

**Meccanica Quantistica**  
**22 Giugno 2017**

**PROBLEM A**

Let us consider a particle with spin  $1/2$ . We measure the observable  $S_x + S_z$ .

- 1) Calculate the possible measured values.

After then we measure the observable  $S_y$ .

- 2) Calculate the possible measured values, the probability to get them and the final states in which the system can be found.

**PROBLEM B**

Consider a particle with mass  $m$  in a two dimensional infinite potential well with size  $[0, a) \times [0, a)$ . At the time  $t = 0$  the particle is described by the state,

$$\psi(x, y) = N \sin\left(\frac{\pi x}{a}\right) \sin\left(\frac{\pi y}{a}\right) \left[1 + 2 \cos\left(\frac{\pi x}{a}\right)\right]$$

Calculate, at the time  $t$ ,

1. The average value  $\langle E \rangle_t$  and the dispersion  $\Delta E_t^2$  of the energy.
2. Calculate the corrections to the first order in  $\varepsilon$  for the ground state and the first excited state under the perturbation  $V = \varepsilon y$ .