

## The Causes of Planetary Migration are Inherent & Unavoidable

### ABSTRACT

In the “evolution” of a gas & dust cloud (e.g, planetary or galactic size) the following effects will be occurring.

The generalised view:- more “outside matter” moves mass outwards from the centre.

The generalised view:- more accretion on the “outside” moves mass towards the centre.

The generalised view:- more accretion “outside the central gravity shell” occurs on bodies orbiting nearer the central body & moves mass towards the centre.

The generalised overview:- Planetary Migration is Inherent & Unavoidable

If it is assumed that a gas & dust cloud (e.g, planetary or galactic size) has already changed into the disc form & starts off at the same density of material throughout, a simple diagram will show the influences.

Draw an isosceles triangle with the unpaired angle less than 120 degrees.

We’ll choose 60 degrees

Mark off 5 equal sub-divisions along both paired sides.

Join these with parallel lines.

Going from shortest to longest, put dividing marks on these of 1, 2 , 3, 4 & 5

Join these with parallel lines, in two different angles.

We will approximate each triangle to have an equal area & therefore represent an equal volume, of the gas cloud, containing an equal amount of mass at the start of mass accretion.

The triangle represents a “pie slice” of the gas cloud, with the “unpaired angle” representing the centre of a sector of the cloud.

[1] Looking at the central & “3 triangle row” firstly; a particle on the mid-point of the common side would be pulled towards the “3 triangle row”, because it has more mass.

Now add the “5 triangle row”.

Looking at the same shape as above, moved out one triangle from the centre; a particle on the mid-point of the common side would be pulled towards the “5 triangle row”, because it has more mass, in this larger view.

The generalised view:- more “outside matter” moves mass outwards from the centre.

[2] Another interaction at play is the small particles falling onto the larger bodies. Any impacting body will add its momentum to the body it hits. “pushing it” in the impactor’s direction of travel.

From the “triangles diagram” it can be seen that there is always more matter “on the outside” than “on the inside”. The ratio of outside/inside increases towards the centre.

As more matter will be hitting the “outside” of the body, there will be more push on it towards the centre.

The generalised view:- more accretion on the “outside” moves mass towards the centre.

[3] There is a further subtle modification to the “falling matter” push.

A central mass will have a shell around it where, any point on it will have the same gravitation attraction. The curvature of this shell will be greater when it is nearer the central mass.

When this “central gravity shell” passes through an orbiting body’s centre of gravity, there is always less than 50% of the body within the “central gravity shell” & the nearer the body is to the central body, the smaller the % of the orbiting body is within the “central gravity shell”.

All matter falling outside the “central gravity shell” will push the orbiting body towards the centre.

The generalised view:- more accretion “outside the central gravity shell” occurs on bodies orbiting nearer the central body & moves mass towards the centre.

The generalised overview:- Planetary Migration is Inherent & Unavoidable

Diagram:-

1<sup>st</sup> row of numbers is number of triangle bases. [b]

2<sup>nd</sup> row of numbers is number of triangles.

3<sup>rd</sup> row of numbers is the cumulative sum of the number of triangles. [=b<sup>2</sup>]

