On the splitting and outburst of 73P/Schwassmann-Wachmann 3

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The major outburst of P/Schwassmann-Wachmann 3, detected ~2 weeks before perihelion as a sudden increase in the production of hydroxyl, is found to have been followed by a steady brightening in the visible light until ~20 days past perihelion, when the comet was a factor of ~200 more luminous than in its quiescent phase. When 80 days after perihelion the nucleus, whose effective diameter is estimated at ~3 km, appeared to be triple (with unconfirmed reports of up to four additional companions), the issue of primary interest was the nature of the relationship between the splitting and the initial stages of the outburst. Application of a standard model for the split comets indicates that, nominally, the first breakup, the separation of the component B from the principal nucleus C (the easternmost component), occurred most probably in late October, some six weeks following the outburst's onset. A secondary breakup, the separation of A (the westernmost component) from C, followed some two weeks later. These fragmentation episodes correlate well with two less prominent secondary flare-ups on the light curve. Also examined are the circumstances of separation for the four additional, suspected companions. The inferred delayed response of the nucleus to the major disturbance on its surface is a phenomenon not previously reported for any other split comet. It was proposed in the early 1980s that some companion nuclei of nontidally split comets may represent large, nearly inert fragments, the surface mantle of refractory material that were torn off, thus exposing the previously protected reservoir of ice beneath. If so, the case of P/Schwassmann-Wachmann 3 suggests that the disturbed areas of the mantle first released considerable amounts of dust, thus producing a particular, an outburst. The separation of a large fragment (or fragments) of the mantle apparently required continuing, more constrained manifestations of elevated activity (triggered possibly by a buildup of vapor pressure in localized subsurface pockets of confined volatile ices) in order to overcome the resistence to fracture offered by the cohesion of the nucleus and its mantle. In any case, the delayed response provides strong evidence against models of a strengthless cometary nucleus.