THE VISUAL BRIGHTNESS BEHAVIOUR OF P/HALLEY DURING 1982–1986

(Letter to the Editor)

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Abstract. The overall long-term behaviour of the total visual coma brightness of P/Halley during October 1982 – June 1986 is presented. The observations used in this study consist of the raw total magnitude data collected from the International Astronomical Union Circulars. We have compared the observed light curve with the predicted one.

1. Introduction

Comet P/Halley has provided an unprecedented opportunity for the study of visual brightness estimates. No comet in history has been observed visually by so many and so often as Halley's in 1985/6. The vast interest among amateur astronomers combined with the fore-knowledge of its observing circumstances and an observing season of about one year in length resulted in thousands of magnitude estimates submitted to various research journals and circulars. The result is an impressive and still growing mountain of several thousand visual magnitude estimates.

The brightness observations provide a data base for studying the factors which affect the distribution of visually estimated total magnitudes of comets. Such observations are very useful to construct a synthetic light curve. The brightness laws can be deduced from the observed data on visual magnitudes and compared with predictions. The observed light curves are very useful for the physical understanding of the mathematical formulae used to make brightness predictions.

2. The Observational Data

We have gathered all the raw data on total visual magnitudes reported in the International Astronomical Union Circulars (IAU circulars) from the period October 1982 to June 1986. The total visual magnitude is affected by the aperture of the telescope. The magnitudes reported in IAU circulars include wide ranged aperture of the telescopes used by various observers. This will certainly increase the scatter in the plotted data. We have used the raw material as such to deduce the nature of the variation in brightness of P/Halley.

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3. The Brightness Variations

The most continuous set of physical data for comets available for study of cometary activity is the visual photometric base of observations describing the total magnitude (m_1) of the coma. The visual brightness data describes cometary activity associated with the resonance – fluorescence of diatomic carbon (C_2) and with the release of dust from the cometary nucleus.

In Figure 1 we have displayed the raw data of total visual magnitudes converted to heliocentric magnitudes (H). The conversion of total visual magnitudes to heliocentric magnitudes (H) removes the effect of magnitude variation due to a varying geocentric distance and all observations get normalised to a distance of 1 AU. This conversion is necessary if one wants to study the nature of variation of brightness of the comet as a function of heliocentric distance. In Figure 1 we have also plotted the predicted total brightness of the comet. The predicted data was adopted from that computed by Yeomans (1983). The observed light curve of P/Halley shows an interesting behaviour. The scatter in the data points reflects both uncertainties in the magnitude determination due to wide range of aperture of the telescopes used by different observers and real

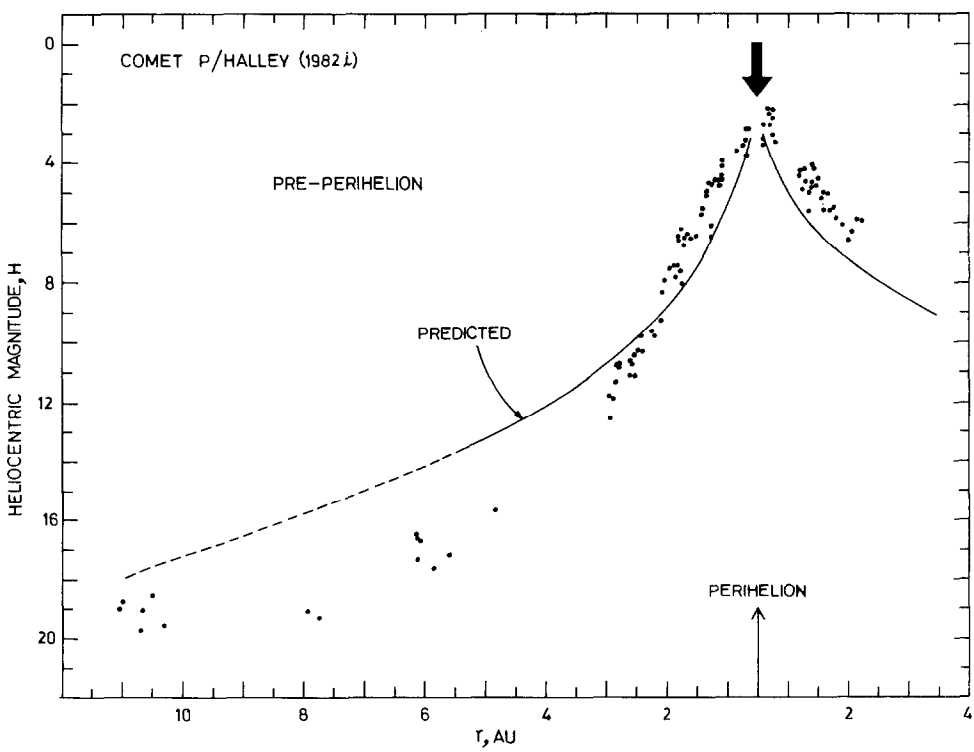

Fig. 1. Brightness variation in P/Halley.

short-term variations in activity. It is clear that at $r \geq 2$ AU the comet was fainter than the predicted brightness and at $r \leq 2$ AU it became brighter than predictions. The maximum brightness was observed not at perihelion (February 9, 1986) but after perihelion passage (April, 1986).

When P/Halley was recovered at $r = 11.04$ AU in October, 1982, it was the very faint object ($V \simeq 24.2$; $H \simeq 19.0$). The comet slowly brightened to $V \simeq 20$ ($H \simeq 17$) by late 1984. During this time the comet exhibited large amplitude variation in brightness on time scales of the order of 1–2 days and even 1–2 hr (Lecacheux *et al.*, 1984; West and Pedersen, 1984). It was speculated that P/Halley's sublimation begin at $r \sim 6$ AU. The activity also began increasing noticeably at that time (Green and Morris, 1986). The comet continued its slow brightness increase still further till at $r \leq 2$ AU the brightness started increasing rapidly as is clear from Figure 1. The comet showed large variations when near the sun. Goraya *et al.* (1987) noticed variations in $V \sim 0.6$ during January 1986 (at $r \sim 0.8$ AU). The outbursts of 0.5–1.5 magnitude amplitude have also been noted in P/Halley (Spinrad, 1984; Le Berte, T., 1986; Ney and Knutson, 1986; West, 1986; Hale and Green, 1986).

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