AstroNet-II Early Stage Researcher:

Dissipative Effects on Attitude Dynamics

Marta Ceccaroni

Backbackground

Bachelor & Master:

- University of Roma Tre, Rome
- Department of Mathematics
- Differential Equations and Functional Analysis
- Master Thesis: The Weak Stability Boundary

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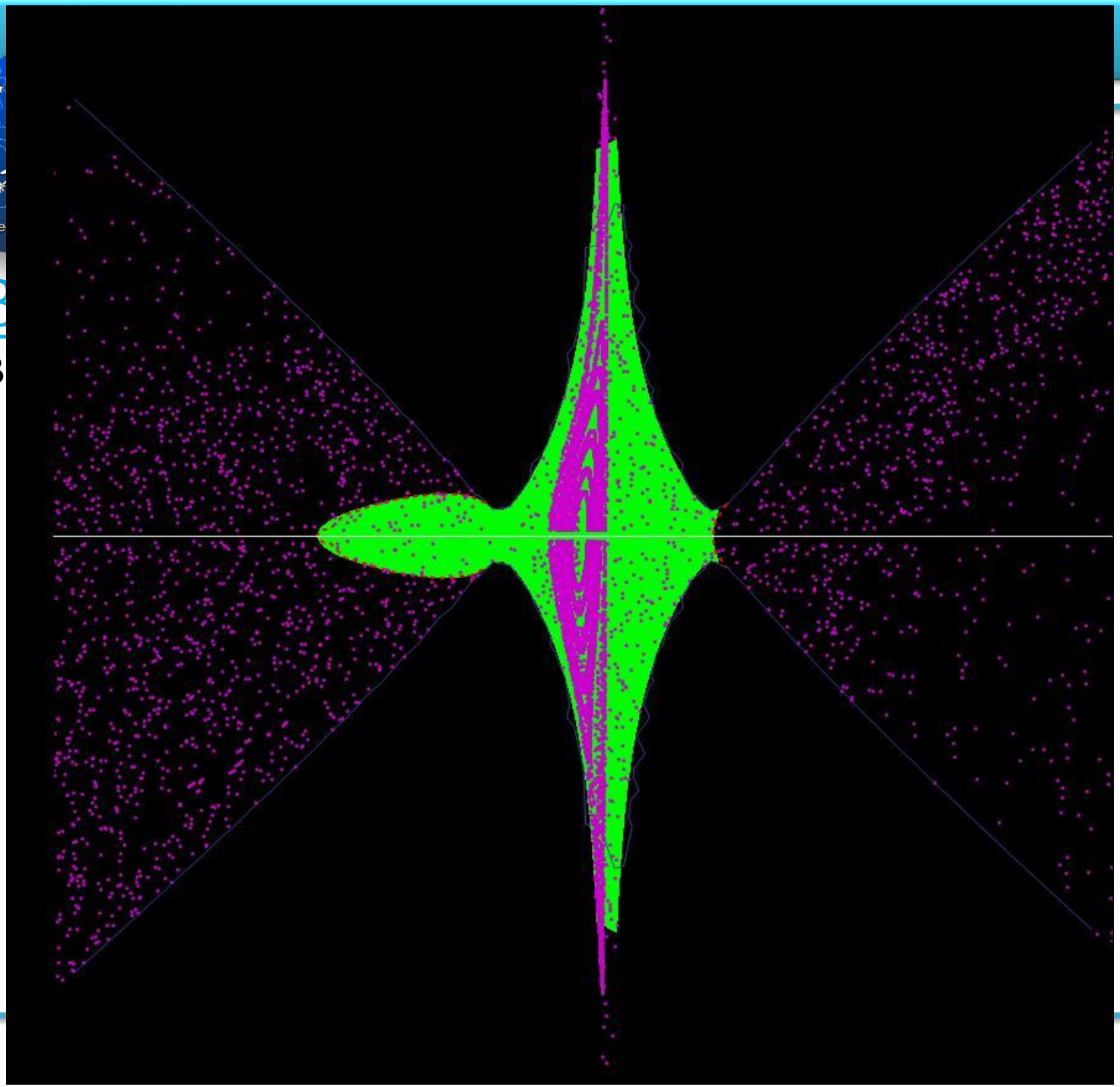

