一個星體的'''公轉速度'''，主要描述[[行星]]、[[天然衛星]]、[[人造衛星]]或[[聚星]]，是以上天體圍繞一個系統的[[barycenter]][[公轉]]的速度，而且通常繞著質量更大的天體。公轉速度可以是公轉一圈的平均速度，或者是在特定的點上該天體的速度。

The orbital speed at any position in the orbit can be computed from the distance to the central body at that position, and the [[specific orbital energy]], which is independent of position: the [[kinetic energy]] is the total energy minus the [[potential energy]].

Thus, under [[Standard assumptions in astrodynamics| standard assumptions]] the orbital speed (<math>v\,</math>) is:

\*in general: <math>v=

\sqrt{2\left({\mu\over{r}}+{\epsilon}\right)}

</math>

\*\*[[elliptic orbit]]: <math>v=

\sqrt{\mu\left({2\over{r}}-{1\over{a}}\right)}

</math>

\*\*[[parabolic trajectory]]: <math>v=\sqrt{\mu\left({2\over{r}}\right)}</math>

\*\*[[hyperbolic trajectory]]: <math>v=\sqrt{\mu\left({2\over{r}}+{1\over{a}}\right)}</math>

where:

\*<math>\mu\,</math> is the [[standard gravitational parameter]]

\*<math>r\,</math> is the distance between the [[orbiting body]] and the [[central body]]

\*<math>\epsilon\,</math> is the [[specific orbital energy]]

\*<math>a\,\!</math> is the [[semi-major axis]]

Note:

\*Velocity does not explicitly depend on [[eccentricity (orbit)|eccentricity]] but is determined by length of [[semi-major axis]] (<math>a\,\!</math>).

==Radial trajectories==

In the case of radial motion:

\*if the energy is non-negative: the motion is either for the whole trajectory away from the central body, or for the whole trajectory towards it. For the zero-energy case, see [[escape orbit]] and [[capture orbit]].

\*if the energy is negative: the motion can be first away from the central body, up to r=μ/|ε|, then falling back. This is the limit case of an orbit which is part of an ellipse with eccentricity tending to 1, and the other end of the ellipse tending to the center of the central body. See also [[free-fall time]].

==Transverse orbital speed==

The transverse orbital speed is inversely proportional to the distance to the central body because of the law of conservation of [[angular momentum]], or equivalently, [[Johannes Kepler|Kepler]]'s [[Kepler's laws of planetary motion|second law]]. This states that as a body moves around its orbit during a fixed amount of time, the line from the barycenter to the body sweeps a constant area of the orbital plane, regardless of which part of its orbit the body traces during that period of time. This means that the body moves faster near its [[periapsis]] than near its [[apoapsis]], because at the smaller distance it needs to trace a greater arc to cover the same area. This law is usually stated as "equal areas in equal time."

==Mean orbital speed==

For '''orbits with small [[eccentricity (orbit)|eccentricity]]''', the length of the orbit

is close to that of a circular one, and the mean orbital speed can be approximated either from observations of the [[orbital period]] and the [[semimajor axis]] of its orbit, or from knowledge of the [[mass]]es of the two bodies and the semimajor axis.

:<math>v\_o \approx {2 \pi a \over T}</math>

:<math>v\_o \approx \sqrt{\mu \over a}</math>

where <math>v\_o\,\!</math> is the orbital velocity, <math>a\,\!</math> is the [[length]] of the [[semimajor axis]], <math>T\,\!</math> is the orbital period, and <math>\mu\,\!</math> is the [[standard gravitational parameter]]. Note that this is only an approximation that holds true when the orbiting body is of considerably lesser mass than the central one, and eccentricity is close to zero.

'''Taking into account the mass of the orbiting body''',

:<math>v\_o \approx \sqrt{m\_2^2 G \over (m\_1 + m\_2) r}</math>

where <math>m\_1\,\!</math> is now the mass of the body under consideration, <math>m\_2\,\!</math> is the mass of the body being orbited, <math>r\,\!</math> is specifically the distance between the two bodies (which is the sum of the distances from each to the center of mass), and <math>G\,\!</math> is the [[gravitational constant]]. This is still a simplified version; it doesn't allow for [[ellipse|elliptical]] orbits, but it does at least allow for bodies of similar masses.

For an '''object in an eccentric orbit''' orbiting a much larger body, the length of the orbit decreases with eccentricity <math>e\,\!</math>, and is given at [[ellipse#circumference|ellipse]].

This can be used to obtain a more accurate estimate of the average orbital speed:

:<math> v\_o = \frac{2\pi a}{T}\left[1-\frac{1}{4}e^2-\frac{3}{64}e^4 -\frac{5}{256}e^6 -\frac{175}{16384}e^8 - \dots \right] </math><ref>{{cite book

| author=H. St̀eocker, J. Harris | year=1998

| title=Handbook of Mathematics and Computational Science

| pages=p. 386 | publisher=Springer

| id=ISBN 0387947469 }}</ref>

The mean orbital speed decreases with eccentricity.

{{earth orbits}}

==參見==

\*[[Hohmann transfer orbit#Example.3B maximum delta-v|examples]]

==參考資料==

<references />

[[Category:Celestial mechanics]]

[[bg:Орбитална скорост]]

[[ca:Velocitat orbital]]

[[cs:Kruhová rychlost]]

[[de:Kosmische Geschwindigkeiten]]

[[es:Velocidad orbital]]

[[fr:Vitesse orbitale]]

[[ko:공전 속도]]

[[hr:Orbitalna brzina]]

[[id:Kecepatan orbit]]

[[it:Velocità orbitale]]

[[ka:პირველი კოსმოსური სიჩქარე]]

[[ja:軌道速度]]

[[nn:Banefart]]

[[pl:Prędkość orbitalna]]

[[pt:Velocidade orbital]]

[[ru:Первая космическая скорость]]

[[sk:Obežná rýchlosť]]

[[sl:Tirna hitrost]]

[[fi:Ratanopeus]]

[[vi:Tốc độ vũ trụ cấp 1]]

[[uk:Перша космічна швидкість]]