

# A method to determine co-ordinates of planetary objects/stars and other objects in the sky/space in 3-dimensional Euclidean space with respect to the Centre of the Universe

Hatim Kanpurwala

Consultant, Mumbai  
E-mail: hatimk@rediffmail.com

## ASSUMPTIONS

It is possible to determine Euclidean distance e.g. using the Parallax method (triangulation method) and other methods with a reasonable limit of accuracy for 3-Dimensional Space for the Observable Universe. It is a known fact that distances can be measured in space e.g. we know the distance of the moon from the earth, distances of various planets/stars from the Earth often quoted in light years.

## Method to determine co-ordinates of the stars/planetary objects in Space

Let there be 'm' objects such as stars/planets whose co-ordinates one needs to measure in 3-dimensional space. And let there be 'n' sensors/transceivers or objects on the Earth or satellites in Space used for measuring distances of the objects in the sky away from it. Hence for 'm' satellites/objects the distances measured by the 'n' sensors/transceivers in 3-dimensional Euclidean space, with Centre of the Universe as a Frame of Reference, will be given by the following **distance equations** –

$$(D11)^2 = (x11-y11)^2 + (x21-y21)^2 + (x31-y31)^2$$

$$(D12)^2 = (x12-y12)^2 + (x22-y22)^2 + (x31-y32)^2$$

.....

.....

.....

$$(Dmn)^2 = (x1m-y1n)^2 + (x2m-y2n)^2 + (x3m-y3n)^2$$

Where,

(x1m, x2m, x3m) are co-ordinates of the m<sup>th</sup> object in 3-D Euclidean Space,

(y1n, y2n, y3n) are co-ordinates of the n<sup>th</sup> sensor/transceiver either on Earth or on a satellite measuring the distance of objects in the sky/space in 3-D Euclidean Space

And Dmn is the distance of the m<sup>th</sup> object from the n<sup>th</sup> sensor in 3-D Euclidean Space.

Therefore,

There are  $nm$  equations or distances measured in space which are known quantities (Refer to methods to measure distances in space e.g. Parallax method for stars/planets/objects in space)

And  $(3n+3m)$  co-ordinates or unknowns,

But, in order to know the unknowns in above equations using the known quantities,

$nm$  must be equal to number of unknowns i.e.  $(3n + 3m)$  Therefore,

$$nm=3n+3m$$

**Case 1)** Let  $m = 1$

Therefore,

$$n = 3n + 3 \text{ or } -2n = 3$$

But as  $n$  and  $m$  are assumed to be finite integer quantities with values  $> 0$ , we reject this case.

**Case 2)** Let  $m=2$

Therefore,

We get  $n=-6$ ,  $n < 0$  which is not possible.

We realize that the minimum value of  $m$  should be 4, so that  $n > 0$ . In other words, for  $m=4$ ,  $n=12$  or alternatively minimum value of  $n$  should be 4 for  $m=12$ , so that the number of unknown values is equal to the number of known values.

## CONCLUSION

Using the minimum values of  $m$  and  $n$ , and the measurable known distances ( $D_{mn}$ ) for these values of  $m$  and  $n$  the co-ordinates of the  $m^{\text{th}}$  planet/star can be determined with respect to the Centre of the Universe by solving the **distance equations** simultaneously using known methods to solve simultaneous determinate equations. As an aside, the co-ordinates of the 'n' sensors are also determined by solving the 'nm' simultaneous equations with respect to the Centre of the Universe.

## Implications and potential applications

1. This can be used for Navigational systems in Space
  2. Remote space probes
  3. Track the movement of stars/planets/alien aircraft/ meteorites' etc in space.
  4. And to stretch the imagination a little, it could be used to possibly to avoid space collisions and prevent impending meteorite crashes on earth.
  5. Global positioning systems.
- Etc...

**Summary and Scope for further research**

The method can be extended to z-dimensional Euclidean space, we get,  $nm = zn + zm$ .

We can prove by mathematical induction that  $m-1=z$  (substitute suitable values for m and z for which n is a +ve integer and we will obtain the pattern  $m-1=z$ )

If distances can be measured in z-dimensional Euclidean space then it is possible to measure co-ordinates in z-dimensional Euclidean space.

The same above techniques can be applied possibly to other frames of reference other than z-dimensional Euclidean space.