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Tidal Tails around Globular Clusters

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Abstract. We present the results of detailed N-body simulations of clusters moving in a realistic Milky Way potential. The strong interaction with the bulge and the disk of the Galaxy leads to the formation of tidal tails, emanating from opposite sides of the cluster. Their orientation and morphology may be interpreted easily in terms of a comoving frame of coordinates.

Tidal tails are often observed around dwarf galaxies and globular clusters (GCs) (see, for example, Odenkirchen et al. 2002). Figure 1 shows the formation and evolution of tidal tails around a GC, simulated as an N-body system moving in a Milky Way potential (Montuori et al. 2007). Tidal tails clearly show up after less than one orbital crossing. Their extension and orientation depend on the velocity and acceleration of the cluster along the orbit. The outer part (at distance $>$ 7–8 tidal radii) of the tails is aligned with the cluster orbit, while the inner part shows a shape which varies with time. When the cluster approaches its apogalacticon, tails divide into multiple "arms", as observed in NGC 288 and Willman 1.

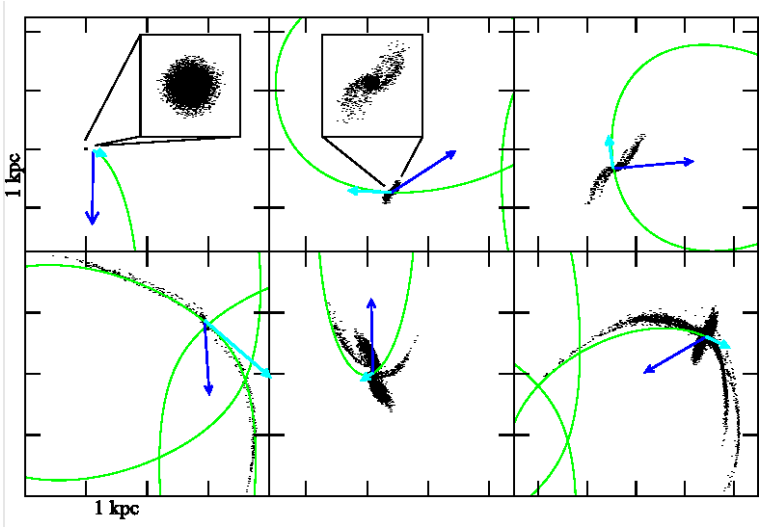

Figure 1. The solid arrow is the GC velocity vector; the dashed arrow points to the Galactic Center; the curve is the GC orbit.

Figure 2 shows the behavior of some orbital quantities. Because the orientation of the inner tails is highly correlated to the cluster orbital phase and with the local orbital angular acceleration, the orbital path cannot be deduced directly from the orientation of the tails, unless a sufficiently large field around the cluster is observed.

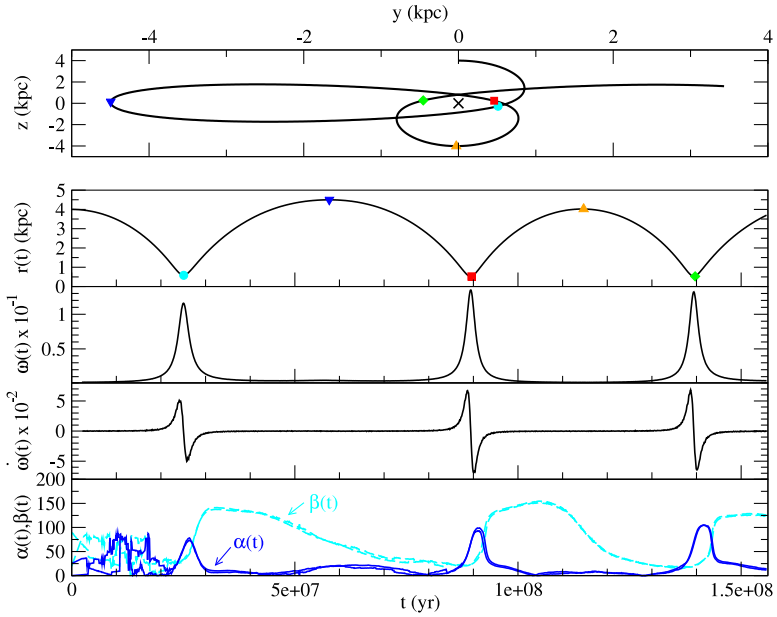

Figure 2. From the top down: GC orbit (*1st panel*); GC distance to the Galactic Center (*2nd panel*); GC angular velocity (*3rd panel*); GC angular acceleration (*4th panel*); angles $\alpha(t)$ and $\beta(t)$ between inner tail and radius vector r and angular velocity, respectively (*5th panel*). All the quantities shown in panels 2 to 5 are vs time.

References

Odenkirchen, M., et al. 2002, AJ, 124, 1497
Montuori, M., Capuzzo Dolcetta, R., Di Matteo, P., Lepinette, A., & Miocchi, P. 2007, ApJ, 659, 1212