Dual Star Distance Calculation

Kepler's law for circular orbits:

$$N^2 \cdot D^3 = G \cdot (Mass\ of\ Sun + Mass\ of\ Dual\ Star)$$

Where: N = 2 Pi / T

T = Period of Revolution in seconds sec

D = Average distance between Sun and Dual Star in meters m

G = Gravitational Constant = $6.672 \cdot 10^{-11}\ \frac{m^3}{kg \cdot \sec^2}$

$M_{SUN} = 1.9891 \cdot 10^{30}\ kg$

So:

$$\frac{D^3 \cdot (4\pi^2)}{(24{,}000\ years)^2} = G \cdot (M_{SUN} + M_{DUAL\ STAR})$$

Or:

$$D^3 = \frac{G \cdot (M_{Sun} + M_{Dual}) \cdot (24{,}000 \cdot 365 \cdot 24 \cdot 60 \cdot 60\ \sec)^2}{4\pi^2}$$

$$D^3 = G \cdot (M_{Sun} + M_{Dual}) * 1.451 \cdot 10^{22}\ \sec^2$$

$$D^3 = (M_{Sun} + M_{Dual}) \cdot 1.451 \cdot 10^{22} \cdot 6.672 \cdot 10^{-11}\ \frac{\sec^2\ m^3}{kg\ \sec^2}$$

$$D^3 = (1 + \frac{M_{Dual}}{M_{Sun}}) \cdot M_{Sun} \cdot 9.701 * 10^{11}\ \frac{m^3}{kg}$$

$$D^3 = (1 + \frac{M_{Dual}}{M_{Sun}}) \cdot 1.930 \cdot 10^{42}\ m^3$$

$$D = \sqrt[3]{(1 + \frac{M_{Dual}}{M_{Sun}})} \cdot 1.245 \cdot 10^{14}\ meters$$

$$D = \sqrt[3]{(1 + \frac{M_{Dual}}{M_{Sun}})} \times 832.2 \ A.U. \qquad \text{(Astronomical Units)}$$

$$D = \sqrt[3]{(1 + \frac{M_{Dual}}{M_{Sun}})} \times .0131 \ L.Y. \qquad \text{(Light Year distance)}$$

For Mass Dual Star = .06 of the Mass of the Sun (Brown Dwarf):

D = **0.01336 L.Y.** or **848.5 A.U.**

For Mass Dual Star = 6 times the Mass of the Sun (Black Hole):

D = **0.02384 L.Y.** or **1515 A.U.**

Note that the above numbers are AVERAGE DISTANCES. At their furthermost point in their orbits (apoapsis), they may be much further apart, depending on the eccentricity of their elliptical orbits, perhaps by a factor of 2 to 6 times the average distance.

Since the celestial bodies revolve around each, there is a Center of Gravity between them that corresponds to one of two focal points in each orbit (focus). Thus the two bodies rotate around each other every 24,000 years, and around the Center of Gravity every 24,000 years.

Also note that relative velocity of a celestial body is slowest at its apoapsis, and fastest at its periapsis (point closest to its focus). Thus with an average period of 24,000 years, the measured relative velocity at apoapsis may correspond to 26,000 years and correspond to 22,000 years or less at periapsis.