



# IMPACT OF MODERN DYNAMICS IN ASTRONOMY

*Proceedings of the IAU Colloquium 172  
held in Namur (Belgium), 6–11 July 1998*

## Cosmology

G. CONTOPOULOS, N. VOGLIS and C. EFTHYMIOPoulos / Chaos in Relativity and Cosmology	1–16
A. MACIEJEWSKI and M. SZYDŁOWSKI / Bianchi Cosmologies as Dynamical Systems	17–24

## Small Bodies in the Solar System

S. FERRAZ-MELLO / Slow and Fast Diffusion in Asteroid-Belt Resonances: A Review	25–37
A. MORBIDELLI / Origin and Evolution of Near Earth Asteroids	39–50
B. G. MARSDEN / Small Bodies in the Outer Solar System	51–54
Cl. FROESCHLÉ, T. J. JOPEK and G. B. VALSECCHI / The Use of Geocentric Variables to Search for Meteoroid Streams and Their Parents	55–64
J. D. HADJIDEMETRIOU / A Symplectic Mapping Model as a Tool to Understand the Dynamics of 2/1 Resonant Asteroid Motion	65–76
M. ŠIDLICOVSKÝ / On Stable Chaos in the Asteroid Belt	77–86
I. V. TUPIKOVA, A. A. VAKHIDOV and M. SOFFEL / Explicit Semi-Analytical Theory of Asteroid Motion	87–96
C. BEAUGÉ, A. LEMAÎTRE and S. JANCART / On the Motion of Trapped Particles in the Vicinity of Corotation Centers	97–105
S. I. IPATOV / Migration of Trans-Neptunian Objects to the Earth	107–116
E. PILAT-LOHINGER, R. DVORAK and Ch. BURGER / Trojans in Stable Chaotic Motion	117–126

## Stellar Systems

S. J. AARSETH / Star Cluster Simulations: the State of the Art	127–137
R. H. MILLER / Dimensionality of Stable and Unstable Directions in the Gravitational $N$ -Body Problem	139–147
H. WOZNIAK and D. PFENNIGER / Distribution of Kolmogorov-Sinaï Entropy in Self-Consistent Models of Barred Galaxies	149–158

D. D. CARPINTERO, J. C. MUZZIO and F. C. WACHLIN / Regular and Chaotic Motion in Globular Clusters	159–168
A. RIAGUAS, A. ELIPE and M. LARA / Periodic Orbits around a Massive Straight Segment	169–178
S. PORTEGIES ZWART and K. TAKAHASHI / Escape from a Crisis in Fokker-Planck Models	179–186
HONSHENG ZHAO / Building Galaxy Models with Schwarzschild Method and Spectral Dynamics	187–194

### **Analytical and Numerical Tools**

P. CINCOTTA and C. SIMÓ / Conditional Entropy: a Tool to Explore Phase Space	195–209
N. VOGLIS, G. CONTOPOULOS and C. EFTHYMIOPoulos / Detection of Ordered and Chaotic Motion using the Dynamical Spectra	211–220
C. EFTHYMIOPoulos, G. CONTOPOULOS and N. VOGLIS / Cantori, Islands and Asymptotic Curves in the Stickiness Region	221–230
T. FUKUSHIMA / Parallel/Vector Integration Methods for Dynamical Astronomy	231–241
S. FERRAZ-MELLO / Do Average Hamiltonians Exist?	243–248
YI-SUI SUN and YAN-NING FU / Diffusion Character in Four-Dimensional Volume-Preserving Map	249–258
I. I. SHEVCHENKO / The Separatrix Algorithmic Map: Application to the Spin-Orbit Motion	259–268
J. G. BRYANT / Canonical Variables of the Second Kind and the Reduction of the N-Body Problem	269–280
R. A. BROUCKE / Motion near the Unit Circle in the Three-Body Problem	281–290
S. R. CHESLEY / A Global Analysis of the Generalized Sitnikov Problem	291–302
F. MONDEJAR and A. VIGUERAS / The Hamiltonian Dynamics of the Two Gyrostats Problem	303–312

### **Planets and Satellites**

P. ARTYMOWICZ / Planetary Systems	313–316
J. CHAPRONT, M. CHAPRONT-TOUZÉ and G. FRANCOU / Complements to Moon's Lunar Libration Theory	317–328
E. BOIS and J. F. GIRARD / Impact of the Quadrupole Moment of the Sun on the Dynamics of the Earth-Moon System	329–338
D. J. SCHEERES / The Effect of $C_{22}$ on Orbit Energy and Angular Momentum	339–348

P. J. MESSAGE / The Use of Lie Series in the Construction of a Perturbation Theory and Some Recent Results in the Theory of the Motion of Hyperion	349–358
--	---------

