Animations of action-minimizing three-body orbits

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In their paper “On action-minimizing retrograde and prograde orbits of the three-body problem", Chen & Lin published orbit diagrams and initial orbital parameters for 142 theoretical three-body systems [1].

Here are java simulations of some of those 142 systems. The aim is to make these orbits easier to visualise by enabling them to be viewed as moving live integrations, rather than just as static diagrams.

These are all theoretical systems, not real systems. Most of the systems are triple star systems. A few of the systems are binary star systems plus a planet. I have listed the orbits in the same order that they are illustrated in [1]. For example, orbit 4B is the second orbit in Figure 4. The initial parameters for all orbits are by [1].

All orbits are of coplanar hierarchical three-body systems. The three bodies are assumed to be point masses. Orbit ratios are the ratio of inner binary orbits to outer binary orbits completed in the same time. For example the orbit ratio 7:1 means that 7 inner binary orbits are completed in the same time as 1 outer binary orbit is completed. The systems for which java simulations have been generated are highlighted. Java simulations for more of the systems will be added later

For some orbits I have used higher precision starting parameters from sources [2] or [3]. Some of the prograde orbits exhibit partner-swapping, which is described in [4].

The orbits for which java animations are provided are listed in the following table.

The java animations can be viewed at the following website

www.orbsi.uk/space/c2/c2.htm

Reference	Orbit Type	Orbit Ratio	Mass Ratio	Notes
4A	retrograde	7 : 1	0.5 : 0.5 : 1	stable
5A	retrograde	3 : 1	0.2 : 0.2 : 1	stable
5D	retrograde	3 : 1	0.8 : 0.8 : 1	stable
6H	retrograde	3 : 1	1 : 3 : 1	stable
7B	retrograde	2 : 1	0.4 : 0.8 : 1	stable
8H	retrograde	2 : 1	1 : 3 : 1	stable
9F	retrograde	5 : 3	0.4 : 0.6 : 1	stable
11J	retrograde	3 : 2	0.2 : 0.2 : 1	stable
16J	retrograde	1 : 1	1 : 1 : 1	stable
17A	retrograde	1 : 1	0.01 : 4 : 1	stable
18A	retrograde	1 : 1	10 : 100 : 1	stable
19D	retrograde	3 : 5	4 : 4 : 1	stable
21A	prograde	variable	1.5 : 1.5 : 1	partner-swapping
21C	prograde	variable	1 : 1 : 1	partner-swapping
21D	prograde	variable	1.5 : 1.5 : 1	unstable

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References:

[1] Chen, K. C., & Lin, Y. C. (2009). "On action-minimizing retrograde and prograde orbits of the three-body problem". Communications in Mathematical Physics, 291(2), 403-441. Full paper in PDF format

[2] Chen, K. C., & Lin, Y. C., (additional data 1)
http://www.math.nthu.edu.tw/~kchen/papers/retr-prog-initial-data.txt

[3] Chen, K. C., & Lin, Y. C., (additional data 2)
http://www.math.nthu.edu.tw/~kchen/papers/retr-initial-data-ext.txt

[4] Edgeworth, S., "Theoretical Partner-Swapping in Triple Star Systems" (2013),
www.orbsi.uk/space/research/se/pdf/theoretical-partner-swapping-triple-star.pdf