

WHERE DID COMET HYAKUTAKE C/1996 B2 COME FROM?

N. E. KUROCHKIN

Sternberg State Astronomical Institute, Moscow 119899, Russia

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The distribution of cometary aphelia (the positions of anti-perihelia) in the ecliptic coordinate system is given. The positions concentrate towards the solar anti-apex. When compared with the positions of the nearest stars with mass $> 1 M$, the aphelia distribution points to Procyon (alpha CMi) as a focus for comets moving from a more distant (> 3.5 pc) comet reservoir. A zone of avoidance (with a radius of $\sim 10^\circ$), almost free of cometary aphelia may be seen around alpha CMi. Such zones may also exist around epsilon Ind, 61 Cyg, and alpha Cen. The aphelion of the comet named Hyakutake C 1996 B2 is located at 10° – 12° from alpha Cen.

KEY WORDS Comets, aphelia, positions

Oort's hypothesis that comets come from a comet store located in the outer region of the Solar System – the Cloud of Oort, has proved a very persistent the explanation of comets' origins. However, the aphelia of the most numerous parabolic comets are distributed almost isotropically, with only a slight concentration towards the solar anti-apex (see Figure 1).

As a result of perturbations in the planetary system or those due to the nearest stars (or invisible minor interstellar bodies), the distribution of the cometary aphelia on the celestial sphere appears unfocused and does not adequately reflect the configuration of the store of comets. The concentration of the aphelia in the anti-apex region allows the determination of the motion of the Sun and the coordinates of the apex with a precision of 10° – 20° (see Khanna and Sharma, 1983, which also contains a list of such determinations).

One can consider the Oort cloud only in terms of a chance coincidence of the location of the cloud with that of the anti-apex. Perhaps focusing effects due to the motion of the Sun should be considered (see Lyttleton, 1948; Tolmanov, 1976).

A comparison of the local maxima of the distribution of cometary aphelia with the locations of the nearest stars reveals appreciable focusing effects in the motion of comets. We therefore can assume the existence of comet reservoirs beyond the nearest stars.

In view of this, the distribution of cometary aphelia around Procyon (Figure 2) is suggestive. Here we can see not only an excess of aphelia, but also a circular

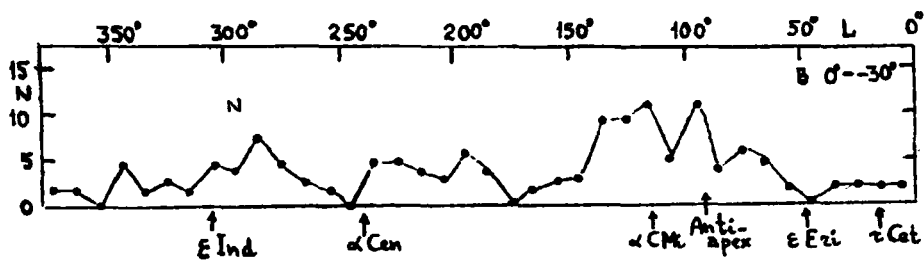


Figure 1 Distribution of the number of cometary aphelia by ecliptic longitude (L) for ecliptic latitudes $-30^\circ < B < 0^\circ$. Concentrations of comets can be seen in the alpha CMi region and near the solar anti-apex position.

structure (the zone of avoidance) which provides direct evidence of the effect of gravitational focusing.

Certain accumulation of cometary sources can be seen near Sirius, as well as possible circular structures around 61 Cyg and epsilon Ind (at a distance of 25–30°).

Figure 2 shows the distribution of cometary aphelia in ecliptic coordinates. The nearest stars, the most massive of which may cause gravitational focusing, are usually found in the empty areas – the zones of avoidance.

The aphelion of the bright comet Hyakutake C/1996 B2 which passed its perihelion in 1996 at a rather short distance from the Earth is located at $A = 13^\circ 15' 35''$,

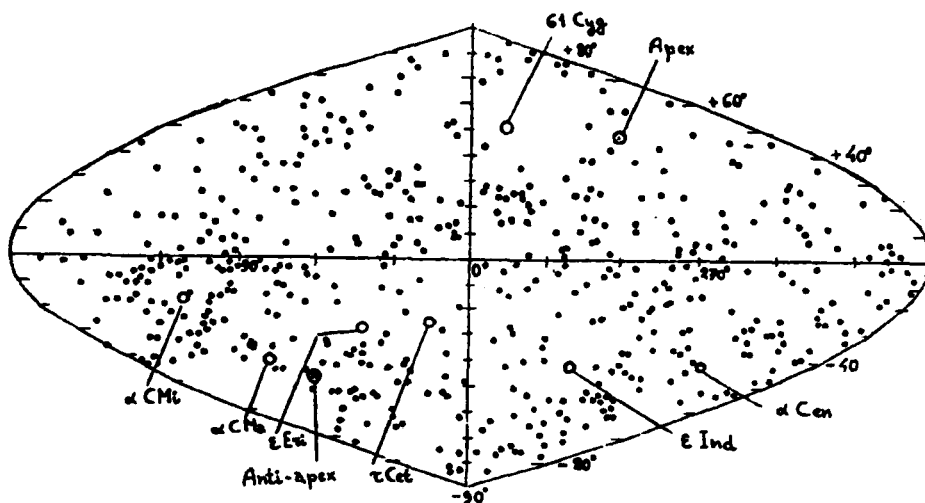


Figure 2 Distribution of the aphelia (the infinitely remote points of the orbits) of parabolic comets in the ecliptic coordinate system (L , B) as compared with the positions of the nearest stars. The zones of avoidance (due to gravitational focusing effects) can be seen around alpha CMi, epsilon Ind, and 61 Cyg.

$D = -49^{\circ}40'53''$ (2000) or $L \simeq 220^{\circ}$, $B \simeq -37.5$ (in ecliptic coordinates) – at a distance of 10° – 12° from the two stars nearest to the Sun – Alpha and Proxima Cen. The above leads to the conclusion that such a location may not be due entirely to chance.

Acknowledgement

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