SPIN@USPAS Summer 2021
Graduate "Spin Dynamics" Homework

HOME WORK 2.3: SPIN CLOSED ORBIT

Solutions to be handed back by Wed. 9 morning (non-spinor questions)
and Friday 11 morning (spinor).

June 7, 2021

Responses, in order to be considered, have to be justified and explained - thank you

Also called stable spin precession direction, or spin closed orbit.
This exercise is a follow on of exercise 2.2.

Consider the motion of the spin of a particle which orbits on a closed orbit around the ring. In this configuration, a stable spin precession direction can be found, which closes on itself after a turn.

(The picture on the right gives an idea of expected outcomes, for instance reading and plotting from zgoubi.plt files).

1/ (4 points) Find the closed spin precession solution at the location of the longitudinal kick (SPINR), in the different energy cases addressed in exercise 2.2.

Hint: A FIT procedure can be used for that. Equality between initial and final spin coordinates can be checked using FAISTORE or, in zgoubi.res listing using SPNPRT.

2/ (4 points) Propagate that closed solution over a few turns around the ring. Produce a graph of $\vec{s}_\pi$ around the ring, in the laboratory frame. Repeat for the different energies.

3/ (4 points) Prove that spins at an angle to the stable precession direction precess around the latter.

4/ Spinor representation:

4.a - (9 points) Provide the answers to these questions using spinors.

4.b - (9 points) Check agreement with your numerical results.