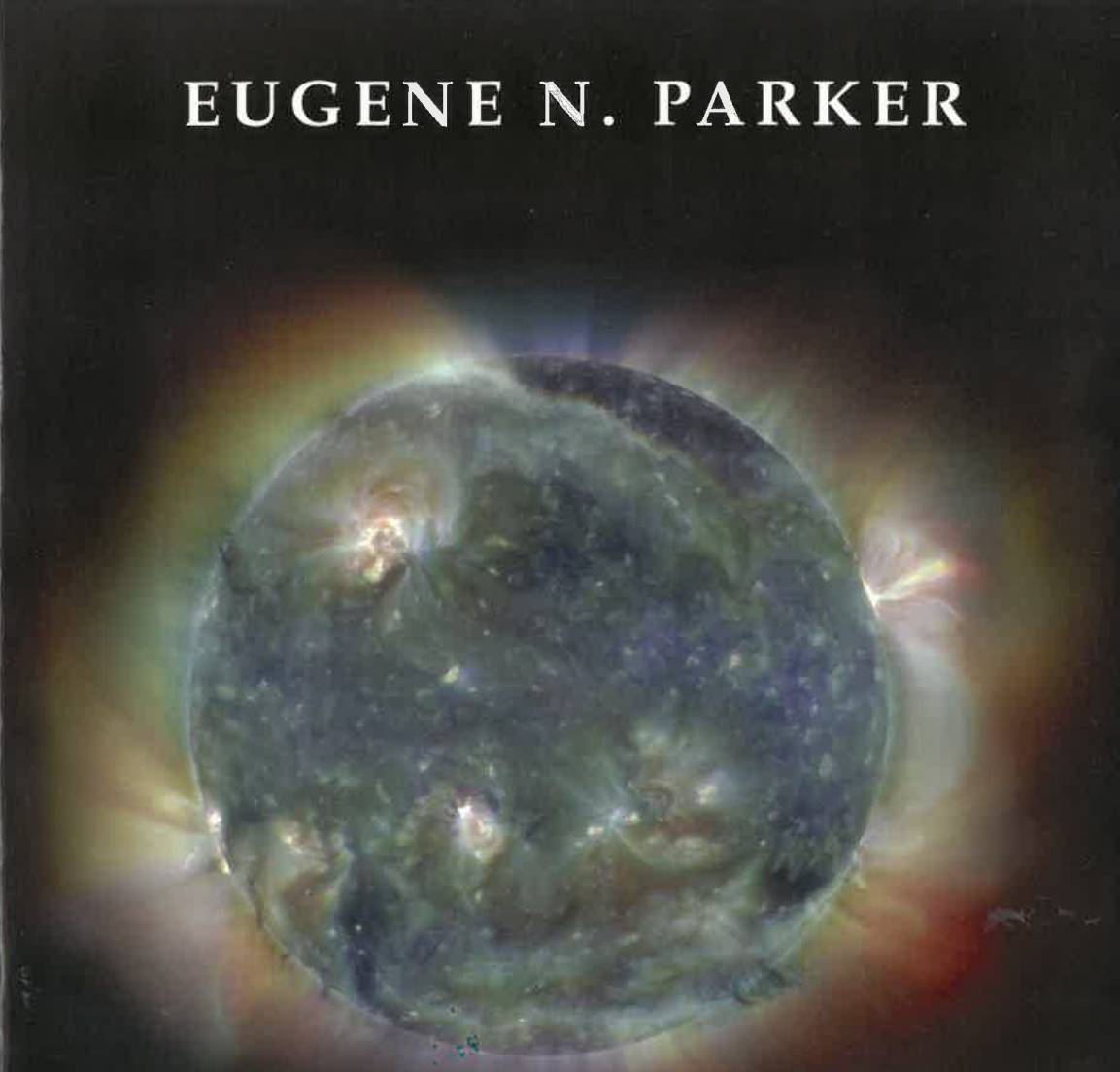
EUGENE N. PARKER



CONVERSATIONS

ON ELECTRIC AND MAGNETIC FIELDS IN THE COSMOS

With best wishes, Alex.
Maybe this book will
immortalize the Chaucer system
of mass, length, and time units

Jane Parker

See p. 63
Alf Dessler
16 Nov. 2018

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Nov 2011

increases without bound as the mass and radius of the hole decrease. In summary, then, we have the well-known fact that weak gravitation and the smallness of quanta in the macroscopic world make l so small.