## EXTENDED ABSTRACTS

### **Small Bodies in the Solar System**

Z. KNEŽEVIĆ and A. MILANI / Higher Order and Iterative Theories to Compute Asteroid Mean Elements	359–360
J. L. HILTON and R. C. STONE / The Asteroid Mass Determination Project at the U.S. Naval Observatory	361–362
M. E. SANSATURIO, A. MILANI, A. LA SPINA and K. MUINONEN / The Asteroid Identification Problem	363–364
D. VOKROULICKÝ and P. FARINELLA / Interaction of Resonances and Yarkovsky Non-Gravitational Effects in the Asteroid Belt	365–368
A. MILANI and G. B. VALSECCHI / Target Plane Confidence Boundaries: Mathematics of the 1997 XF11 Scare	369–370
MURISON / A Dynamical Survey of Inner Solar System Asteroids	371–372
E. DESVOIVRES, J. KLINGER and A. C. LEVASSEUR-REGOURD / Detailed Study of the Dynamics of Fragments of Comet C / 1996 B2 Hyakutake	373–374
Ch. BURGER, E. PILAT-LOHINGER, R. DVORAK and A. CHRISTAKI / Proper Elements and Stability of the Trojan Asteroids	375–376
F. LÓPEZ-GARCÍA and A. BRUNINI / Dynamical Behaviour of Asteroids in the 4:1 Resonance	377–378
K. GOŹDZIEWSKI and A. J. MACIEJEWSKI / Perturbations of Small Moons Orbits due to their Rotation: the Model Problem	379–380
D. NESVORNÝ and A. MORBIDELLI / Mean-Motion Resonances in the Asteroid Belt	381–382
I. I. SHEVCHENKO / On the Critical Phenomena in the Dynamics of Asteroids	383–386
F. ROIG and S. FERRAZ-MELLO / Dynamics of Real Asteroids at the Hecuba Gap	387–388
A. SIMULA, S. FERRAZ-MELLO and C. GIORDANO / Modelling Very-High-Eccentri-city Asteroidal Librations with the Andoyer Hamiltonian	389–390

### **Stellar Systems and Galaxies**

S. TREMAINE / Resonant Relaxation	391–392
-----------------------------------	---------

P. J. GROSBOØL and P. A. PATSIS / Periodic Orbits in Three-Armed Galaxies	393–394
V. DE BRUYNE, F. LEEUWIN and H. DEJONGHE / Orbits in a Stäckel Approximation	395–396
K. V. JOHNSTON, S. SIGURDSSON and L. HERNQUIST / Measuring Mass Loss Rates from Galactic Satellites	397–398
S. A. CORA, M. M. VERGNE and J. C. MUZZIO / Effect of Chaotic Orbits on Dynamical Friction	399–400
W. D. HEACOX / Nonparametric Statistical Models of Globular Cluster Dynamics	401–402
F. BANCKEN and E. JEHIN / Orbits of Hipparcos Metal-Poor Stars with Well-Defined Spectroscopic Abundances	403–404
L. G. TAFF and J. L. HERSEY / HST-FGS Astrometry of the Low Mass Binary L722–22	405–407
L. G. KISELEVA and P. P. EGGLETON / Can Combination of ‘Kozai effect’ and Tidal Friction Produce Close Stellar and Planetary Orbits?	409–410
J. PALACIÁN, P. YANGUAS and S. FERRER / Simple Periodic Orbits in Elliptical Galaxies Modelled by Hamiltonians in 1-1-1 Resonances	411–412

### **Planetary Systems**

P. BIDART and J. CHAPRONT / Moon’s Planetary Perturbations	413–414
T. V. IVANOVA / On the Construction of a Long Term Moon’s Theory	415–416
S. BOUQUILLON and J. SOUCHAY / A New Model of Mars Rotation from Pathfinder Data	417–418
S. CHAMPENOIS / Dynamics of the Mimas-Thetys System	419–424
M. J. MARTÍNEZ USÓ, F. J. MARCO-CASTILLO and J. A. LÓPEZ ORTÍ / A Necessary Condition to the Simultaneous Correction of Celestial Reference Frames	425–426
A. A. CHRISTOU / Secular Perturbations near Mean Motion Resonances	427–428
N. CALLEGARI Jr, T. YOKOYAMA and E. P. MARINHO / Dynamics of Fictitious Earth Satellites with Possible Past Value of the Ecliptic	429–430
I. STELLMACHER / An Intermediary Periodic Orbit for Hyperion	431–432

### **Tools**

G. F. GRONCHI and A. MILANI / Averaging of Earth-Crossing Orbits	433–434
S. KLIONER and M. SOFFEL / Rotational Motion of Celestial Bodies in the Relativistic Framework	435–436

S. BREITER and A. A. JACKSON / Lommel Functions in some Drag-Perturbed Problem	437–438
Ch. K. MCCORD and K. R. MEYER / Two Conjectures of G. D. Birkhoff	439–440
J. R. DONNISON / Three-Body Stability Criteria	441–442
M. GUZZO / Nekhoroshev Stability in Quasi-Integrable Degenerate Hamiltonian Systems	443–444
G. BENETTIN, F. FASSÒ and M. GUZZO / Nekhoroshev-Stability of $L_4$ and $L_5$ in the Spatial Restricted Problem	445–446
K. TSIGANIS, A. ANASTASIADIS and H. VARVOGLIS / Effective Lyapunov Numbers and Correlation Dimension in a 3-D Hamiltonian System	447–448
J. E. CHAMBERS / A Symplectic Integration Scheme that Allows Close Encounters between Massive Bodies	449–450
A. CELLETTI, G. DELLA PENNA and C. FROESCHLÉ / Analytical Approximation of the Dissipative Standard Map	451–452
F. J. MARCO-CASTILLO, M. J. MARTÍNEZ USÓ and J. A. LÓPEZ ORTÍ / Second Order Perturbations of Elliptic Elements with respect to the Initial Ones	453–454

### Miscellaneous

A. APARICIO and L. FLORÍA / Zonal Harmonics of the Gravity Field in DEF-variables	455–456
M. A. VASHKOVYAK / On the Stability of Stationary Solutions of the Twice-Averaged Hill's Problem taking into account the Planet Oblateness	457
A. MAKHLOUF and N. DEBBAH / Study of the Normal Variational Equation in an Homogeneous Field of Degree Five	459–460
L. FLORÍA / Generalized Gylden-Type System in Universal DS-like TR-variables	461–462
A. CORDERO, J. MARTÍNEZ ALFARO and P. VINDEL / Orbital Structure of the Two Fixed Centres Problem	463–464
A. D. CHERNIN / Chaos in Three-Body Dynamics: Intermittency, Strange Attractor, Kolmogorov-Sinai Entropy	465–466