absorption act results in the momentum of the quantum being partly transferred to the atom, and these momenta have mainly one direction. The subsequent re-radiation is spherically symmetrical except into a stimulated emission may take place. The pressure of radiation is more important than thermal collisions in supporting the outer atmosphere against solar gravity. This same situation obtains in certain diffuse nebulae. From the degree of excitation and ionization and from the character of the radiation one infers high temperatures. Millions of degrees are often cited in the literature. For true thermal equilibrium such temperatures would indeed be required. But the gas in most nebulae would be considered an excellent vacuum in most laboratories and its constituent atoms would not be in thermal equilibrium. It is important to recall the fictitious nature of these temperatures in considering mechanisms for the origin of cosmic radiation. The temperature of cosmic-ray particles, with energies of some ten Bev would be around 10^4 degrees. Nebulae are not "blackbodies."

Third, we cannot always correctly infer the temperature of a source from the noise-radiation which it emits. Clearly, if there are enough charges circulating about a sunspot to produce a field of thousands of gauss over many thousand square miles, there will also be enough charges in irregular, and hence accelerated, motion to produce abundant radiofrequency radiation. The irregular character of this motion would be expected to result in the radiation of continuum-like noise rather than particular frequencies, though at any one time one particular frequency or set of frequencies may be preferentially radiated. The radiofrequency radiation therefore will not necessarily be truly thermal.

No doubt much confusion is the result of a temptation to attach physical significance to the equivalent noise temperature T. This is a quantity used to express the available power of a source of noise. It is defined as the fictitious temperature of a resistor whose Johnson noise would have an available power equal to that of the source under observation. The convenience in this specification lies in the fact that the result is independent of the bandwidth of the detector and the internal resistance of the source. The bandwidth need not be measured, and the temperature T is determined directly. Whatever the method of measurement, however, it merely gives information in regard to power and nothing concerning the details of the mechanism of the origin. In most cases, of which the measurement of solar or celestial noise is one, the temperature T is purely a convenient fiction to which no direct physical significance can be attached.

Erratum: A Ferroelectric Curie Point in KTaO₃ at Very Low Temperatures

[Phys. Rev. 79, 885 (1950)]

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September 19, 1950

THROUGH a regrettable error, the word "ferromagnetic" was substituted for "ferroelectric" in the title of this Letter to the Editor as printed.

Proton-Proton Scattering at 100 Mev

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September 12, 1950

THE recent operation of the Harvard 95-in. cyclotron has made possible proton-proton scattering experiments in the 100-Mev region. The experiment described here is similar to one in progress at Rochester, in that the equipment is placed directly inside the vacuum tank of the cyclotron.

The internal proton beam was intercepted by a ten-mil polyethylene foil mounted in the median plane of the magnet gap.

Anthracene scintillation crystals placed above and below the median plane counted the scattered and recoil protons in coincidence as in the method of Wilson and Creutz. The light flashes from the crystals were transmitted through seven-foot Lucite rods to RCA 5819 photo-multiplier tubes placed in magnetic shields. The positions of the counters depended on the angle to be studied, but in all cases only those protons scattered in a vertical plane were counted. One counter defined the solid angle while the other counter was made much larger in order to detect all recoils associated with the protons entering the defining counter. The larger counter could be moved by remote control from the cyclotron control room. A plateau was obtained when the coincidence rate was plotted as a function of position of this counter. A delayed coincidence rate was used as a measure of the accidental coincidences.

To obtain suitable counting rates, the beam current of the cyclotron was reduced to about 10^-6 amp. This was accomplished by shutting off the hydrogen supply and by placing flaps on the edge of the dee to reduce the height of the gap. Helium was let into the system to maintain the ion source arc, in order that the hydrogen remaining in the system would be ionized at the tank center as desired. In order to reduce the possibility of protons undergoing multiple traversals of the target, a beam height clipper with a one-fourth-in. gap was placed on the opposite side of the tank from the target. The multiple scattering in the target was sufficient to cause the protons to hit the clipper after one or two traversals.

For each scattering run the beam current was monitored by measuring the C¹⁰ positron activity formed in the polyethylene foil. Since the cross section for the formation of C¹⁰ is known, it is possible to get an absolute differential cross section. However, the absolute value may be in error by as much as 20 percent whereas the relative angular cross section should be correct to better than 10 percent.

The differential scattering cross section in the center-of-mass system, shown in Fig. 1, appears to be isotropic within statistical deviation over the range of angles measured. Further details will be published at a later date.

I wish to express my sincere appreciation to Professor N. F. Ramsey, under whose direction this work was performed.

4 A more detailed description has been given in a Ph.D. thesis presented to Harvard University.