tion in space of these clusters is compared with that of other types of objects and with dynamical models.

Nature of Non-Synchronous Rotation of Some Close Binary Components. SU-SHU HUANG, *Northwestern University*.—In general components in close binaries rotate in synchronism with their orbital motion as would be expected from theoretical considerations. But in occasional cases this rule is violated. Those stars, like β Lyrae, that rotate slower than the synchronous velocity may be due to evolutionary expansion (Kopal, *Ann. Astrophys.* **19**, 298, 1956). Those stars, like the primary of U Cep and RZ Sct, which rotate faster than the synchronous values, form the subject of the present discussion.

In a theory for the formation of emission rings, first discovered by Joy, in many Algol-type eclipsing binaries, the importance of angular momentum transfer has been emphasized (Huang, *J. Roy. Astron. Soc. Canada* **51**, 91, 1957). This led Struve (*Publ. Astron. Soc. Pacific* **75**, 207, 1963) to question whether the fast rotation of U Cep may be also a result of angular momentum transfer. Here we propose that indeed the ring formation and nonsynchronous rotation are one and the same phenomenon resulting from the flow of gases ejected from the less massive secondary to the neighborhood of the more massive primary. Two alternate possibilities can then be advanced in order to understand nonsynchronous rotation. The rotating gaseous ring may be formed so close to the stellar surface that it practically forms an extension of the reversing layer. Or instead of developing a rotating ring the gaseous particles fall into the stellar atmosphere which is thereby driven by these fallen particles to become rapidly rotating.

As a result of observed nonsynchronism many theoretical investigators have studied the equilibrium surface of the nonsynchronous rotating component. A recent study (Huang, to be published in *Prof. O. Struve Memorial Volume*) shows, however, no such equilibrium surface exists. This is because in a coordinate system rotating with the nonsynchronous component, time enters explicitly in the equation that corresponds to the Jacobian integral in the restricted three-body problem.

Polarization of the Coronal Green Line Observed During the Eclipse of 30 May 1965. CHARLES L. HYDER, *Sacramento Peak Observatory*.—Airborne observations of the polarization of the coronal green line were conducted during the eclipse of 30 May 1965. The polarizations observed indicate that the excitation of the green line was predominantly radiative throughout the corona.

Some of the directions of polarization deviate significantly from radial (electric vibration). These de-

viations are thought to be due to coronal magnetic fields with nontangential, nonradial components lying in the plane of the sky.

Possible Models of Horizontal Branch Stars. ICKO IBEN, JR., *Massachusetts Institute of Technology* AND JOHN FAULKNER, *California Institute of Technology*.—In an attempt to describe the structure of horizontal branch stars in globular clusters, several double energy-source models (helium burning in a hydrogen-exhausted core and hydrogen burning in a shell) have been evolved through core helium-burning phases. Initial models (Faulkner, *Astrophys. J.*, to be published) possess the following characteristics: $M_{\text{core}} = (0.4 \rightarrow 0.6) M_{\odot}$, $X_{\text{core}} = 0$, $Y_{\text{core}} = 1.0$; $X_{\text{envelope}} = 0.65, 0.90$; $M_{\text{star}} = (0.60 \rightarrow 1.25) M_{\odot}$, $Z_{\text{star}} = 2 \times 10^{-3} \rightarrow 2 \times 10^{-5} = 2 \times Z_{\text{CNO}}$.

During the major portion of the core helium-burning phase, stars with $X_{\text{envelope}} = 0.65$ evolve toward higher surface temperatures, whereas stars with $X_{\text{envelope}} = 0.90$ evolve toward lower surface temperatures. The difference in direction of evolution is accounted for by the fact that the strength of the hydrogen-burning shell relative to the strength of the helium-burning shell is much smaller in the models with $X_{\text{envelope}} = 0.9$.

Best fits with the horizontal branch in low metal clusters such as M2 and M92 are achieved with $M_{\text{star}} \sim 0.70 M_{\odot}$, $Z_{\text{star}} \sim 2 \times 10^{-4}$, and $M_{\text{core}} \sim 0.425 M_{\odot}$ when $X_{\text{envelope}} = 0.65$ or $M_{\text{core}} \sim 0.60 M_{\odot}$ when $X_{\text{envelope}} = 0.90$. The model with $X_{\text{envelope}} = 0.65$ evolves almost horizontally in the H-R diagram for approximately $t_{\text{HB}} \sim 1.3 \times 10^8$ yr and the model with $X_{\text{envelope}} = 0.90$ evolves for approximately $t_{\text{HB}} \sim 4 \times 10^7$ yr.

By considering in addition the hydrogen-burning main-sequence and red-giant progenitors of horizontal branch stars, it is possible to construct arguments favoring the choice $X_e = 0.65$. (1) The turn-off region in the H-R diagram of M92 corresponds to stellar masses $M \sim 1.1 M_{\odot}$ when $X_e = 0.90$ and to $M \sim 0.7 M_{\odot}$ when $X_e = 0.65$. Mass loss on the order of $0.4 M_{\odot}$ in giant phases preceding and/or during the helium flash is thus required when $X_e = 0.90$. When $X_e = 0.65$, mass loss need not be invoked. (2) The age of M92 is calculated as $t_{\text{GC}} \sim 2.0 \times 10^{10}$ yr when $X_e = 0.90$ and is calculated as $t_{\text{GC}} \sim 1.7 \times 10^{10}$ yr when $X_e = 0.65$. The choice $X_e = 0.65$ thus gives an age more consistent with the Hubble time. (3) The shape of M92 in the H-R diagram is reproduced more faithfully when $X_e = 0.65$. (4) By comparing star densities along the horizontal and red giant branches, Woolf (*Astrophys. J.* **139**, 1081, 1964) suggests that the lifetime of a star along the horizontal branch is related to the cluster age by $t_{\text{HB}}/t_{\text{GC}} \sim 10^{-2}$. With $X_e = 0.90$, the calculations give $t_{\text{HB}}/t_{\text{GC}} \sim 0.2 \times 10^{-2}$, a ratio approximately five times