matters arising

Waste and the Pacific

SIR,—The letter which appeared in *Nature* concerning the distribution of tar along latitude 35°N in the Pacific Ocean[1] raises the question of the cause of the pronounced peaks which occur.

One of the explanations advanced is that meanders in the Kuroshio current could be responsible for the distribution. If this were the case, the distribution would have peaks corresponding to the meander wavelengths, which are typically 200 km to 400 km (2° to 4° longitude). This is unlikely to be correct, since the three pronounced peaks are separated by distances of 2,000 km (20° longitude) and 1,300 km (13° longitude).

Another possible explanation of this distribution is that the intense Kuroshio current may generate a series of Rossby waves, which can propagate across the entire Pacific Basin[2].

In a numerical model recently developed by myself (to be published) a surface layer, 100 m deep and in an idealised basin, was subjected to a zonal wind stress typical of winter in the Northern hemisphere. The energy dissipation was parameterised to occur over the contintental shelves. The resulting steady circulation produced (Fig. 1) shows 'ripples' in the eastward flowing current between the subarctic gyre and the sub-tropical gyre (30°N to 55°N). The wavelengths in this particular example decrease from 1,300 km (13° longitude) in the western half of the basin to 600 km (6° longitude) in the east. The amplitude of meridional velocity at 35°N decreased from 8 cm s^{-1} in the west to 4 cm s^{-1} in the east.

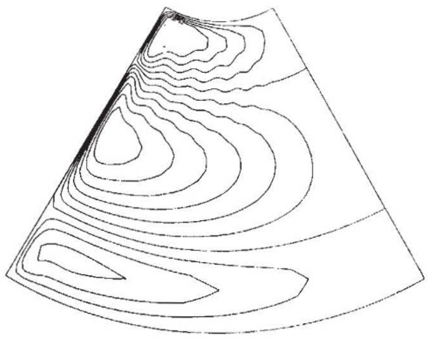

FIG. 1 The pattern of streamlines induced by a steady wind field in a hypothetical ocean basin, which extends from the equator to 60°N, and has a width of 60° longitude. The flow of the water is parallel to the streamlines and its intensity is proportional to the concentration of streamlines. The intense flow on the western edge of the basin is representative of the Kuroshio current in the North Pacific and the Gulf Stream in the North Atlantic.

I suggest, therefore, that the observed distribution of tar may be explained more satisfactorily in terms of the type of waves predicted by the model.

Yours faithfully,

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1 Wong, C. S., Green, D. R., and Cretney, W. J., *Nature*, **247**, 30 (1974).
2 Moore, D. W., *Deep Sea Research*, **10**, 735 (1963).

obituary

G. P. Kuiper

GERARD PETER KUIPER died suddenly on December 24, 1973, after a long and greatly distinguished career of ardent devotion to astronomy. He has left his mark by his achievements in observational and theoretical research and in developing new instruments, and in many other ways—as a director and founder of research institutes, as a writer and editor in the grand manner, as from the outset a prominent collaborator in the NASA lunar and planetary programmes which he called "the greatest scientific venture of history."

Kuiper was born on December 7, 1905 in the Netherlands. In 1933 he gained his doctorate in Leiden for a thesis on binary stars with the renowned Ejnar Hertzsprung as his adviser. He then went to work mainly on the same subject at Yerkes Observatory, where Otto Struve had assembled perhaps the most brilliant team of young astronomers in existence. After spending the year 1935–6 at Harvard, Kuiper returned to Yerkes as a staff-member and, apart from civilian scientific war services—he had become a United States citizen in 1937—he remained until 1960, twice serving as Director of the Yerkes and McDonald Observatories 1947–49, 1957–60. He then moved to the University of Arizona in Tucson, where he founded and directed the Lunar and Planetary Laboratory and its Catalina Observatory with an armoury of large telescopes for planetary work. These included the well-known 61-inch high resolution telescope specially adapted for observations in the near infrared, one of the many fields in which Kuiper was a pioneer. He relinquished some administrative responsibilities in 1973, but at the time of his death he was planning fresh developments of his scientific work. In the United States and abroad, Kuiper received numerous honours for his contributions to astronomy; the Royal Astronomical Society elected him an Associate in 1951.

As long ago as 1937, Kuiper's paper on Hertzsprung-Russell diagrams of stellar clusters pointed the way to much subsequent empirical work on stellar evolution. His pioneering work with Stromgren and Struve on models for close binary stars initiated what is still one of the most lively branches of stellar astrophysics. His classical papers of 1938 on the empirical mass-luminosity relation and of 1942 on "the nearest stars" remained for over a decade the main compendia of empirical stellar parameters.

Kuiper's dominating lifelong interest was, however, the solar system. He discovered two new satellites Miranda (Uranus) and Nereid (Neptune), the atmosphere on Saturn's satellite Titan, and the asteroid that bears his name. From 1960 onwards he produced (with