

## J99E.3—Magnetic Field at a Pulsar

### Problem

The x-ray pulsar SGR1806-20 has recently been observed to have a period  $T$  of 7.5 s and a relatively large “spindown” rate  $\dot{T} = 8 \times 10^{-11}$ ; C. Kouveliotou *et al.*, *Nature* **393**, 235 (1998). Calculate the maximum magnetic field at the surface of this pulsar, assuming it to be a standard neutron star of mass  $1.4M_{\odot} = 2.8 \times 10^{30}$  kg and radius 10 km, that the mass density is uniform, that the spindown is due to electromagnetic radiation, and that the angular velocity vector is perpendicular to the magnetic dipole moment of the pulsar.

Give a numerical answer for the surface magnetic field in units of the so-called QED critical field strength  $m^2c^3/e\hbar = 4.4 \times 10^{13}$  gauss.