LETTERS TO NATURE

PHYSICAL SCIENCES

Search for Infrared Anomalies associated with Gravitational Events at the Galactic Centre

WEBER[1–4] has reported bursts of gravitational radiation apparently arriving from the direction of our galactic centre (or anti-centre). The resulting mass-loss implied by the estimated energy flux of nearly 100 W cm^{-2} at Earth has caused much theoretical discussion[5–8] with regard to possible source models. This reported high gravitational flux at Earth suggests a search for accompanying electromagnetic bursts from the same direction. Such searches have already been made for microwaves[9,10], X-rays[11,12] and neutrinos[13,14]. All of these searches establish very small upper limits on the ratio of electromagnetic (or neutrino) to gravitational energy flux at Earth; however, radio pulses noncoincident with Weber's pulses have recently been reported[15]. Here we report the results of our search for bursts of infrared radiation from the galactic centre region.

Observations were made from the Cerro Tololo Inter-American Observatory, near La Serena, Chile. Clear nights provided continuous observation periods of up to 8 h. The infrared source coincident with the dynamical centre of the galaxy at RA 17 h 42–43 min and dec −28° 59′ has recently been mapped at 2 μm and 10 μm (refs. 16–18). For observations of this source the 16-inch reflector was used to view a region one arc min in diameter at the centre of the infrared source. Observations covered a period from July 24 to August 8, 1972 (when weather permitted) and totalled 45 h of observing time. Observations were confined to those times when the galactic centre was near the zenith. These times also correspond theoretically to a maximum in the response of an east–west oriented gravitational antenna.

We used a liquid nitrogen cooled PbS detector to view the 2 μm and 4 μm atmospheric windows. Before each observing period, a scan of α Sco was made as a calibration of detector noise and sensitivity. The galactic centre infrared source is first magnitude[16,17,19] in the L band and could be seen with a 2:1 signal-to-noise ratio using a 100 s time-constant. The chart recorder monitor using a 0.1 s time-constant could easily have detected an increase of two orders of magnitude in infrared flux from the galactic centre.

Weber has supplied us with a list of 74 gravitational events covering the period July 23 to August 8, 1972. During our observations, Weber recorded five coincidences between gravitational antennas at the Maryland and Argonne Laboratories. No significant increases in infrared flux above a level of 10^{-14} W cm^{-2} were found within ±1 min of these events. This upper limit on the infrared flux that might be associated with a gravitational pulse is a factor of 10^{16} less than the gravitational flux necessary to excite the coincidences in the gravitational antennas. Since the bandwidth of the 2 μm and 4 μm windows is 2×10^{13} Hz, the energy flux per unit bandwidth in the infrared fluctuated less than 5×10^{-28} W cm^{-2} Hz^{-1} during a gravitational event. This limit is of the order of 10^{26} less than the required gravitational flux per unit bandwidth and is nearly the same as the limit set in the microwave regions[9,10,15].

If the reported high flux gravitational events are confirmed, there are several possible explanations for this absence of observed coincident fluctuations in infrared levels. First, if there is a net polarization of the gravitational radiation, it has been shown that the location of the source of gravitational radiation is not near the galactic centre region[6,7]. Second, dust in the dense region within 1 pc of the galactic centre may absorb most electromagnetic radiation, re-emitting it over comparatively long time periods. Third, there may simply be very little electromagnetic radiation accompanying such gravitational events. Finally, if one assumes no net polarization of the gravitational waves, Weber's data only limit the position of the source to within 4 arc deg of the galactic centre. We have narrowed this search to the small region near the galactic nucleus because the high mass density there makes gravitational radiation more plausible.

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R. E. SLUSHER
J. A. TYSON

Bell Laboratories,
Murray Hill, NJ 07974

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Position of OH471

Carswell and Strittmatter, reporting the high redshift[1] they measured for OH471, do not quote the accurate radio and optical coordinates which were the basis of its identification. These coordinates are:

Radio α(1950) = 06 h 42 min 53.3 s ±0.2 s δ(1950) = 44° 54′ 33″ ±1″
Optical α(1950) = 06 h 42 min 53.1 s ±0.1 s δ(1950) = 44° 54′ 31″ ±1″

The radio position was measured by the method described by Adgie *et al.*[2] except that an interferometer spacing of only 1,300 wavelengths was used. The optical position was meas-