Comet Hale-Bopp (C/1995 O1) beyond a heliocentric distance of 6 AU

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The physical evolution of comet Hale Bopp is investigated along the preperihelic arc of its orbit at heliocentric distances larger than 6 AU. The comet's considerable intrinsic brightness and activity are explained by the existence of a relatively large area on its nucleus surface that is a reservoir of both carbon monoxide and dust particulates. Three recurring dust emission events observed in August–October 1995 are studied in some detail. The characteristic shape of the features generated in the course of these episodes is interpreted as a product of a sharply peaked diurnal emission profile and suggests a probable common source to all the three events. The timing of these events is shown to exhibit a periodicity that may indicate the state of rotation of the comet, which apparently is not pure spin. The total mass of dust ejected during one of the episodes is calculated from reports of the comet's "nuclear magnitudes" at pertinent times to be on the order of 10^{11} grams. Estimates of the dust production rate are compared with the published production rates of carbon monoxide and it is concluded that the mass loading of the CO gas flow by dust was enormous, certainly much greater than a factor of 15. Finally, comet Hale Bopp is compared with other comets known to have experienced activity at large heliocentric distances. Most similarities are found with the dust emission pattern of comet 29P/Schwassmann-Wachmann 1.