PROXIMITY SPACE

The System of Study: Let us postulate a system of study consisting of a population of gaseous atmospheric molecules engaged in completely random motions in proximity space (defined below). That system has a system temperature, $\bar{T}$. Let us go on to postulate an imaginary sphere surrounded by the gas molecules. The intangible surface of that imaginary sphere is our **surface of interest**.

Cartesian Space: Each of the molecules in that population is moving at its true path velocity v. The Cartesian framework of spatial dimensions allows us to break that true path velocity into three component velocities—the x-velocity along the x-axis, the y-velocity along the y-axis, and the z-velocity along the z-axis.

When the Cartesian axes are aligned along geographic coordinates (north-south, east-west, and up-down) we have geographic space. However, the Cartesian axes may be aligned in any way that best suits the scholar's purposes. Whatever the alignment, Cartesian space is always three-dimensional, exists everywhere in the free atmosphere, and may be assumed to persist over time.

Proximity Space: In this series of essays, we will make use of a supplemental spatial framework that has only one dimension, is strictly localized, and does not persist over time. We call that supplemental space the **proximity space**. No proximity space exists until we postulate a surface of interest. When—and only when—that surface of interest is postulated, does a single matching proximity space come into existence.

Definition of Proximity and Proximity Space: Pick any one of our postulated system of atmospheric gas molecules and the distance between the point on that molecule's surface that is closest to the surface of interest and the nearest point on the surface of interest can be represented as a straight line. The length of that line is that molecule's **proximity** to the surface of interest. It follows that every one of our many postulated molecules has a proximity to the surface of interest. The total of all possible proximities makes up the **proximity space** of our system of study.

Definition of the Proximity Dimension: Each proximity in our proximity space has three significant characteristics: one of distance and two of direction. Together, they make up the proximity dimension. Distance is self-explanatory. The two directions are normal to and toward the surface of interest, and normal to and away from the surface of interest. With our three principles still fresh in our minds, the first of these two directions takes on special significance.

The Localization of Proximity Space: A proximity space is a relative space. It is related only to a single surface of interest. If more than one surface of interest exists in a study, then each surface of interest will have its own unique proximity space. Parameter values in these individual proximity spaces may (and probably will) vary from one such space to another.

The Temporary Nature of Proximity Space: The proximity space does not exist until we postulate a surface of interest. When we turn our attention to some other surface of interest, that first proximity space temporarily ceases to exist. That is because a single system of study may have only a single proximity space at one time. Consequently, a single proximity space may appear and disappear repeatedly during a course of study, as the scholar turns his attention from one surface of interest to another and back again. However, at any one moment during that study, there is only one proximity space.

Modes of Proximity Space Movements: We have postulated that the molecules of our system of study are in random movement normal to the surface. These movements can be translational, rotational, vibrational, or librational.

The *p*-Population: To save space, let us call the proximity space population the ***p***-population. Molecules in the ***p***-population have parameters that bear a ***p*** subscript except for those brief instants when they are interacting with the surface of interest.

The *p*-Axis: Most ***p***-population parameters (molecular speeds, for instance) have a range of values. These values may be assumed to be ranged systematically along a ***p***-axis.

The Surface of interest: The surface of interest must be a surface, but it can be either a real surface or an imaginary one. Moreover, the shape of that surface is not relevant. It can be the roughly spherical surface of a cloud droplet. It can be the jagged surface of a snowflake or a pollen particle. It can be the surface of a human body or the surface of a leaf. If the surface of interest is an imaginary surface, it can be a plane through which molecules are passing or a plane upon which they are impacting. It can even be the surface of a Mobius Strip or the surface of Klein's Bottle.

The surface restriction is one of utility. It allows us to include liquids and solids in our proximity spaces. That is important because many of our advanced papers deal with liquids and solids (especially water and ice). In liquids and solids, the component molecules are continually interacting—but they are not continually interacting with the surface of interest. If our surface of interest is the surface of a spherical cloud droplet, for instance, then molecular movements from all Cartesian directions both outside and inside of the droplet will carry the ***p*** subscript—except when they are interacting with that droplet surface.

The *i*-Subpopulation: We have stated above that at any given instant in time, the overwhelming majority of molecules in the proximity space population will not be interacting with the surface of interest. This statement implies that there are times when molecular interaction with the surface of interest **is** taking place. When those interactions occur, the molecule leaves the p-population and instantly and temporarily becomes a member of the ***i*-**subpopulation. Parameter subscripts follow suit, and ***p*-**subscripts instantly and temporarily become ***i*-**subscripts.

A molecule carries the ***i*-**subscript for only a very specific time. It carries it from the instant of initial contact with the surface of interest, through interaction with the surface of interest, and until the instant of final contact with the surface of interest. At that instant, it once again puts on the ***p***-subscript.

The *i*-Axis: Most ***i*-**subpopulation parameters (molecular speeds, for instance) have a range of values. These values may be assumed to be ranged systematically along an ***i*-**axis.

Proximity Speed: Molecules move along the ***p*-**axis with a velocity whose magnitude is **proximity speed** ($v_{\pm p}$) and whose direction is either normal to and toward the surface of interest (v_p) or normal to and away from the surface of interest (v_{-p}).

Impulse Speed: Molecules move along the ***i*-**axis with a velocity whose magnitude is **impulse speed** ($v_{\pm i}$) and whose direction is either normal to and toward the surface of interest (v_i) or normal to and away from the surface of interest (v_{-i}).

Summary: In the papers that follow—unless otherwise made explicit—we may make the following assumptions:

1) The postulation of a surface of interest creates a ***p*-population** of molecules within the system.

2) The ***p* subscript** on a molecular parameter denotes that the parameter involves molecular movement **normal to and toward** the surface of interest.

3) The **-*p* subscript** on a molecular parameter denotes that the parameter involves molecular movement **normal to and away from** the surface of interest.

4) The ***i* subscript** on a parameter denotes that the parameter involves molecules whose current interaction is with the surface of interest and whose molecular center of mass is moving **toward** the surface of interest.

5) The ***-i* subscript** on a parameter denotes that the parameter involves molecules whose current interaction is with the surface of interest and whose molecular center of mass is moving **away from** the surface of interest.

The Ephemeral Nature of Molecular Populations: We must emphasize that molecular membership in these four subpopulations is continuously changing. The subpopulations persist over human time scales, but an individual molecule changes its membership billions of times a second. The basic concept of statistical mechanics, however, is that it is the characteristics of a population that are important, not the characteristics of any individual member of that population.

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