Recent background

PhD:

- Strathclyde University (prof. James Biggs)
- Advanced Space Concepts Laboratory
- PhD thesis: Natural and perturbed dynamics around Trojan bodies

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ESA ARIADNA STUDY:

- Analytical perturbative theories of motion in highly inhomogeneous gravitational fields (Francesco Biscani)

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Three masses in Lagrangian configuration,
(Sun-Jupiter-624Hektor-Spacecraft)

* new, general, analytical WSB theory
  =>estimation of the ‘stable’ zone around a Trojan
* INSIDE: Inhomogeneous CR2BP , analitic closed form perturbative theories in highly inhomogeneous gravitational fields
  => frozen orbits
* OUTSIDE: Lagrangian CR4BP +Low thrust,
  =>artificial non-Keplerian orbits

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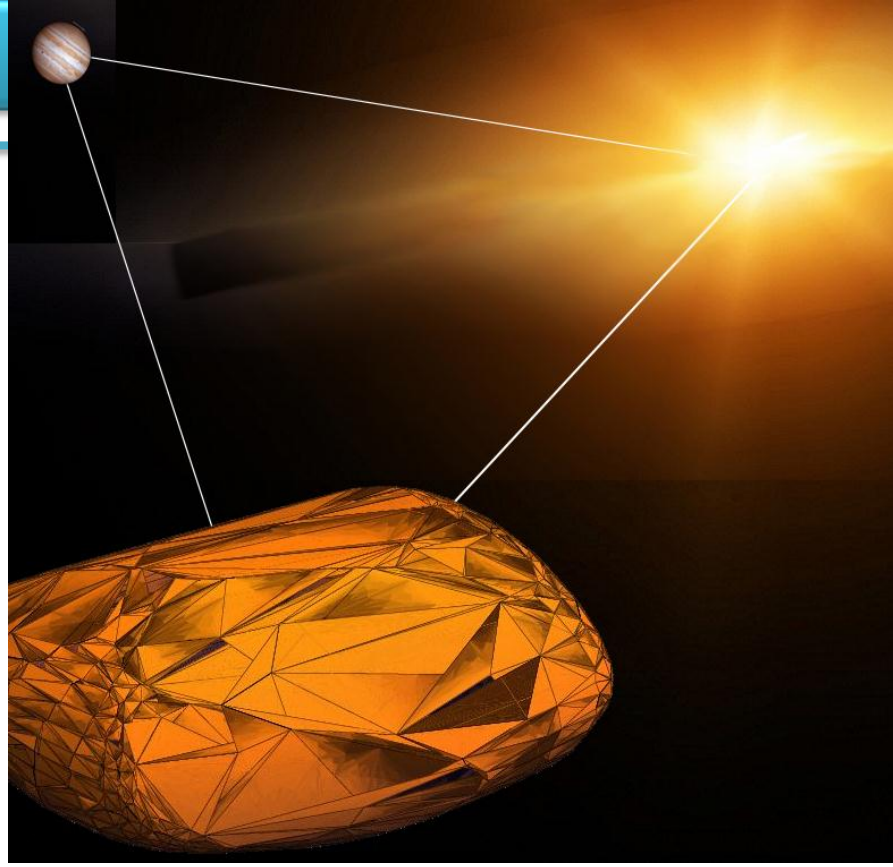

