COMPARISON OF LIGHT VARIABILITY AND WATER MASER EMISSION IN R CETI

REBECCA P. WEBB
PRISCILLA J. BENSON
IRENE R. LITTLE-MARENIN
Wellesley College
Whitin Observatory
Wellesley, MA 02181

Received 21 November 1988

Abstract

We have observed water maser emission in R Cet at 22 GHz at the Haystack Observatory[1] from January 23, 1985, to September 28, 1988. We have compared the water maser data to visual data compiled by the AAVSO. The intensity of the water maser emission varies in correlation with the visual light curve but with a phase lag of 0.25. The intensity of the water emission varies from cycle to cycle.

* * * * *

We have observed water maser emission at 22 GHz in the Mira variable R Ceti (M4E-M9, P=166.24 days). This star is the first short period Mira variable in which water maser emission has been detected. The emission was first detected on January 23, 1985, at Haystack Observatory. Subsequent observations have been made approximately once a month from November 11, 1986, to September 28, 1988, and the maser feature has been present each time, a fact which is not true for most stars in the observing program. R Ceti has a single, narrow feature centered about 31 km/s with FWHM approximately 0.6 km/s. The maser flux which is plotted versus the Julian Day in Figure 1 shows a cyclic increase and decrease in the intensity of the maser emission.

We have compared the water maser data to visual data compiled by members of the AAVSO over the same period of time (shown in Figure 2). The water maser flux varies in correlation with the visual intensity. However, there is a phase lag in the maser emission with respect to the visual light curve of approximately 0.25, as may be seen by comparing Figures 1 and 2. The maser flux appears to peak about 42 days after the visual maximum.

Because the water maser data points are so scattered, we have plotted flux versus the visual phase (Figure 3) to more easily study the curve. We have observed R Ceti during the parts of four cycles, and each cycle is denoted by a different symbol. Studying the curve, we note that the intensity of the maser emission varies from cycle to cycle while the periodicity remains. We have also noted that the curve is asymmetric. The visual light curve of R Ceti is distinctive because of its asymmetry, but the asymmetry of the maser flux curve is larger. The maser flux curve rises through only 33% of its total period, while that of the visual light rises through 43% of its period.

We will continue monitoring R Ceti and comparing our data to those compiled by the AAVSO in hopes of determining more definitely the source of water maser pumping. We thank the members of the AAVSO for making the visual observations and Janet Mattei and Elizabeth Waagen for helping us obtain the visual data. PJB thanks the National Science Foundation for partial support of this work under grant AST86-10467.

---

[1]Radio astronomy at Haystack Observatory of the Northeast Radio Observatory Corporation is supported by the National Science Foundation under grant AST85-12598.

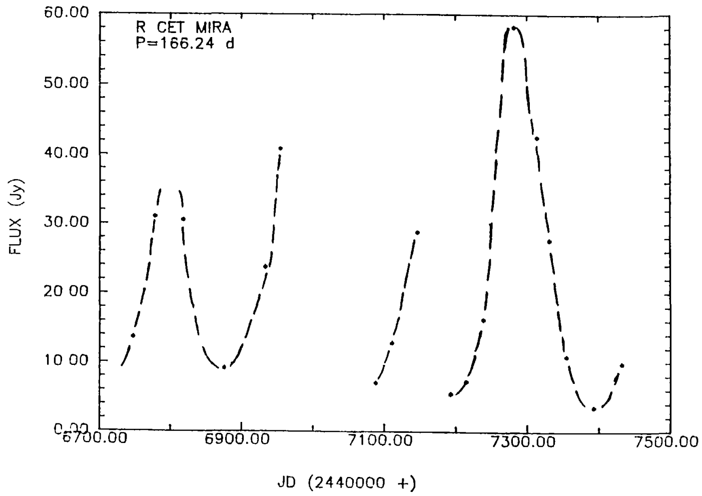

Figure 1. Flux of water emission from R Cet plotted vs. Julian Day.

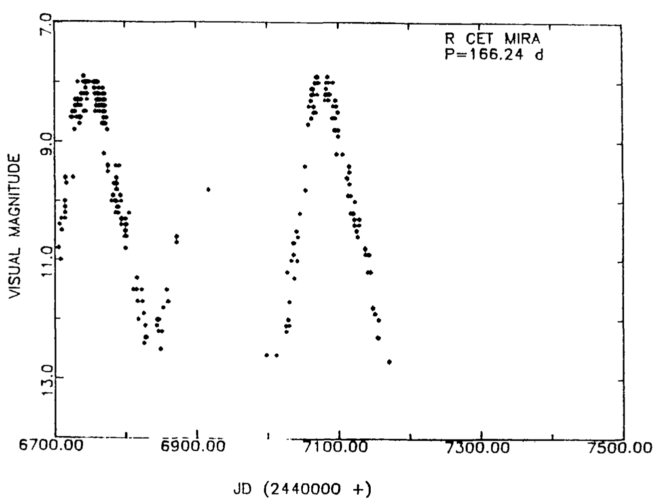

Figure 2. AAVSO visual data for R Cet plotted vs. Julian Day.

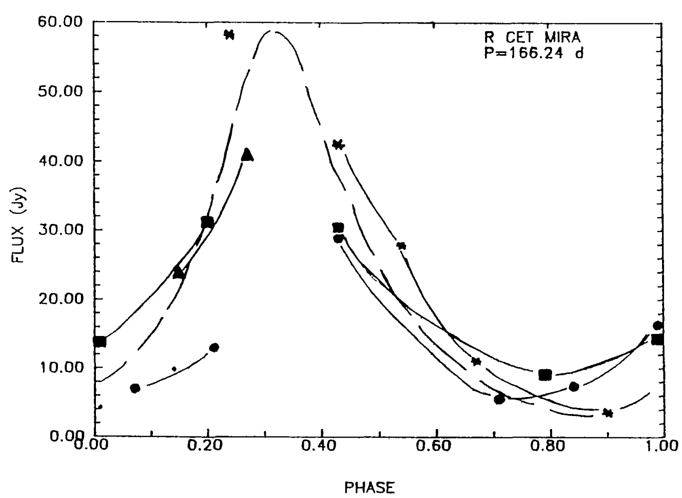

Figure 3. Water maser flux plotted versus visual phase for R Cet. Different symbols indicate different cycles.