by the expansion, breakup, transition to emission, or ejection of absorption features. The phase of minimum visibility of absorption features in the center of the disk are seen, on the average, 6 min preceding the flare in the red wing but not until 7 min after flare start in the blue wing. Four graphs of the velocities of ejected filaments show rapid acceleration within 10 min prior to or after the start of the flares.

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Random Walks of Cosmic Rays in Astrophysical Magnetic Fields. E. C. ROELOF (introduced by John C. Noyes), *Boeing Scientific Research Laboratories*.—The motions of charged cosmic ray particles traversing the galaxy, penetrating the interplanetary magnetic field from the galactic field, or traveling outward from the sun, have been described as a "random walk" along magnetic field lines. Current investigators have assumed that the particle follows a helical path about a field line until it encounters a "kink" in the line or a sharp gradient in field strength which abruptly changes the pitch angle (the angle between the helix and the field line), temporarily deranging the helical motion and perhaps even reversing the particle's direction. The purpose of this paper is to show that a random walk can occur without such strong field discontinuities (which require such mechanisms as shock waves and instabilities in the plasma), but simply with the aid of weak irregularities in an otherwise uniform field. The reason is that weak irregularities, assumed to be completely random themselves, have a net statistical tendency to increase the pitch angle of the particle, even though any single irregularity has a negligible effect upon the motion. The result follows from the statistical solution of the equation of motion (see author's abstract in *Trans. Am. Geophys. Union* **46**, 135, 1965). The time dependence of the pitch angle is presented for a uniform mean field and a mean field which falls off in magnitude as the inverse square of distance. This latter case is discussed with reference to diffusion-like behavior of solar flare particles in the interplanetary magnetic field.

Galaxy Content of the Coma Cluster. HERBERT J. ROOD, *Wesleyan University*.—As an initial step in a detailed photometric investigation of a 0.32 sq deg region centered on the Coma Cluster, morphological types and angular dimensions of 180 galaxies have been determined. The sample consists of all galaxies (excluding dwarfs of low surface brightness) with $V \leq 17.5$. The plate material consists of five 200-in. plates. The angular dimensions, determined by visual inspection, are the lengths of the

major and minor axes of isophotes with a surface brightness equal to approximately 22 photovisual magnitudes/sec².

The sample consists of 1 Sc pec, 81 S0, 74 E, 20 SB0, and 4 barred spiral galaxies. Several of these galaxies are peculiar (displaying transverse dust lanes, triple nuclei, jets, etc.). Nearly all of the SB0 galaxies are almost certainly Coma Cluster members, not field objects.

The logarithm of the integrated distribution function of major axis lengths is derived for E, S0, SB0, and E+S0+SB0 galaxies. Each of these distribution functions is qualitatively similar to the logarithm of the integrated luminosity function observed by Abell. The values of slopes and points where there are sharp slope changes, however, appear to depend on morphological type.

The frequency distribution of apparent ellipticities ϵ is derived for the E, SB0, and S0 galaxies with major axes equal to or longer than 3.3 times the seeing disk diameter. More than half of the SB0 galaxies (12 out of 20) have $0.35 \leq \epsilon \leq 0.55$. More than half of the S0 galaxies (36 out of 66) have $\epsilon \geq 0.65$. There is a tendency for the larger S0 galaxies to appear flatter.

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Thermal Instability in Stars with Helium-Burning Shells. W. K. ROSE, *Princeton University Observatory*.—M. Schwarzschild and R. Härm (*Astrophys. J.* **142**, 855, 1965) have reported a thermal instability which they encountered in following the evolutionary sequence of a $1 M_{\odot}$ star. The instability appeared during those phases of evolution when the star possessed both a helium-burning shell and a hydrogen-burning shell.

In the present investigation a series of stellar models of $0.5 M_{\odot}$ and $0.75 M_{\odot}$ which have helium-burning shells and pure helium envelopes have been computed. For a sufficiently high mass fraction inside the core (approximately 0.8 for $M=0.75 M_{\odot}$) these models are found to behave as relaxation oscillators, i.e., the helium burning is a periodic function of time. The peak burning is more than 10 times the burning expected in the absence of the instability. The luminosity of the unstable star varies by about a factor of 3 in a single relaxation oscillation while the radius varies by about 50%. The periods of these relaxation oscillations are about a few thousand years.

There are a number of observations which may be