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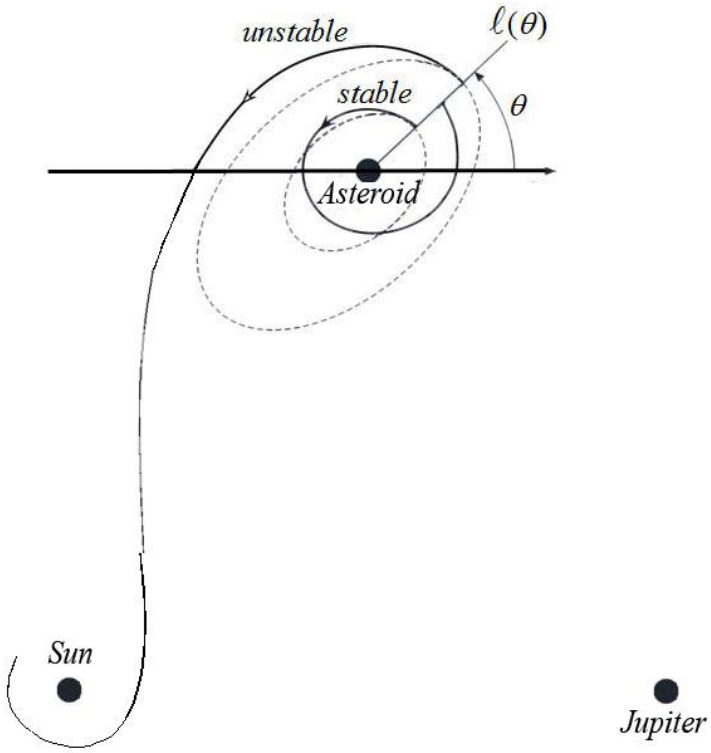

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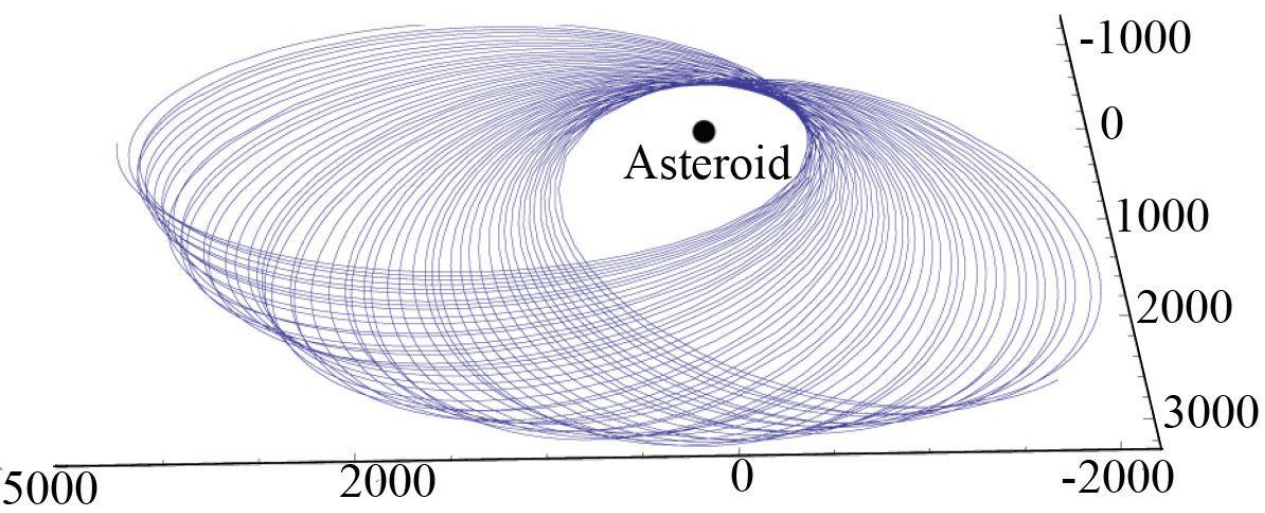

