

POST-NEWTONIAN CIRCULAR RESTRICTED 3-BODY PROBLEM: SCHWARZSCHILD PRIMARIES

F. L. Dubeibe^{1,2}, F. D. Lora-Clavijo²,
and G. A. González²

The restricted three-body problem (RTBP) has been extensively studied to investigate the stability of the solar system, extra-solar subsystems, asteroid capture, and the dynamics of two massive black holes orbited by a sun. In the present work, we study the stability of the planar circular restricted three-body problem in the context of post-Newtonian approximations. First of all, we review the results obtained from the post-Newtonian equations of motion calculated in the framework of the Einstein-Infeld-Hoffmann formalism (EIH). Therefore, using the Fodor-Hoenselers-Perjes formalism (FHP), we have performed an expansion of the gravitational potential for two primaries, deriving a new system of equations of motion, which unlike the EIH-approach, preserves the Jacobian integral of motion. Additionally, we have obtained approximate expressions for the Lagrange points in terms of a mass parameter μ , where it is found that the deviations from the classical regime are larger for the FHP than for the EIH equations.

¹ Facultad de Ciencias Humanas y de la Educación, Universidad de los Llanos, Villavicencio, Colombia (fldubeibem@unal.edu.co).

² Grupo de Investigación en Relatividad y Gravitación, Escuela de Física, Universidad Industrial de Santander, A.A. 678, Bucaramanga, Colombia.

THE NATURE OF FIFTY PALERMO SWIFT-BAT HARD X-RAY OBJECTS THROUGH OPTICAL SPECTROSCOPY

A. F. Rojas¹, N. Masetti^{2,1}, D. Minniti^{1,3,4},
E. Jiménez-Bailón⁵, V. Chavushyan⁶, G. Hau⁷,
V. A. McBride^{8,9}, L. Bassani², A. Bazzano¹⁰,
A. J. Bird¹¹, G. Galaz¹², I. Gavignaud¹, R. Landi²,
A. Malizia², L. Morelli^{13,14}, E. Palazzi²,
V. Patiño-Álvarez^{15,6}, J. B. Stephen²,
and P. Ubertini¹⁰

We present the nature of 50 unidentified hard X-ray emitting objects detected with *Swift*-BAT and listed as of unidentified nature in the 54-month Palermo BAT catalogue. We found 45 extragalactic sources: 26 type 1 AGN, 15 type 2 AGN, one type 1 QSO, one starburst galaxy, one X-ray bright optically normal galaxy, and one LINER. We report 30 new redshift measurements, 13 confirmations and 2 more accurate redshift values. The remaining five objects are galactic sources: three are Cataclismic Variables, one is a X-ray Binary, and one is an active star.

¹ Departamento de Ciencias Físicas, Universidad Andrés Bello, Campus La Casona, Fernández Concha 700, Santiago, Chile (ale.rojaslilayu@gmail.com).

² INAF – Istituto di Astrofisica Spaziale e Fisica Cosmica di Bologna, Via Gobetti 101, I-40129 Bologna, Italy.

³ Millennium Institute of Astrophysics, Av. Vicuña Mackenna 4860, 782-0436 Macul, Santiago, Chile.

⁴ Vatican Observatory, I-00120, Vatican City State.

⁵ Universidad Nacional Autónoma de México, Apartado Postal 70-264, 04510 México D.F., Mexico.

⁶ Instituto Nacional de Astrofísica, Óptica y Electrónica, Apartado Postal 51-216, 72000 Puebla, Mexico.

⁷ European Southern Observatory, Ave. Alonso de Cordoba 3107, Casilla 19001, Santiago, Chile.

⁸ Department of Astronomy, Astrophysics, Cosmology and Gravity Centre, University of Cape Town, Private Bag X3, Rondebosch 7701, South Africa.

⁹ South African Astronomical Observatory, PO Box 9, Observatory 7935, South Africa.

¹⁰ INAF – Istituto di Astrofisica e Planetologia Spaziali, via Fosso del Cavaliere 100, I-00133 Roma, Italy.

¹¹ School of Physics & Astronomy, University of Southampton, Southampton, SO17 1BJ, UK.

¹² Instituto de Astrofísica, Facultad de Física, Pontificia Universidad Católica de Chile, Casilla 306, Santiago 22, Chile.

¹³ Dipartimento di Fisica ed Astronomia "G. Galilei", Università di Padova, vicolo dell'Osservatorio 3, 35122 Padova, Italy.

¹⁴ INAF - Osservatorio Astronomico di Padova, Vicolo dell'Osservatorio 5, 35122 Padova, Italy.

¹⁵ Max-Planck-Institut für Radioastronomie, Auf dem Hügel 69, 53121 Bonn, Germany.