it usually displays a well defined lower edge lying between 100 and 110 km, giving scattered and diffuse echoes above the principal echo; fourth, in well defined cases the diffuse echoes are contained below a sharp upper boundary that starts at about f_oE and

Table 1 Summary of Observational Results*

Date (month/day/yr)	Starting UT (h : m : s)	τ (s)	Length (h : m)	$Q \dagger$	A (mag)	Period range (s)	Diaph $\ddagger$	Comments
12/28–29/68	05 : 59 : 57	2.000	1 : 08	0.006	0.0012	4.0, 408	13	U filter, 1P21
01/15–16/69	07 : 24 : 59	2.000	1 : 03	0.004	0.0010	4.0, 378	28	No filter, 1P21
12/23–24/71	07 : 13 : 27	0.074	0 : 06.3	0.011	0.008	0.146, 13.6	18	No filter, FW-130
12/24–25/71	07 : 59 : 38	0.074	0 : 15.1	0.014	0.008	0.146, 13.6	23	No filter, FW-130
01/14–15/72	04 : 47 : 43	0.014	0 : 52	0.023	0.006	0.028, 2.61	23	U filter, FW-130
01/16–17/72	07 : 08 : 59	0.014	1 : 05	0.015	0.006	0.028, 2.61	23	U filter, FW-130

* All data taken with the CTIO 36-inch telescope except on 01/15–16/69 when the 16-inch was used.

$\dagger$ Noise statistic defined by Hesser, Ostriker and Lawrence⁷.

$\ddagger$ Diaphragm diameter in arc s.