Spin-half board documentation v1.0a

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The SLP Spin-half board was designed to be used as a teaching aid in the course CHC 441: Quantum Mechanics for Everyone, which was offered at the University of Oregon during the Spring term of 2014. It is meant to simulate a measurement on a spin-half particle in activities aimed at teaching students about Hilbert-spaces and the Born rule. Figure 1 shows the top view of the board, which is $1.5'' \times 1.5''$ in area.

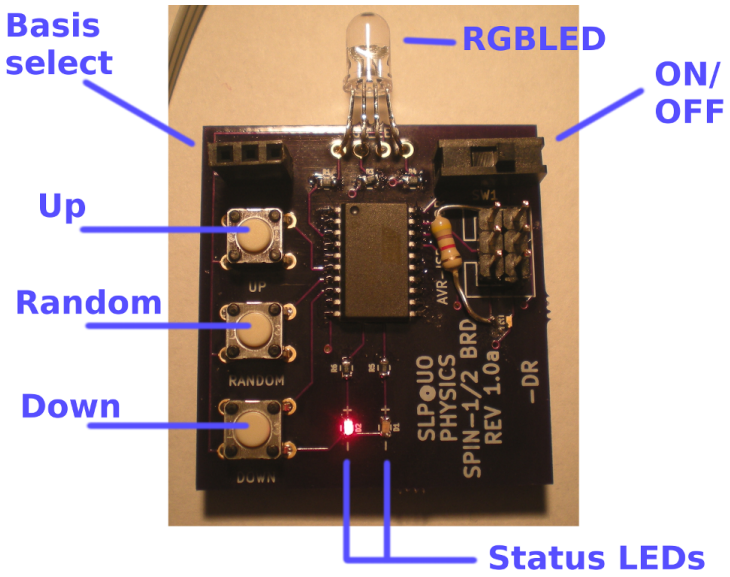

Figure 1: Top view of the spin-half board with essential labels.

As shown in Fig. 1, for inputs the board consists of a power (on/off) switch, a "basis-control" switch, and three tactile push-buttons labeled 'Up', 'Random,' and 'Down'. In some versions the basis-control switch is replaced by a 3-pin female header, which allows for a wired-extension for the switch (See Fig. 2). For outputs, the board has an RGB LED mounted in front, and two status LEDs (one **red** and one **green**). The board also consists of an atmel ATTINY2313 microcontroller chip, six programming headers, assorted surface-mounted resistors, and a socket for a 3V 2032 button-cell for power on the bottom-side.

When the board is powered on, if properly pre-programmed, one of the two status LEDs should be lit up. This indicates the 'mode' the board is currently operating in. If the **red** status LED is lit, then the board is said to be in the **red**/**blue** mode. In this mode, pushing the 'Up'('Down') button will cause the RGB LED to glow **red**(**blue**). Pushing the 'Random' button will pick one of the two colors at random.

Otherwise, if the **green** status LED is lit, then the board is in the **green**/**white** mode. In this mode, pushing the 'Up'('Down') button will cause the RGB LED to glow **green**(**white**). Pushing the 'Random' button will pick one of the two colors at random. The mode can be toggled via the basis-control switch.

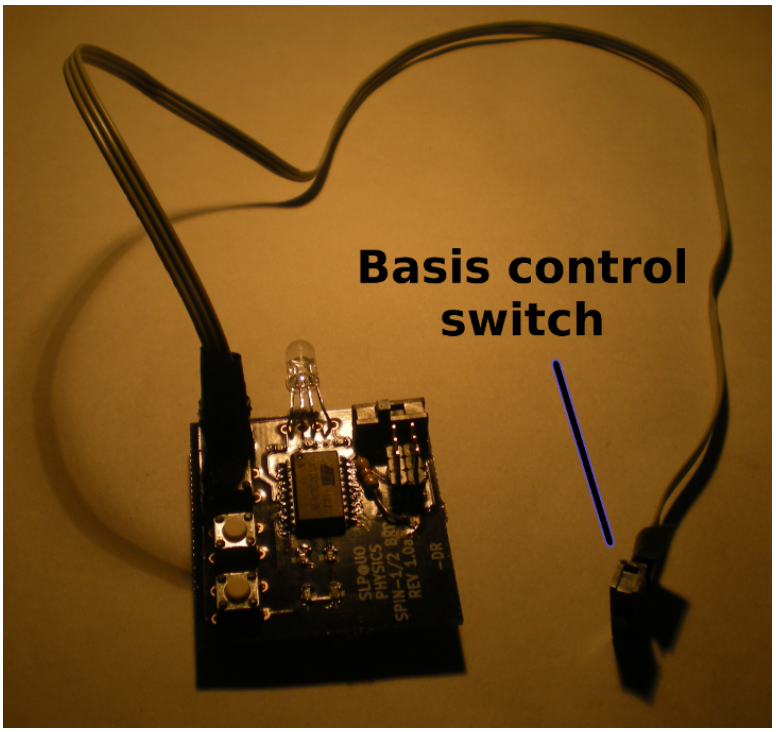

Figure 2: The basis-control switch may be connected with a wired-extension.

In activities, the student holding the board plays the role of the spin-half particle, while the student with the basis-control switch plays the role of the experimenter. The two modes are non-commuting basis choices. The spin-half student must first be aware of his/her state. Then the experimenter picks a basis(mode) for measurement. The spin-half particle then consults Table 1 and yields a response accordingly. After the "measurement" the spin-half particle updates his/her state to match the experimental outcome, thereby obeying the Born rule.

Table 1: Spin-half State-response look-up.

State	**R**/**B**-mode response	**G**/**W**-mode response
R	**R**	RANDOM
B	**B**	RANDOM
G	RANDOM	**G**
W	RANDOM	**W**