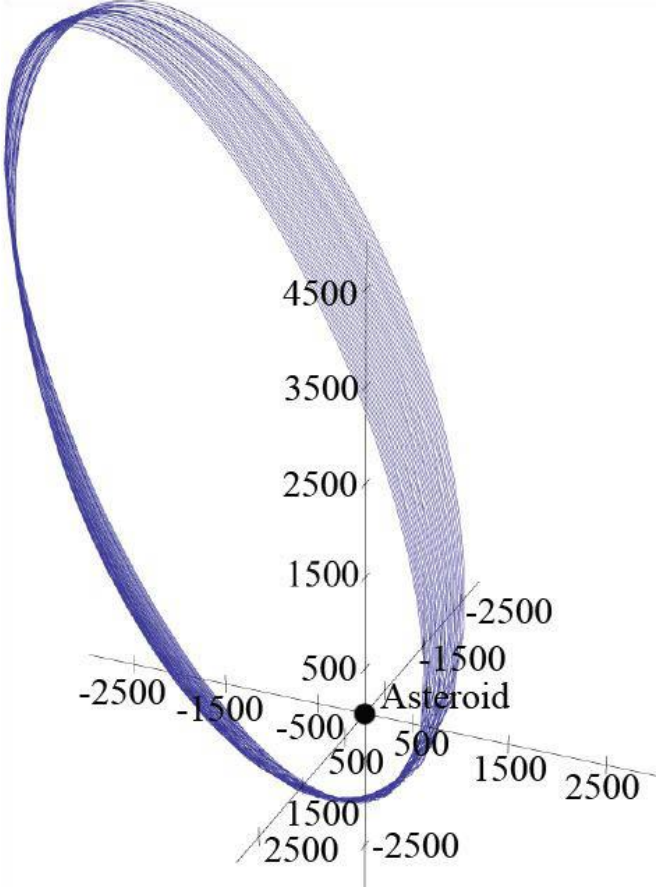

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