CCSU

DEPARTMENT OF MATHEMATICAL SCIENCES

COLLOQUIUM

Friday, February 3
3:00 – 4:00 PM
Maria Sanford, Room 101

ON THE PERIOD OF THE PERIODIC ORBITS OF THE RESTRICTED THREE BODY PROBLEM

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Abstract: It is known that one of the solutions of the two-body problem consists in two bodies moving on circles. If the mass of one of these two bodies is very large compared with the other, the radius of the circle that describes the big mass body is very small. For this solution is possible to set up a rotating system of coordinates in such a way the two bodies stay put on the x axis of this new rotating system of coordinates. This is possible because, in this solution, the two bodies not only move on circles but they move in concentric circles and they also move with the same angular velocity.

Let us consider a third body in this system with mass so small that it does not affect the motion of the other two bodies, for example the Sun-Planet-Asteroid or Sun-Planet-Spacecraft system. The problem of finding out the possible orbits of this third body is called the circular restricted three body problem. Two well-known solutions for this problem comes from the Lagrangian points L_4 and L_5. They correspond to the third body moving in such a way that the position of all three bodies always form an equilateral triangle.

In this talk, we will show that the period T of a closed orbit of the planar circular restricted three body problem (viewed on rotating coordinates) depends on the region Ω it encloses. Roughly speaking, we show that $2T = k\pi + \iint_{\Omega} g dA$ where k is an integer and $g: R^2 \rightarrow R$ is a function that only depends on the constant C known as the Jacobian integral; g does not depend on Ω. This theorem has a Keplerian flavor in the sense that it relates the period with the space ``swept" by the orbit. As an application, we prove that there is a neighborhood around L_4 such that every periodic solution contained in this neighborhood must move clockwise. The same result holds true for L_5.

For further information:
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