through the surface, from pinpoint explosions on the surface, is assumed to be negligible. The presence of silicate and metallic dust grains plus inert molecules, can suffice to damp explosive chain reactions of this type.

The temperature of the ice is not expected to change significantly during this period. The sublimation of volatile constituents will keep the temperature low. Also, the ices are expected to be poor thermal conductors.[14]

At lower altitudes, the pressure will be high enough to produce melting. The instantaneous pressure differential between the fore and aft stagnation points will tend to force portions of the surface, which melt when turning through the forward stagnation point, to flow into the underlying cracks and crannies. The liquids will also spread a short distance on the surface.

The melting and refreezing process is apt to take place quickly, especially for objects which are turning rapidly. Substances like water, which expand on freezing, can melt under pressure and refreeze when the pressure is removed provided the temperature is not too low. Liquids which ooze into the substrata will tend to sublimate the more volatile materials while freezing themselves. By this process a shell of low-vapour-pressure ice is expected to form around the cometoid. It might have a shiny glassy appearance if it could be broken off and examined. The shiny, metallic appearance reported for many "flying saucers" might be caused by reflections from a slick ice surface. The shell, which would contain tiny pores, will protect the more fragile substrata, which at this stage are porous but tending to be more solid towards the centre. This might also result in bands or markings of melted material around the sphere. If the whole sphere were not covered it would look like a ball of ribbon.

A spinning disc could leave concentric stripes, or a cigar-shaped object spinning about its longitudinal axis (with this axis pointing in the direction of flight so as not to break in half) might have a series of bands, etc. If the melted ices were of a different colour than the rest of the matrix, the stripes could be very noticeable. The imbedded dust could add colouring.

2. Natural Life Mechanisms

Since the majority of the ices expected in cometoids cannot exist at temperatures much above a hundred degrees Kelvin, it follows that these objects must be quite cold as long as they exist. Even ordinary water ice would remain at 273° K. or less. Hence, during the disintegration period, cometoids in general may have very cold ice structures which are filled with hot gases. These gases, being in a state of flux, will shoot out through the various openings in the shell to produce a miniature coma. Cometoids which consist of inhomogeneous ices, in general then, will hollow out, and become more like hot-air balloons.

Also, because of radical recombinations and sublimation, or melting and evaporation at the forward stagnation point, small jets tending to oppose the body's motion will occur. Actually, the reactions will not occur instantaneously, so that a sphere tumbling randomly will have a path through the sky which is slightly erratic. A disc-shaped body, spinning clockwise about a vertical axis, would make a gradual counterclockwise turn.

If a jet occurred from the interior through just one opening in the shell or if one of several jets predominated, the sphere or disc would wobble in flight.

Only a small fraction of the cometoids that enter the atmosphere can remain intact. Of course, one large object could yield several smaller bodies. The "survival of the fittest" concept applies here. Only those objects which have a certain structural integrity can last long enough to reach low altitudes where they would exist for a limited time.

One requirement for a sphere is that it be spinning about an axis perpendicular to the plane of the trajectory. A sphere, *per se*, has no lift, but one that is spinning and blowing out gas jets can have a lift coefficient. Referring to Fig. 1, if the sphere is spinning counterclockwise

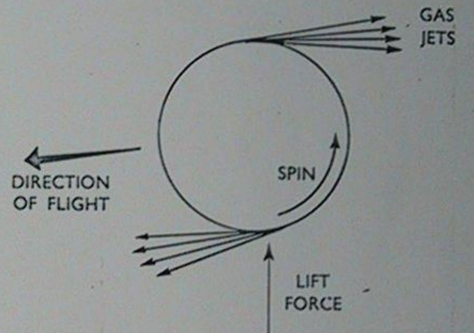

Fig. 1. How a sphere, spinning because of tangential gas jets, experiences a lift coefficient

because of a tangential gas jet, then the jet will oppose the air stream underneath so as to build up an excess pressure relative to the jets on top. This tends to produce a lifting force. If the sphere was spinning in the opposite direction it would tend to dive down into the atmosphere where the crushing drag forces would break it apart.

The tendency for the sphere to carry air with it as it spins, like a spinning baseball, would not overshadow the jets. If it did, the sphere would dive down, and the lift would have to be attributed to lift from a clockwise spin. This is unlikely because the objects probably will not be spinning so fast.

There is another lift mechanism that might apply. If some of the internal ices are melting there will be a tendency for the liquid to extrude out the bottom through any holes that are available. Internal pressures will not push liquids out of the top portion since they would be held away because of gravity. "Centrifugal forces" are probably inadequate to accomplish this. The