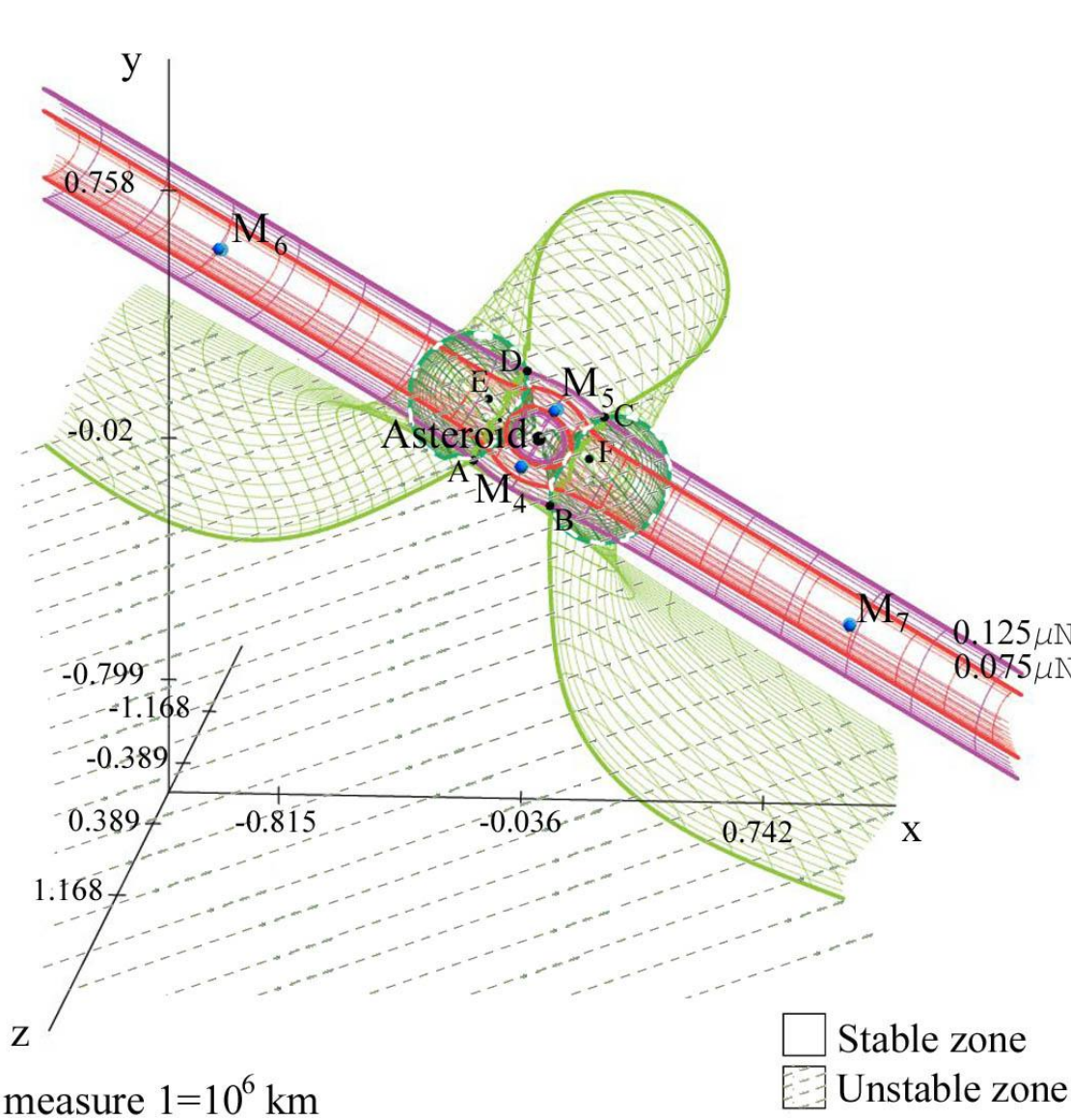
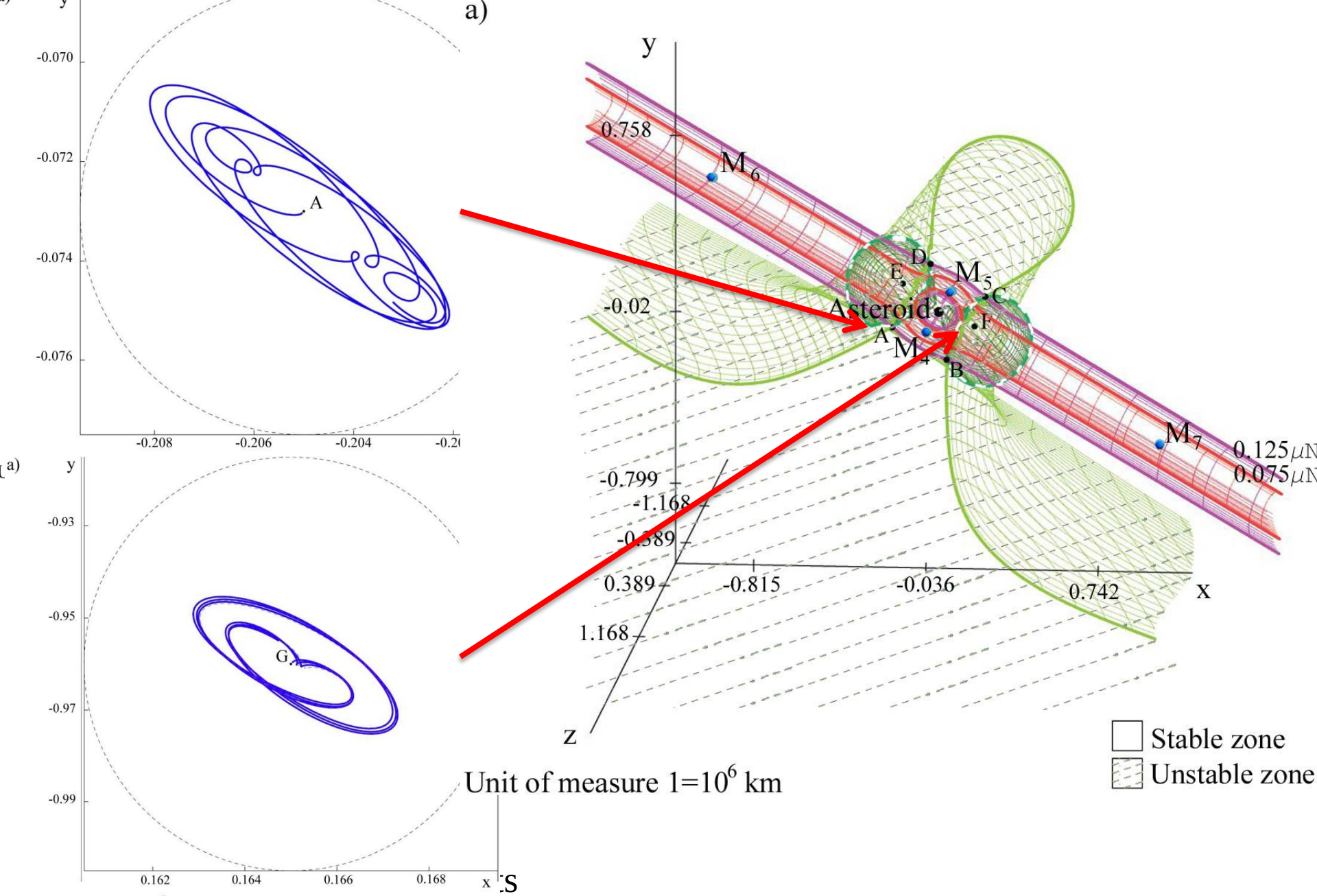


