decide to which cosmological model our universe belongs.

Variability of the Optical and Radio Emission of Quasi-Stellar Sources. M. F. BARNOTHY AND J. M. BARNOTHY, *University of Illinois*.—The synchrotron emission and self-absorption mechanism suggested by Dent (*Science* **148**, 1458, 1965) and by Maltby and Moffett (*Science* **149**, 63, 1965) for the variable radio component of 3C273B requires for the injection of the relativistic electrons a source confined in a volume of 2 pc diameter, with an energy output comparable to that of the visible universe. We can avoid this unlikely energy requirement if we adopt the suggestion made by one of us (Barnothy, J. M., *Astron. J.* **70**, 666, 1965), namely that quasi-stellar sources are merely optical effects created by gravitational lenses acting upon nuclei of Seyfert galaxies. The variable component could then arise by two different mechanisms: (a) a supernova explodes in a distance less than 1 pc from the optical axis of the gravitational lens. Through the amplification, the brightness of the supernova would appear as having an absolute magnitude $M = -27$, increasing thus the brightness of 3C273B by $-1^m.4$. The electrons emitted by the supernova and trapped by its magnetic field of, say, $H = 10^{-2}$ G will produce a synchrotron radio emission which would increase the radio emission by about four flux units, provided that the energy output in the form of relativistic electrons is equal to the optical emission of the supernova. The optical brightness variation will follow the light curve of the supernova, while the radio emission will follow the time integral of the light curve; resulting in a phase difference between the intensity changes of the two emissions, as noted by Dent. (b) Violent events (velocities up to 3000 km/sec) which occur in the nuclei of Seyfert galaxies will cause within few years considerable changes in the magnetic field, electron density, and star distribution in the area surrounding the optical axis, where the brightness amplification can reach values up to 10^{10} . Should the optical axis thereby intercept a bright star or an area of high magnetic field and relativistic electron density, optical and radio emission variations with magnitudes as observed may result.

Variations in 3C345. J. FREDERICK BARTLETT, *California Institute of Technology*.—In the course of a study of radio source structure at the Owens Valley Radio Observatory, which extended from April 1962 to June 1964, six sets of observations were taken at a wavelength of 10.6 cm of the object 3C345, which has been identified with an optical counterpart displaying quasi-stellar properties (Sandage, A. B., and Wyndham, *Astrophys. J.* **141**, 328).

It has been possible to confirm the flux variation first discovered at 3.75 cm (Dent, *Science* **148**, 1458). Moreover, the total increase over the observed period was nearly 50%. Additional observations taken during 1965 indicate that the flux level has decreased since then and is now 20% above the 1962 value.

Restricted Problem of Three Bodies. JAMES H. BARTLETT (introduced by G. C. McVittie), *University of Alabama*.—The equations of motion of a sputnik in the gravitational field of two other bodies of finite mass have been integrated numerically, using a modified Runge-Kutta-Gill procedure. If the masses are m_1 and m_2 , and $\gamma = (m_1 - m_2) / (m_1 + m_2)$, K is the Jacobi constant and $T = K - \gamma^2$, and if E and F are the Thiele regularizing variables, then a periodic solution may be represented by a plot of F vs E for given values of T and γ . A continuous family of such solutions forms a surface in (T, E, F, γ) space, which may be termed an eigensurface and which is characteristic of a *class* in the terminology of Strömberg.

More than 9000 periodic solutions have been determined, and the evolution of the simple symmetric classes (α), (f), and (n) has been traced over the whole mass-ratio range $-1 \leq \gamma \leq 1$. The class (g - f) and the new symmetric classes (β), (δ), and (α - δ) have been studied over the range $-1 \leq \gamma \leq 0.93$. Asymptotic periodic orbits have been calculated as a function of mass ratio, and found to appear and disappear in pairs. Further, some new asymmetric classes have been discovered.

For a given mass ratio γ , and $E = 0$, the section of the eigensurface is a plot of T vs F and may consist of more than one curve. As γ varies, these curves may move toward each other, touch, and split into two other curves which then move apart.

When the eigensurface touches the zero-velocity surface, a change of symmetry (reversal of velocity) occurs, as from g to f and from α to δ .

The g class at $\gamma = -1$ consists of at least two branches which cross, one with eccentricity not zero and the other with eccentricity zero. As γ increases, these two branches split apart sideways. Since the curves at $\gamma = -1$ do not appear to possess any single quantity which is invariant, it is unlikely that the curves for $\gamma \neq -1$ have an invariant, either.

New Observations of Solar Chromospheric Spicules. JACQUES M. BECKERS, *Sacramento Peak Observatory*, ROBERT W. NOYES, *Smithsonian Astrophysical Observatory*, AND JAY M. PASACHOFF, *Harvard College Observatory*.—We observed the spectra of spicules on the solar limb simultaneously at two heights in the quiescent chromosphere with the