ture much higher. This hot spot and some other parts of the sun showed higher temperatures for the maser channel than for the parametric amplifier channel.

These differences in temperature for the two channels indicate a magnetization of at least 2000 G for the east limb hot spot. These results exceed the 10% difference for the two channels one might expect for a spot of this temperature at 7.3 cm according to Swarup, Kakinuma, Covington *et al.* (*Astrophys. J.* p. 1257, No. 4, 1963). This excess may be due to our maximum errors which were 17.5%, caused largely by rain on the radome.

Observations of Interplanetary Scintillation at 1400 Mc/sec. D. E. HOGG AND T. K. MENON, *National Radio Astronomy Observatory*.—Scintillations produced by the interplanetary medium have been observed at 1400 Mc/sec, using the sources 3C 273 and 3C 279. The scintillation index is a function of the angular distance of the source from the sun and varies from about 1.4 at 20 solar radii to 0.10 at 50 solar radii. Moreover, the dispersion in the scintillation index is greater near the sun. The period of scintillation was about one second. The large scintillation index observed for 3C 279 confirms the suggestion that this source has a small-diameter component at centimeter wavelengths.

Numerical Experiments on Collective Effects in Stellar Dynamics. FRANK HOHL AND MARC R. FEIX (introduced by WINDSOR L. SHERMAN), *NASA, Langley Research Center and College of William and Mary*.—Recently several authors have used one-dimensional models to investigate plasma theory. We have used such a model to investigate a gas of stars. Since the model is one dimensional, the stars can be represented by a large number of mass sheets. The motion of such sheets is easily followed on a high-speed electronic computer. Since irregular forces due to stellar encounters can be neglected, a self-consistent Vlasov model will describe the system. We have found that systems which are initially equivalent but have different graininess (that is, different numbers of stars) display identical time behavior. Therefore, the only difference between our one-dimensional sheet model and a three-dimensional point model is that of solving the Vlasov equation in one instead of three dimensions. We have performed "numerical experiments" to investigate the time development of instabilities and/or the approach to equilibrium of systems of stars. We have found that the time behavior depends mainly on the initial ratio of T/P , where T is the kinetic energy and P

is the potential energy of the system. For initial values of T/P of the order of 0.5 (the equilibrium value), collective damping will force the gas to its equilibrium state in a few plasma periods [$2\pi(4\pi Gmn)^{-1}$]. In the steady state the dimension of the system is then found to be of the order of a Debye length [$V_T(4\pi Gmn)^{-1}$]. If the initial value of T/P is much larger or much smaller than the equilibrium value, the system will break up into smaller clusters. Analysis of the individual particle trajectories indicates that the initial break up is due to a phase instability of the individual particle orbits. The connection of our results with the usual Rayleigh-Jeans instability is discussed.

Nuclear Reaction Rates in Extremely Dense Matter. H. M. VAN HORN, *Center for Radiophysics and Space Research, Cornell University*.—Under conditions of extremely high pressure, such as may be encountered in the later stages of stellar evolution, the microscopic structure of a plasma at moderate temperatures will be that of a crystalline lattice rather than that of a gas. Approximations are derived for the effective interaction potential of two like ions within such a crystal structure, and rates of energy generation are calculated on the basis of these approximations. The two extremes of temperature both high and low in comparison with the zero-point energy are considered, and appropriate formulas are derived for the energy generation. Finally, application is made to the hydrogen content of the white dwarfs and to the rate of the carbon-carbon reaction in advanced evolutionary phases.

On the Mass-Luminosity Relation for Galaxies. SU-SHU HUANG, *Northwestern University*.—Poveda (*Astrophys. J.* 134, 910, 1961) discovered, and later Pskovskii (*Soviet Astron.* 9, 253, 1965) confirmed, that the dust-poor stellar systems obey a mass-luminosity relation of the form $\mathcal{L} \propto \mathcal{M}^\alpha$, where $\mathcal{M}$ and $\mathcal{L}$ represent, respectively, the mass and the photographic luminosity of the galaxy and α is found to be around 0.75.

Pskovskii found a similar relation for spiral galaxies ($\alpha=1.08$). We suggest that this relation arises from the fact that the more the mass in the gaseous state the more bright young stars will be formed and, consequently, predict a relation between $\mathcal{L}$ and the mass in the gaseous state. Indeed, we have found an empirical relation $\mathcal{L} \propto \mathcal{M}_H^{1.4}$, where $\mathcal{M}_H$ is the mass of neutral hydrogen determined from radio observation.

The existence of the $\mathcal{M}$ - $\mathcal{L}$ relation for the dust-poor systems may be due to several causes. If the