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LAGRANGE: how to study the solar gravito-magnetism and internal dynamics by means of a Sagnac-like experiment at the scale of the Inner solar system

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The paper proposes to locate four spacecraft in four out of the five Lagrange points of the Sun-Earth system, then exchanging electromagnetic pulses among them. Including stations on Earth, various closed paths for
the pulses are possible and their shape and size remain fixed in time with respect to the earth. According to General Relativity, the time of flight of the pulses moving to the right should be different from that of the pulses travelling to the left, provided a gravito-magnetic field exists and indeed such field should be there because of the angular momentum of the sun. The time of flight difference, in linearized general relativity, turns out to be proportional to the angular momentum of central mass (in practice, of the Sun). We shall show that existing technologies would allow measurement accuracies of the time asymmetry better than 1%, depending on the accuracy of the clock. An experimental evaluation of the angular momentum of our star would also give important information of the internal dynamics of the Sun and the depth of the tachocline. Light closed contours of the size allowed by the sun-earth Lagrangian points would also act as detectors for a possible galactic gravito-magnetic field, and in particular for a possible “dark” component of it. The peculiar configuration discussed in this paper would also be an opportunity for a number of additional experiments, from an accurate evaluation of the influence of the quadrupole moment of the Earth and of the Sun on the Shapiro gravitational time delay; to the detection of gravitational waves with techniques different from the interferometric approach usally considered. It is then worth mentioning that radio beacons placed in four Lagrangian points could also be used as ”artificial pulsars” for a relativistic positioning and navigation system at the scale of the solar system.