Frank Wilczek (2005, 2006) provides a penetrating discussion of the choices of fundamental constants, e.g., G, c, h, or G, c, e, or h, e, m, with which one might establish convenient systems of units. He notes that ignoring the fundamental laws of physics opens the possibility for arbitrarily many different units besides length, mass, and time, with SI units as an "appalling" example, where the natural units of electric charge, defined by Coulomb's law, eqn. 2.1, are ignored and the coulomb becomes an additional unit.

6.6 Chaucer Units

When it comes to extended discussions of the relative merits of diverse systems of units, A. J. Dessler interjected the Chaucer system of units some years ago to lighten the mood. Rejecting the metric system he turned to historical precedent, with furlongs, stones, and fortnights in place of cm, g, s, or m, kg, s, respectively. For the convenience of the reader, we note here the standard conversions.

$$1 \text{ furlong} = \tfrac{1}{8} \text{ mile} = 660 \text{ feet} = 2.01 \times 10^4 \text{ cm};$$

$$1 \text{ cm} = 4.98 \times 10^{-5} \text{ furlongs}$$

$$1 \text{ stone} = 14 \text{ pound} = 6.36 \times 10^3 \text{ g}; \; 1 \text{ g} = 1.573 \times 10^{-4} \text{ stones}$$

$$1 \text{ fortnight} = 2 \text{ weeks} = 1.210 \times 10^6 \text{ s}; \; 1 \text{ s} = 0.826 \times 10^{-6} \text{ fortnights}$$

The speed of light becomes $c = 1.80 \times 10^{12}$ furlongs/fortnight. The unit of force is defined as the force that accelerates one stone at a rate of one furlong per fortnight^2, which we call the *tug*. The unit of work and energy becomes one tug furlong, and might be called the *heave*. Thus,

$$1 \text{ tug} = 0.872 \times 10^{-4} \text{ dynes}; \; 1 \text{ dyne} = 1.147 \times 10^4 \text{ tugs}$$

$$1 \text{ heave} = 1.751 \text{ ergs}; \; 1 \text{ erg} = 0.570 \text{ heaves}$$

The acceleration of gravity at the surface of Earth is, accordingly,

$$g = 980 \text{ cm/s}^2 = 7.14 \times 10^{10} \text{ furlongs/fortnight}^2$$

which might be reduced somewhat by the levity of the Chaucer system itself. One parsec is

$$1 \text{ pc} = 3.18 \times 10^{18} \text{ cm} = 1.58 \times 10^{14} \text{ furlongs};$$
$$1 \text{ furlong} = 6.33 \times 10^{-15} \text{ pc}$$

The unit of electric charge, which might be called the *zap*, is defined in the usual way, as the charge exerting a force of one tug on an equal charge at a distance of one furlong. It turns out to be

$$1 \text{ zap} = 1.88 \times 10^{2} \text{ esu; one esu} = 5.32 \times 10^{-3} \text{ zaps}$$

The charge on an electron is then,

$$e = 4.80 \times 10^{-10} \text{ esu} = 2.56 \times 10^{-12} \text{ zaps}$$

The electric field at a distance r from a point charge q is defined as q/r^2. The magnetic field is defined by the traditional Biot relation (3.3), wherein the constant K is put equal to $1/c$. We honor the founder of the Chaucer system by naming the unit of magnetic field the dessler, just as the unit of magnetic field in the cgs system is called the gauss. With these definitions the electromagnetic equations are symmetric in **E** and **B**, and Maxwell's equations take the familiar form of eqns. (1.5) and (1.6).

Having served its purpose here, the Chaucer system merits no further comment.