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N-body and N-vortex dynamics on surfaces of revolution : curvature and topological contributions

One of the today's challenges is the formulation of the N-body and N-vortex dynamics on Riemann surfaces. In this talk we show how the two problems are strongly related one another when looking at them from the point of view of the intrinsic geometry of the surface where the dynamics takes place. Given a surface M of metric g , the distribution of matter S on M , we deduce the dynamics of the masses and some of its properties. Among other things, we find that in the plane the two masses problem does not obeys to the known Kepler laws. Moreover, Newton's Laws are not longer verified on closed surfaces with variable curvature. For masses on an infinite cylinder we are able to observe topological effects due to the topology of the surface (with D. Dritschel, G. Duarte, R. Schaefer, T. Stuchi).