Unit of measure 1=10^6 km


a)
y
0.758
M6
D
E
M5
C
-0.02
Asteroid
A
F
M4
B
M7
0.125μN
0.075μN
-0.799
-1.168
-0.389
0.389
1.168
-0.815
-0.036
0.742
x
z
Stable zone
Unstable zone
Unit of measure 1=10^6 km
-0.070
-0.072
-0.074
-0.076
-0.208
-0.206
-0.204
A
a)
y
-0.93
-0.95
-0.97
-0.99
0.162
0.164
0.166
0.168
x
G
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References

[1] April 2012: Ceccaroni, M., Biggs, J. D., Biasco, L.:
"Analytic estimates and topological properties of the weak stability boundary";
Cel Mech & Dyn Astr (2012) 114:124 DOI 10.1007/s10569-012-9419-x.

[2] November 2012: Ceccaroni, M., Biscani, F., Biggs, J. D.:
" Analytical method for perturbed frozen orbit around an Asteroid in highly inhomogeneous gravitational fields. A first approximation"
Solar System Research, Accepted for publication

[3] November 2012: Ceccaroni, M., Biggs, J. D.: \Analytic perturbative theories in highly inhomogeneous gravitational fields."
Icarus, Accepted for publication

[4] November 2011: Ceccaroni, M., Biggs, J. D.:
"Low-thrust propulsion in a coplanar circular restricted four body problem";
Cel Mech & Dyn Astr, Volume 112, Issue 2 (2012), Page 191-219.
DOI:10.1007/s10569-011-9391-x.

Present

AstroNet-II project:

- Dissipative effects on Attitude Dynamics.
- Analytical and numerical approaches :

  perturbative and Kam theories, quasi-periodic approximations,

  Lyapunov exponents, frequency analysis and Greene's method.

=>accurate description of the dynamics

Extend to the rotational dynamics & include dissipative effects.

periodic attractors

invariant tori

basins of attraction of the different resonances.

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Thanks for your attention

Questions?