

Lyapunov Time of the Lorra Cluster Members

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We computed Lyapunov Times of the Lorra Cluster Members for different Solar System Models.

1 Introduction

We checked the calculations of Lyapunov time (LT) for the Lorra Cluster (LC) members identified by Novaković et al. (2012). The authors calculated the family population for $v_{\text{cut}} = 10 \text{ m s}^{-1}$ for 14 members. With $v_{\text{cut}} = 20 \text{ m s}^{-1}$ the number of members rises to 20, as was shown in Novaković et al. (2012). After removing the 2006 AX67 asteroid as an interloper, 19 members remained. We used the current database of LC members, i.e., we have included all current observations, as of 2019 August 1, and orbits taken from Asteroids Dynamic Site (ASTDyS)¹ orbital elements database. In comparison to Novaković et al. (2012) some asteroids have already become numbered, see Tab. 1 of this paper. With one-opposition asteroids from the list in Novaković et al. (2012), only the last two remain: 2010 EW42 and 2010 EJ81, for which LT was not calculated because of too large uncertainty in orbital elements.

2 Lyapunov Time of the Lorra Cluster Members

Using the ORBFIT software v.5.0.5 we computed LT for all studied LC members. Our computations were made for different Solar System Models (SSMs). Seven planets in Tab. 1 denote: Venus, EarthMoon, Mars, Jupiter, Saturn, Uranus, and Neptune. We used also barycentric correction for Mercury. The calculations were made for 10 My backward with 200 y as time between two outputs and the sampling ratio of the filter equal to 5. The results are given in Tab. 1. In Tab. 1 the column 'Seven planets WLO/NOV' denotes the LT computed by us and by Novaković et al. (2012) for the SSM containing seven planets. The results are similar to that of Novaković et al. (2012), but ours are refined because of new observations.

¹<https://newton.spacedys.com//astdys2/index.php?pc=4>

Tab. 1: Lyapunov Times of the Lorra Cluster Members, in kyr.

Asteroid	Seven planets WLO/NOV	Seven planets +Ceres	Seven planets +Ceres +Pallas	Seven planets +Ceres +Vesta
5438	43.1/41.7	32.0	28.0	30.2
208099	68.2/75.4	36.0	30.9	32.2
336870/2011 FQ151	52.5/115.1	27.1	33.6	29.6
513137/2001 RF42	43.5/57.7	37.4	32.5	28.0
452369/2001 XF167	63.0/48.2	30.9	30.0	25.3
444003/2003 YY120	172.1/203.3	41.8	39.9	32.3
423692/2006 AL16	163.4/162.1	43.4	36.4	31.4
456555/2007 BJ62	158.4/219.3	40.1	39.2	32.6
456456/2006 VZ122	31.6/31.8	38.1	23.6	22.0
2003BW5	5.3/6.7	25.6	5.6	7.9
2005YD18	38.8/38.9	9.5	23.8	19.4
2006RM98	15.5/22.1	14.3	13.9	18.8
2008AD104	47.8/41.6	29.9	27.7	26.8
2010CG176	49.3/75.1	40.1	33.8	23.5
2010AX32	120.4/198.4	33.0	36.8	29.6
2017BB65/2008 BB10	100.4/202.0	44.5	36.6	29.0
2008DE8	67.0/83.8	38.1	28.7	33.9

Generally, shorter LT are for the SSMs with additional objects, which can be understood, as presented in Novaković et al. (2012).

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References

Novaković, B., Dell’Oro, A., Cellino, A., Knežević, Z., *MNRAS* **425**, 1, 338 (2012)